

NORWAY. PROGRESS REPORT ON CETACEAN RESEARCH, JANUARY 2007 TO DECEMBER 2007, WITH STATISTICAL DATA FOR THE CALENDAR YEAR 2007

COMPILED BY SIDSEL GRØNVIK

Norwegian Institute for Nature Research, The Polar Environmental Centre, N-9296 Tromsø, Norway

This report summarises information obtained from:

Name of agency/institute	Abbreviation (use in rest of report)	Contact e-mail address
The Institute of Marine Research	IMR	tore.haug@imr.no; nils.oien@imr.no arne.bjoerge@imr.no
The University of Oslo, Natural History Museum	NHM	oystein.wiig@nhm.uio.no
The Norwegian Polar Institute	NP	lydersen@npolar.no
The Norwegian School of Veterinary Science	NVH	morten.tryland@veths.no; anuscha.polder@veths.no

1. SPECIES AND STOCKS STUDIED

IWC common name	IWC recommended scientific name	Area/stock(s)	Items referred to
Bowhead whale	<i>Balaena mysticetus</i>	North Atlantic	2.1.1;4.4
Fin whale	<i>Balaenoptera physalus</i>	Northeast Atlantic	2.1.1;2.1.2;3.1.1;4.1;9
Humpback whale	<i>Megaptera novaeangliae</i>	North Atlantic	2.1.1;2.1.2;2.2;3.1.1;3.1.3;4.1;4.4;9
Killer whale	<i>Orcinus orca</i>	Northeast Atlantic	2.1.1;2.1.2;2.2;3.2;4.1
Minke whale	<i>Balaenoptera acutorostrata</i>	Northeast Atlantic	2.1.1;2.1.1;3.1.3;3.2;4.1;4.2;4.4;6.2;9
White whale	<i>Delphinapterus leucas</i>	Svalbard	5
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	Northeast Atlantic	2.1.1;2.1.2;9

2. SIGHTINGS DATA

2.1 Field work

2.1.1 Systematic

During the period 2 July to 5 August 2007 a sighting survey was conducted with two vessels covering the Small Management Area EB, which includes the Barents Sea proper east of 28°E eastwards to Novaya Zemlya and from the Norwegian and Russian coastal areas northwards to the ice-edge. This was the last year of the recent 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. A total of 2,230 nautical miles was surveyed on primary effort and 159 sightings of minke whales were made during this effort. Sightings of other cetacean species include fin whales (25 primary sightings), humpback whales (19 primary sightings), *Lagenorhynchus* dolphins (204 primary sightings), harbour porpoise (76 primary sightings) and killer whales (1 primary sighting). One observation of particular interest was made 13 July 2007 of a bowhead whale in the Barents Sea at position 78°12'N, 39°01'E. Biopsy samples and associated identification photos from about 50 humpback whales were collected. (IMR)

In July 2007 whale observers were placed onboard two chartered vessels doing fish surveys in the Norwegian Sea, as part of a contribution towards the TNASS survey effort to map whale distributions throughout the North Atlantic. (IMR)

In August to September 2007 whale distributions were mapped during an ecosystem survey in the Barents Sea by having dedicated whale observers onboard who collected information following line transect protocols. (IMR)

2.1.2 Opportunistic, platforms of opportunity

IMR vessels and coastguard vessels have collected incidental observations of marine mammals. Recorded data include date, position, species and numbers. During 2007 a total of 965 observation incidents have been reported. The most frequently observed species were minke whales (224), *Lagenorhynchus* dolphins (181), fin whales (136), humpback whales (107), harbour porpoises (82), killer whales (57) and pilot whales (30).

2.2 Analyses/development of techniques

A study of humpback whales in the northeast Atlantic based on incidental sightings, ecosystem surveys, sightings surveys and photo identification work indicate that the abundance of humpback whales in the Barents and Norwegian Seas combined is around 1,000 animals in mid-summer and there is no statistical evidence of an increase over the years. However, summer distributions have varied between surveys with the year 1995 as the most extreme with a major part of the animals sighted around the Bear Island. Prior to 1995 most humpbacks were sighted in the Norwegian Sea, while post 1995 sightings are more widespread and also include many observations in the eastern part of the Barents Sea. Photo identification work has been carried out within the season July – September in waters surrounding the islands Jan Mayen, Bear Island and Hopen. Resightings, within year or up to eleven years after first sighted, were within the same general areas as the first sight, indicating strong site fidelity for this season. There was one exception in this material, demonstrated by one individual which was seen at Jan Mayen in August 1997 and off Bear Island in July 2003. For data collected over the years 1992-2003, the average distance between resightings is 134 km (SD = 175 km), and in a sight-resight pair, there is a tendency that the latest dated position is farthest to the north and east, indicating a general movement in late summer to fall in a northeastern direction. (IMR)

A study based on historic catch positions, incidental observations and dedicated sightings surveys, indicates that although some of the killer whale populations in the northeast Atlantic undoubtedly follow the migrations of the Norwegian spring spawning herring, this is not a general rule. Estimates of abundance show an interannual variability from about 5,000 to 25,000, probably caused by difficulties in group size estimation and differences in area coverage between surveys. (IMR)

3. MARKING DATA

3.1 Field work

3.1.1 Natural marking data

Several photo IDs were collected from humpback, minke, fin and blue whales during the period 13 August to 2 September in the waters between northern Norway and Svalbard. (IMR)

3.1.2. Artificial marking data

No new information.

3.1.3 Telemetry data

During the period 13 August to 2 September 2007 field work with emphasis on instrumentation of minke whales was conducted in the waters between northern Norway and Svalbard, including the Bear Island. One minke whale was radio tagged in the Storfjord area southeast of Spitsbergen and followed for 116 hours. The area seemed to be a feeding area with several minke and fin whales present at the time. Within the area a satellite tag was also applied to a minke whale which was then followed for about three weeks. A VHF tag with suction cups was also tested on a humpback whale and stayed attached for about two hours. (IMR)

3.2 Analyses/development of techniques

Killer whales staying in the Norwegian spring spawning herring overwintering area in Vestfjorden, northern Norway, have been studied by means of photo identification for many years. Using mark-recapture estimators, the local population in Vestfjorden was estimated to be about 600 animals in 2003. Reproduction rate seems to be low as the calving interval ranged from 3 to 14 years. (IMR)

During the years 2003-2006, five minke whales have been tagged in the Norwegian Sea and Svalbard areas to increase the data base of surfacing rates for use in estimation of abundance of minke whales in the Northeast Atlantic. While one of the whales was followed for less than 3 hours, the other four were followed over periods of 19-40 hours. They showed large individual variation in hourly blow rates, which is of the same order of magnitude as variation between individuals, and spans the range 33-72 blows/whale/hour. These are in accordance with results from earlier radio-tagging and visual experiments. The mean intersurfacing interval of 18 minke whales radio-tagged in Norwegian waters is 77.31 s, corresponding to a blow rate of 46.6 blows/whale/hour. (IMR)

A statistical model for successive dive times of North-eastern minke whales has been developed with the aim of describing the variability in the short term dive patterns between whales as well as within the whale over longer time periods. The dives were divided into short, medium and long dives. It was found that the series of rapid blows were not very dependent on the longer dives which may mean that the minke whales operate well beyond their theoretical diving capacity based on body size. It was also found that the variability in the conditional

probability of a dive being long given that it is not short was considerable both between and within whales, and roughly of the same magnitude. (IMR)

4. TISSUE/BIOLOGICAL SAMPLES COLLECTED

4.1 Biopsy samples (summary only)

Biopsy samples were collected from minke (3), humpback (11), fin (12) and killer (1) whales during the period 13 August to 2 September in the waters between northern Norway and Svalbard. (IMR)

4.2 Samples from directed catches (commercial, aboriginal and scientific permits) or bycatches

During the traditional whaling season (April-October), body condition data and tissue materials for studies of DNA identity were collected from all minke whales taken by vessels participating in the Norwegian small type whaling. (IMR)

4.3 Samples from stranded animals

No new information reported from 2007

4.4 Analyses/development of techniques

The Norwegian DNA register for minke whales has been further studied to investigate stock structure. Although some heterogeneity can be found, no significant differences are apparent between the *Small Areas* within the North-eastern management area. (IMR)

The status of the Norwegian minke whale DNA-register as of March 2008 is given in the table below:

Year	DNA-register ¹	IWC catch statistics ²	Not landed ³	Landed ⁴	Duplicates ⁵	Missing samples ⁶	Lab problem ⁷	Total missing ⁸
1997	488	503	7	496	3	5	0	8
1998	609	625	11	614	1	4	0	5
1999	571	591	17	574	2	1	0	3
2000	470	487	6	481	3	8	0	11
2001	538	552	11	541	2	1	0	3
2002	625	634	9	625	0	0	0	0
2003	637	647	9	638	1	0	0	1
2004	530	544	7	537	7	0	0	7
2005	626	639	6	633	3	4	0	7
2006	531	545	7	538	4	2	1	7
2007 ⁹	-	597	5	592	-	-	-	-

The number of individuals contained in the DNA-register, and the number of individuals missing. For 2007 the genetic analyses are not completed, as indicated by the ‘-’ in the table.

¹ Number of unique individuals contained in the DNA-register (not containing duplicates).

² Number of individuals caught by Norway, including individuals not landed.

³ Number of individuals killed, but not taken onboard the vessel.

⁴ Number of individuals taken onboard the vessel.

⁵ Number of occurrences of (tissue) sample switching on board the vessel as detected by comparison of genetic profiles. The result is that two samples have been returned from one individual, and no sample has been returned for one individual.

⁶ Number of individuals for which tissue samples are missing for other reasons than sample switching.

⁷ Genetic laboratory not able to obtain microsatellite profile from tissue sample.

⁸ The difference between the columns “Landed” and “DNA-register”.

⁹ Laboratory analyses not yet completed.

Starting with catches from 2007 the Institute of Marine Research (Bergen, Norway) will do the genetic analyses.

As part of the work with mapping stock structure, migration and habitat use for humpback whales in the northeast Atlantic, DNA laboratory analyses of about 60 biopsy samples collected in Norwegian waters have been conducted in cooperation with P. Palsbøll at the University of Stockholm. Standard methods for population genetics studies will now be applied to the data. (IMR)

Biopsy samples of bowhead whales from western Greenland are analyzed in cooperation with Mads Peter Heide Jørgensen, Greenland Institute of Natural Resources and Lianne Postma, Fisheries and Oceans. (NHM)

The mitochondrial cytochrome b (cytB) gene has been sequenced for a set of historic bowhead whales from Svalbard and compared to the highly variable control region haplotypes. Preliminary analyses show that the assignment of mitochondrial haplotypes on the basis of cytB sequences yields a significantly lower number but do not correlate to haplogroups based on control region sequences. The cytB based haplotypes occur at much higher frequencies and allow frequency-based comparisons of the genetic structure of bowhead whale stocks. (NHM)

DNA suitable for PCR amplifications has been extracted from historic whale samples from South Georgia. Amplification and sequencing of two stretches of the mitochondrial cytB gene offers an easy and rapid approach to identifying samples suitable for further genetic analyses and to determine the species status of whale remains with reasonable confidence. At least for humpback, fin, and sei whales, South Georgia provides suitable material for studying historic population structures. A manuscript is under review in Marine Mammal Science. The project is done in cooperation with Tony Martin, BAS. (NHM)

5. POLLUTION STUDIES

Biopsy samples of white whales sampled at Spitsbergen (captured in 1995-1997) were analysed for toxaphenes. Results (Andersen et al., 2006) showed that concentrations of sum toxaphenes in white whale blubber (biopsies) (11,447 ng/g lipid weight (lw)) were 2.5 times higher than the mean concentrations of sum DDTs and sum PCBs, and 4.5 times higher than sum chlordanes measured earlier in the same individual white whales. (NVH/National Veterinary Institute)

6. STATISTICS FOR LARGE CETACEANS

6.1 Corrections to earlier years' statistics for large whales

No corrections made.

6.2 Direct catches of large whales (commercial, aboriginal and scientific permits) for the calendar year 2007

Species	Type of catch	Management Areas					Total catch
		EB	EN	ES	EW	CM	
Minke whale	Small-type whaling	28	98	295	176	0	597

6.3 Anthropogenic mortality of large whales for the calendar year 2007

6.3.1 Observed or reported ship strikes of large whales (including non-fatal events)

No observations or reports from 2007

6.3.2 Fishery bycatch of large whales

No observations or reports from 2007.

7. STATISTICS FOR SMALL CETACEANS

7.1 Corrections to earlier years' statistics for small cetaceans

No corrections made.

7.2 Direct catches of small cetaceans for the calendar year 2007

No direct catches.

7.3 Anthropogenic mortality of small cetaceans for the calendar year 2007

7.3.1 Observed or reported ship strikes of small cetaceans (including non fatal events)

No observations or reports from 2007.

7.3.2 Fishery bycatch of small cetaceans

Numbers for 2007 will be presented in a working paper during the meeting of the Scientific Committee in Santiago de Chile in June.

8. STRANDINGS

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

9. OTHER STUDIES AND ANALYSES

In 2007, an age-length structured multispecies model (Gadget, Globally applicable Area-Disaggregated General Ecosystem Toolbox) was parameterised for the Barents ecosystem in order to analyse the historic population dynamics of major fish and marine mammal species. Presently, minke whale is the only sea mammal included in the model but incorporating harp seals predatory interactions in the model will be an important task in the future. There are, however, not sufficient data available on harp seal diet to parameterize a MSFR. The model was used to examine possible effects of a number of plausible biological and fisheries scenarios. The results suggest that changes in cod mortality from fishing or cod cannibalism levels have the largest effect on the ecosystem, while changes to the capelin fishery had only minor effects. Alternate whale migration scenarios had only a moderate impact on the modelled ecosystem. Indirect effects are seen to be important, with cod fishing pressure, cod cannibalism and whale predation on cod having an indirect impact on capelin, emphasising the importance of multi-species modelling in understanding and managing ecosystems. Models such as the one presented here provide one step towards an ecosystem based approach to fisheries management. (IMR)

Since 2003 marine mammal observers have participated on ecosystem surveys in the Barents Sea conducted in August-October. In addition to marine mammal distributions, these surveys provide information on ocean climate and distribution of water masses, and abundance and distribution of pelagic fish. During these surveys 11-18 species of marine mammals are observed each year, and of these white-beaked dolphins *Lagenorhynchus albirostris*, common minke whales, fin whales and humpback whales are most frequently observed. The distribution of these species within the Barents Sea differs. Humpback and fin whales are predominantly observed along the shelf edge, in the deeper troughs around Bear and Hopen Islands and in the northern Barents Sea. White-beaked dolphins and common minke whales occur throughout the Barents Sea, although the white-beaks have high density areas south of the high density areas of the baleen whales. While the smaller and rapid white-beaked and minke whales have dynamic distributions changing from year to year, the larger whales, and particularly the humpback whales, have conservative distributions that are similar between years. (IMR)

Predators aggregate where prey is available, a process termed the predators' aggregative response. Therefore, systematic spatial concordance between predators and potential prey species is a good indicator of predator-prey interactions. In the Barents Sea, the different prey species have different spatial distributions; polar cod in the north and east, capelin in the central areas, herring in the south and the newcomer, blue whiting in the south-west. And furthermore, within these prey species, also the different age groups differ in distributions. In capelin, for instance, the older capelin is distributed further north and east than the younger capelin, at the time of the ecosystem cruise. Thus, within the Barents Sea, we can use the aggregative response to investigate both which prey stocks the cetaceans are targeting, as well as which demographic part of the stocks. Humpback, fin and minke whales aggregate in the north where 2-year old capelin is abundant. During the years covered the capelin stock has been small but increasing, and 2-year olds have been more abundant than older capelin. White-beaked dolphins are associated with 1-year old capelin. Furthermore, white-beaked dolphins and fin whales were also associated with blue whiting. It is interesting to note that none of these species were associated with juvenile herring, which could have been an alternative prey during periods of low capelin abundance. Krill may therefore be more important as alternative prey, but we have insufficient data on krill distributions to test this hypothesis.

Finally, annual abundance indices of humpbacks within the Barents Sea are identical to annual changes in capelin abundance. No such correlation is observed between the other three cetacean species and prey abundance. We suggest that the number of humpback whales immigrating to the humpback core areas is

regulated by the amount of food within these areas, while the other cetacean species respond to changes in food availability by tracking different prey species, which result in the dynamic spatial distributions of these species. (IMR)

10. LITERATURE CITED

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