REPORT OF THE EIGHTH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE

Akraberg, Faroe Islands, 13 - 16 June, 2000

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1. CHAIRMAN'S WELCOME AND OPENING REMARKS

Chairman Mads Peter Heide-Jørgensen welcomed the members of the Scientific Committee to their 8th meeting (Appendix 1). He noted that the past year had seen the departure of one of the founding members of the Scientific Committee, Jóhann Sigurjónsson, and his replacement by Droplaug Ólafsdóttir. In addition Christian Lydersen, who could not attend the meeting, had replaced Lars Folkow.

2. ADOPTION OF AGENDA

The agenda (Appendix 2) was accepted with no changes.

3. APPOINTMENT OF RAPPORTEUR

Daniel Pike, Scientific Secretary of NAMMCO, was appointed as Rapporteur.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

4.1 National Progress Reports

National Progress Reports for 1999 from the Faroes, Iceland, and Norway were submitted to the Committee. The National Progress Report from Greenland was not available.

4.2 Working Group Reports and Other Documents

Working Group Reports and other documents available to the meeting are listed in Appendix 3.

5. COOPERATION WITH OTHER ORGANISATIONS

5.1. International Whaling Commission

Nils Øien reported from the annual meeting of the International Whaling Commission Scientific Committee (IWC/SC) held in May 1999. The IWC/SC had considered the following issues of concern to the NAMMCO Scientific Committee:

- The Catch Limit Algorithm had been re-programmed under the auspices of the Norwegian Computing Centre, and the revised program will be re-tuned by the IWC Secretariat in time for the next meeting of the IWC/SC.
- The theoretical aspects of combining partial abundance estimates for a single stock area over several years were considered.
- A working group established with the task of seeking an operational definition of stock continued its work.
- A new abundance estimate for the Central Small Area around Jan Mayen Island for 1987 was accepted by the IWC/SC.
- The status of beluga and narwhal world-wide was reviewed. Stock structure was identified as the most important question for these species. Concerns were expressed about the decline of beluga in West Greenland and other areas.
- By-catch mitigation methods were reviewed.
- A Greenlandic research program to conduct abundance surveys for minke and fin whales were reviewed, and will be further developed for the next meeting.
- The Pollution 2000+ program, which aims to assess the effects of various pollutants on cetaceans using harbour porpoise and bottlenose dolphins as model species, was accepted.

The question of potential involvement in the latter program by the NAMMCO Scientific Committee was considered. Some scientists from NAMMCO member countries are already involved in the program, and it was generally agreed that the NAMMCO Scientific Committee could add little to the program by becoming officially involved. It was therefore decided to monitor developments in this area but not to seek direct involvement.

5.2 ICES

Tore Haug reported that the last ICES Annual Science Conference did not include programs directly of concern to NAMMCO. However, two working groups (Working Group on Marine Mammal Habitats and the Working Group on Marine Mammal Population Dynamics and Trophic Interactions) addressed questions relating to marine mammals in Baltic waters during a meeting in March 2000.

Daniel Pike noted that the ICES Working Group on Marine Mammal Population Dynamics and Trophic Interactions had provided a report from their 1998 meeting that had been utilised by the NAMMCO Scientific Committee Working Group on Marine Mammal – Fisheries Interactions in their deliberations, and that future interaction with this Working Group should be considered. Grete Hovelsrud-Broda reported that she had recently met with the new General Secretary of ICES (David deGriffith), and would soon be completing the process of establishing a Memorandum of Understanding with ICES for cooperation on scientific matters.

5.3 Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga

The Joint Commission has not met since 1997. The NAMMCO Scientific Committee has been tasked with providing management advice for West Greenland beluga and narwhal (see items 9.4 and 9.5). Daniel Pike noted that he had suggested a joint meeting between the NAMMCO Scientific Committee Working Group on Narwhal and Beluga and the Scientific Working Group of the Joint Commission. This proposal was however not accepted. The Canadian Department of Fisheries and Oceans has since denied permission to Canadian scientists to participate in the NAMMCO Working Group.

The Scientific Committee noted that this situation was not conducive to scientific cooperation and progress on this matter, and urged the Council of NAMMCO to come to a cooperative agreement with the Joint Commission.

6. INCORPORATION OF THE USERS KNOWLEDGE IN THE DELIBERATIONS OF THE SCIENTIFIC COMMITTEE- REPLY FROM COUNCIL

At its 8th meeting in Oslo in September 1998 the Council recommended that the Scientific Committee should develop a strategy for how to incorporate the knowledge of users in the advice provided by the Scientific Committee. A strategy to utilise Stock Status Reports as a means to incorporate user knowledge was approved by the Scientific Committee at their 7th meeting. At its 9th meeting in Akureyri in October 1999 the Council endorsed the proposals and provided some guidance for the Assessment Committee working with the Minke Whale Stock Status Report:

"... the proposed Assessment Committee should carefully prepare for the meeting on the "Draft Minke Whale Stock Status Report", and in particular work with the Secretariat with respect to the following questions:

- Define areas and type of information subject to dialogue between scientists and minke whale hunters
- Should the scientists meet minke whale hunters from all interested countries at the same time, or should there be meetings between scientists and minke whale hunters in each of the interested countries?
    - Time and venue for meetings
    - Papers to be distributed before the meetings
    - Language / interpretation
    - How to select hunters with relevant knowledge

- Planning of questions to be asked to hunters"

The Scientific Secretary reported that little progress had been made on this item since the Council meeting. Discussions have been initiated with hunter organisations in Norway and Greenland regarding their participation in a minke whale assessment group, but no formal planning decisions have yet been made. It is anticipated that the minke whale assessment process will be formally initiated sometime in 2000.

7. UPDATE ON STATUS OF MARINE MAMMALS IN THE NORTH ATLANTIC

At its 5th meeting in 1997, the Scientific Committee agreed that the "List of Priority Species" should be replaced by a new document, entitled "Status of Marine Mammals in the North Atlantic". The new document would incorporate status information on all marine mammal species in the North Atlantic. At its 7th meeting in 1999, the Scientific Committee agreed that the Secretariat should proceed with the development of this report, with priority given to the eight species (minke whale, fin whale, walrus, pilot whale, bottlenose whale, beluga, narwhal, ringed seal) for which the Scientific Committee has generated advice. It is planned that these documents will be translated as appropriate and circulated to hunter organisations in member countries for their comments and incorporation of hunter knowledge (see Item 6). Once the final versions are ready, they will be published by one or several means, most likely on the NAMMCO Web Site and as a brochure.

The Scientific Secretary noted that draft stock status reports have been completed for minke whales and pilot whales. Both reports are under review by the Scientific Committee, and should be formally approved as soon as possible. Progress on these reports has been slower than anticipated because of competing priorities. However at least two more reports should be completed by year end.

Noting the importance of these reports in addressing agenda item 6, the Scientific Committee agreed to complete their review of the two draft stock status reports before 1 July 2000. The Committee also directed the Scientific Secretary to complete reports on ringed seal and walrus as the next highest priorities.

8. ROLE OF MARINE MAMMALS IN THE MARINE ECOSYSTEM

8.1 Economic aspects of marine mammal-fishery interactions

At its 8th meeting in Oslo in September 1998 the Council requested that the Scientific Committee should investigate the following economic aspects of marine mammal-fisheries interactions:

i) to identify the most important sources of uncertainty and gaps in knowledge with respect to the economic evaluation of harvesting marine mammals in different areas;
ii) to advise on research required to fill such gaps, both in terms of refinement of ecological and economic models, and collection of basic biological and economic data required as input for the models;
iii) to discuss specific cases where the present state of knowledge may allow quantification of the economic aspects of marine mammal-fisheries interactions;
    a) what could be the economic consequences of a total stop in harp seal exploitation, versus different levels of continued sustainable harvest?
    b) what could be the economic consequences of different levels of sustainable harvest vs. no exploitation of minke whales?

At the Seventh Meeting of the Scientific Committee in April 1999, the Committee decided to reactivate the Working Group on the Economic Aspects of Marine Mammal - Fisheries Interactions to deal with this request. It was agreed to separate the request into two sections. At the first Working Group meeting items i) and ii) were to be considered, while treatment of item iii) was to await the conclusions on the first two. The Working Group met in Copenhagen 16-17 February, 2000, and their report is included as Annex 1.

Significant uncertainties remain in the calculation of consumption by marine mammals, and this uncertainty was the most important factor hindering the development of models linking consumption with fishery economics. While point estimates of abundance are available for some species in some areas at certain times of the year, data on seasonal distribution is lacking for all species and areas. Diet can be variable within and between years for some species, and more data are needed to derive predation functions to link diet composition to prey abundance. Energy consumption can be described generally through allometric relationships, but many of these species concentrate their energy consumption over relatively short periods of the year, and data describing this seasonality is lacking for most species. It is necessary to explicitly describe the uncertainty inherent in consumption estimates, but this is not possible with the data currently available. The quality of the data necessary to estimate consumption is generally highest for minke whales and harp seals in the Barents and Norwegian Seas, pilot whales around the Faroes and for harp, hooded and grey seals off southeastern Canada.

The Working Group used available information to derive estimates of consumption of cod, herring, capelin and shrimp by harp seals, minke whales and *Lagenorhynchus* spp. and bottlenose dolphins in some areas. Harp seals and minke whales are the most important marine mammalian consumers of fish in the Barents and Norwegian Seas. Minke whales are likely the most important consumers around Iceland, although the data on diet composition are very limited. Dolphins of genus *Lagenorhynchus* are likely of importance also, but there are too few data on abundance, distribution and diet to assess this quantitatively. The harp seal is the most important consumer in most areas of Greenland, but here data were again too sparse to derive reliable quantitative estimates. Harp seals are the most important pinniped predator off southeastern Canada, but the importance of cetaceans in this area has not been assessed.

In addition to these species that undoubtedly are important because of their large consumption, there are also species that might be in more direct conflict with fisheries, because of their consumption of valuable fish species of commercial size. The hooded seal is known to be in this category, but both narwhal and sperm whales are also known to eat commercially interesting fish. This potentially makes narwhal important consumers in Baffin Bay, and sperm whales so in the Norwegian Sea, but no data on their diets are available from these areas. Killer whales appear to be important predators on herring in Icelandic and adjacent waters and humpback, pilot and sperm whales may also be important consumers of commercial fish species.

Consumption by marine mammals was similar to fisheries landings in some areas. While this does indicate that there is at least a potential for interaction between marine mammal predation and fisheries, the magnitude of marine mammal predation must be put into the context of total natural mortality for the target species. For example, while minke whales and harp seals may be important predators on cod and capelin in some areas, cod are likely of far greater importance as predators for both species.

Multispecies models presently in use or under development in Norway and Iceland offer a means of assessing the impact of marine mammal predation on fish stocks, and preliminary investigations in this area have already been conducted. Furthermore, such models can be linked to fisheries economic models to assess the impact on fisheries. The Working Group concluded that, for certain selected areas and species, there were sufficient data on marine mammal consumption, stock dynamics of prey species, and the economics of the fisheries themselves, to make this a realistic proposition.

The Scientific Committee therefore recommended that the next logical step in addressing the request from NAMMCO Council should be for NAMMCO to lead or assist in the development of a multispecies-economic model for a candidate area. A subcommittee of the Working Group could be tasked with developing the specifications for such a model. The candidate species/areas identified, in order of preference, were:

1. Consumption by minke whales and harp seals in the Barents and Norwegian Seas. Likely fishery interactions are with capelin, herring and cod. The major information gap identified is likely the lack of predation functions applicable under various conditions of prey availability.
2. Consumption by minke whales around Iceland. Likely fishery interactions are with capelin and cod. The major data gaps identified were a lack of area- and season- specific diet data for minke whales, and a lack of data on energy consumption by minke whales. However, this last could likely be addressed with data from other areas.

The Scientific Committee reiterated that the estimation and model uncertainties are such that definitive answers to part iii. of the request from Council, to quantify the economic aspects of marine mammal-fisheries interactions in candidate areas, cannot be expected in the near term.

The Scientific Committee thanked Aqqalu Rosing-Asvid for his efforts as chairman of the Working Group, and agreed to his request to select a new chairman in the near future.

9. MARINE MAMMAL STOCKS -STATUS AND ADVICE TO THE COUNCIL

9.1 and 2 Harp and hooded seals

Ecological studies in the Nordic Seas

A project aimed to provide the data necessary for an assessment of the ecological role of Greenland Sea harp and hooded seals throughout their distributional area of the Nordic Seas (Iceland, Norwegian, Greenland Seas) was initiated with a pilot study in 1999. A research cruise to the pack-ice in the Fram Strait between approximately 82°27' N; 33°00 E (north of Kvitøya) and the Greenland east coast was performed in the period 23 September - 12 October 1999. Biological material for studies of feeding habits, nutritional status, lipid contents, age, reproduction, genetics and pollutants were collected from both harp and hooded seals in the area

The project will continue in 2000-2002, preferably (i.e., if sufficient funding is obtained) as a joint effort for the four NAMMCO-countries Greenland, Iceland, Faroes and Norway. In 2000, a research cruise to the pack ice along parts of the east coast of Greenland, will be conducted in July/August. The objective will be to obtain data on distribution, diet and body condition from the two seal species. Simultaneously, harp and hooded seals taken by local hunters in eastern Greenland and as bycatches in other fisheries in Iceland and the Faroes, will be sampled for the same parameters in these countries.

Aerial harp seal pup surveys in the White Sea

During the 1997 and 1998 meetings of the Joint ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP), it was noticed and appreciated that Russian scientists had made substantial efforts to obtain reliable pup production estimates for the White and Barents Sea stock of harp seals. As also stated in the 1998 report, WGHARP looked forward to seeing progress in this Russian work, including experimentation with the isohaline method as well as further analyses of the 1998 photographic survey data.

In January 2000 Russian scientists decided that new aerial pup surveys would be conducted in the White Sea during the 2000-breeding season. On several occasions the WGHARP has discussed the possibilities and indisputable advantages involved in exchange of scientists between the "harp-and-hooded-seal-counting" countries during each other's fieldwork and subsequent analyses, discussions and presentations of results. This would ensure standardisation of both the field- and analytical methods involved. For this reason Russian scientists were asked if it would be possible for Norwegian and Canadian scientists to participate in the 2000 aerial surveys, field work as well as subsequent analyses. An immediate positive answer and invitation was received, and Norway participated with four persons during field work in the period 6 – 17 March 2000. Unfortunately, the

intended Canadian participation proved impossible this time. Further participation by foreign guest scientists in subsequent analyses and presentation of the obtained data is planned.

The Russians decided to attempt to obtain two full independent surveys of the breeding lairs: one with helicopter and one with aeroplane. The helicopter, plane and photographic equipment applied were virtually identical to what were used in the 1997 and 1998 surveys. The base for the helicopter surveys was a small village named Zimnyaja Zolititsa north of Arkhangelsk. The helicopter survey was performed, starting in the north and proceeding south and southwestwards during the period 10-12 March, usually with two flights per day. The whole breeding area was covered with parallel transects between which the distances were 7.4 km in low density areas or 3.7 km in more densely populated areas. The weather was favourable, and an apparently good coverage was obtained using this method. Representatives of the Norwegian group participated on all flights. The aeroplane was stationed in Arkhangelsk. Using information about positions of the breeding lairs obtained during the helicopter surveys, the aeroplane aerial surveys started on 13 March with a reconnaissance flight. The first photographic survey was performed on 16 March (with Norwegian participation) during which about half of the breeding lair was covered with parallell transects with a distance of 7.5 km between them. On 18 March a full coverage photographic survey was successfully performed with the aeroplane.

The obtained full coverage, using helicopter and aeroplane independently, clearly fulfils the previous recommendation given by WGHARP that the various parts conducting research in the White Sea should combine their efforts to optimise activities and ensure that surveys, sampling and assessments are completed successfully. Presumably, the 2000 fieldwork will provide two independent estimates for which comparison would be both interesting and useful. How these new estimates relates to the 1997 (helicopter survey) and 1998 (aeroplane survey) estimates will also be of great interest. For relevant comparison, it is of utmost importance that interpretation of obtained photos is standardised.

WGHARP 2000

It is the intention of Russian scientists to analyse the data and present the results at the WGHARP meeting in Copenhagen 2-6 October 2000. The terms of references for the group at this meeting will be to:

a) complete the assessment of stock size and pup production of harp seals in the White Sea / Barents Sea and of hooded seals in the Greenland Sea;
b) assess the sustainable yield at present stock sizes for the above two stocks and provide short- and medium-term catch projections for these stocks as well as for Greenland Sea harp seals;
c) identify B_{lim}, B_{msy} and other relevant biological reference points for Greenland Sea harp seal, Greenland Sea hooded seal, and the White Sea / Barents Sea harp seals. These are parameters derived from fishery biology which pertain to the minimum stock size required to maintain a viable population.
d) examine current biological reference points used for harp and hooded seals, and consider the appropriateness of these and other possible reference points (including B_{lim} and B_{msy}) for the stocks of Greenland Sea harp and hooded seals and White Sea / Barents Sea harp seals;
e) summarise new information on predation on commercially important fish stocks by marine mammals;
f) agree on objectives and presented plans for the forthcoming Workshop on Population Modelling of Pinnipeds.

Items c) and d) are set up to provide ACFM with the information required to respond to requests for advice/information from the Joint Norwegian-Russian Commission. WGHARP will report at the 2001 Annual Science Conference and to ACFM at its October/November 2000 meeting. Furthermore WGHARP will report to the NAFO Scientific Council at its meeting in May 2001.

9.3. Harbour porpoise

In 1997, the NAMMCO Council recommended that the Scientific Committee should carry out a comprehensive assessment of the harbour porpoise throughout its North Atlantic range, to include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals. The Scientific Committee decided that the matter could best be dealt with by convening an international workshop/symposium on harbour porpoises, which would involve experts working on this species throughout its North Atlantic range. The Scientific Committee formed a steering committee, consisting of Tore Haug, Gísli Víkingsson, Lars Witting and Geneviève Desportes who, in concert with the NAMMCO Secretariat, made the International Symposium on Harbour Porpoises in the North Atlantic a reality.

The International Symposium on Harbour Porpoises in the North Atlantic was held on board the Norwegian Coastal Steamer *MS Nordlys* enroute from Bergen to Tromsø, September 10-14, 1999. It was attended by 31 delegates and included 22 presentations. The Symposium agenda was structured around four theme sessions, each led and chaired by an invited keynote speaker: 1) Distribution and stock identity; 2) Biological parameters; 3) Ecology and pollutants; 4) Abundance, removals and sustainability of removals. The keynote speakers also had the responsibility of summarising the discussions around their respective themes, and synthesising conclusions and recommendations. These were presented and discussed on the final day of the Symposium. The report from the symposium is presented in Annex 2.

Both the invited review papers and many of the submitted papers are offered the possibility of being published in a separate symposium volume of NAMMCO Scientific Publications.

Distribution and stock identity

In addition to the keynote review of current and published information (by Liselotte W. Andersen), this session contained two papers, dealing with satellite tracking (in Kattegat/Skagerrak) and stock identity studies (based on material from the North Sea and Barents Sea) using genetic techniques.

Movements and distribution

Although the general distribution of harbour porpoises in the North Atlantic has been described, little information is available on the movements of porpoises within and between areas. Information on the extent of movements made by porpoises, whether there is any temporal variation in their movements, and whether there are differential movements made by females and males, or mature and immature individuals, is essential to understand the dynamics of the different stocks. Fortunately, recent advances in satellite telemetry have been successfully applied in several regions, allowing for an initial examination of these variables.

Available data has revealed that porpoises are capable of extensive movements in the western Baltic, inner Danish waters, Kattegat and Skagerrak. Immature porpoises were observed to move from the inner Danish waters up to 800 km along the Swedish west coast to the southeast of Norway during April-July. Mother/calf pairs tagged in the same area moved back and forth along a 100 km coastline of west and north Sjælland in Denmark. Adult males were observed to be more stationary than the adult females and the immature animals, staying within an area of a few kilometres for several weeks during April-June and November-December. Only immature porpoises entered the northern Kattegat and Skagerrak. Contact was maintained with the porpoises throughout the reproductive season from late March to early December. The adult animals stayed within the inner Danish waters and the western Baltic in the period of contact, suggesting that these areas contain animals from the same breeding stock.

Preliminary results from yet unpublished experiments have revealed that three adult harbour porpoises tagged in Varangerfjord in northern Norway have exhibited extensive movements both along the Russian coast and into the Barents Sea.

Data on the movements of harbour porpoises on the east coast of America are also available from satellite tagged animals.

Stock Identity
Genetic techniques have been widely used in studies of population structure in a variety of species including cetaceans. Within the last decade, genetic techniques have provided valuable information regarding harbour porpoise population structure. Unfortunately, there has been an inconsistent application of diverse techniques, such as RFLP analysis of mtDNA, sequencing of mtDNA, isozyme electrophoresis and microsatellites, in the different areas. This means that a valid comparative analysis between nearby areas, which would contribute to a more coherent picture of the harbour porpoise sub-populations/populations, cannot be performed. Nevertheless, the population genetic studies applied in the different regions do to some extent support the existence of genetically different harbour porpoise sub-populations/populations in the North Atlantic.

Although the International Whaling Commission (IWC) has divided the North Atlantic into 13 putative sub-populations, several new studies suggest that a revision of this putative structure is in order. In the Northeast Atlantic it has been suggested that the North Sea may be divided into a northern and southern region. Further, it has been suggested that the northern North Sea may have an east-west division where porpoises may be associated with the coasts of either Scotland or Norway. If females are more philopatric than males, then such a division in stocks may be maintained in spite of high probability of offshore mixing.

Some confusion about the definition of the North Sea and inner Danish Waters (IDW) exists. Previously, Skagerrak was included in both the North Sea and the Baltic Sea. More recent population genetic studies includes the Skagerrak in the North Sea and not in the inner Danish waters, and distinguish between the IDW and the North Sea. Another recent study detected significantly different haplotype frequencies between samples from the Kattegat-Skagerrak area, the Swedish Baltic Sea and the Norwegian west coast, but it was not clear whether the Kattegat-Skagerrak sample was considered to represent the North Sea or the inner Danish waters or Swedish waters. In the latter case, 2 different sub-populations within the Kattegat, Skagerrak and Belt waters was indirecly assumed, i.e. a Swedish Baltic and a inner Danish water or Swedish water sub-population.

In Icelandic, Faroese, Iberian and West African waters, no genetic population structure studies had been applied to test the proposed population structure model of harbour porpoises in these regions.

In the discussion under this item, some points were raised: 1) That there is a great need for cooperation between jurisdictions for both genetic and satellite tracking studies; 2) That there is a need for ways of combining various types of data (eg. data from tracking, genetic and contaminants studies) to get a better picture of stock identity and boundaries; 4) That there is a need for a coherent theoretical framework for analyzing stock identity and determining sustainability.

Biological parameters
There were six papers presented in this session, covering aspects of reproduction, growth and life history. The keynote paper (by Christina Lockyer) presented a review of current and published information. Further, new information was provided on parameters for harbour porpoise from Iceland, West Greenland and Denmark. A summary of the most current biological parameter data is provided in the Table 1 of Annex 2.

The following points were raised in the discussion under this item: 1) That the possibility of determining sexual maturity from biopsy samples be thoroughly investigated, as this would aid greatly in determining the structure of wild populations; 2) Satellite tracking of instrumented mother-calf pairs may give information on maximum duration of lactation - however genetic samples must be collected to confirm the mother-calf relationship.

Ecology and Pollutants

Seven papers were presented under this session, covering items such as health status, pollution, fatty acid compositions, diets, parasites and echolocation. The keynote paper (by Arne Bjørge) presented a review of current and published information on habitat use, trophic ecology and contaminants.

Harbour porpoises are inhabitants of coastal waters and their habitat includes some of the most polluted waters of the North Atlantic. Harbour porpoises have a small body size, and therefore a relatively high metabolic rate, and they feed at high trophic levels. These three factors combine synergistically to place the species in an ecological situation where it is highly exposed to environmental contaminants.

Harbour porpoises are most frequently observed in areas with water depths of less than 200 m. This is confirmed by the recent findings on the distribution and movements of animals equipped with satellite-linked tags. However, harbour porpoises have also been observed over deep oceanic waters during offshore sighting surveys.

Harbour porpoises feed at or near the seabed, and benthic fish species constitute a large proportion of their diet. Temporal and spatial changes in diet compositions have been observed. These changes possibly reflect seasonal changes in the relative abundance of prey stocks, and differences in prey communities according to local bathymetry and other environmental factors. Even though harbour porpoises forage almost exclusively on fish, a wide range of fish species are represented in the diet. Fish in general have little capacity to metabolise some important pollutants, such as organochlorines, and therefore act as an effective mechanism in the transfer of pollutants to piscivorous marine mammals such as the harbour porpoise.

Some of the classical organochlorines, such as PCB's, are still abundant in the marine biota, and represent a continuing health hazard for top marine predators. Harbour porpoises feed at approximately the same trophic level as grey and harbour seals and white-sided dolphins. In Norwegian waters, the foraging habitats and diets of harbour porpoises and harbour seals overlap almost completely. However, mean levels of total PCB and DDT in harbour porpoises were 2-3 times those of harbour seals from the same areas, possibly reflecting a poorer capability of harbour porpoises to metabolise these compounds. Gradients in levels of organochlorines in harbour porpoises have been observed over short distances both in the Northwest and Northeast Atlantic.

Recent deployments of satellite-linked transmitters on harbour porpoises revealed large variability in individual movement patterns and habitat use. Some individuals travelled long distances in short periods of time (at the scale of hundreds of kilometres) between foraging sites. This underlines the importance of careful consideration of spatial and temporal scale in studies of harbour porpoise habitat use. Knowledge of habitat use is a prerequisite for an improved understanding of exposure to pollutants, and the pathways of compounds from the environment to the tissues and organs of the harbour porpoise.

Abundance, removals and sustainability of removals

There were four papers presented in this session, covering issues such as habitat-related management in the Northwest Atlantic, status in the Baltic, and experiments and action plans aimed to reduce bycatches in fisheries. The keynote paper (by Garry Stenson) presented a review of current and published information.

Stock Identity

In order for stock assessment and management to be effective, it is necessary to understand the relationship between animals that are being caught and the animals that are surveyed. This is

particularly important for areas/stocks subject to high removals. The relationship between putative populations in one such area, the North Sea, Skagerrak, Kattegat, Belt and Baltic, is unclear.

A point raised in the discussion was that there is considerable uncertainty about the precise meanings of terms like "stock", "population" and "sub-population", especially as they are used by researchers in different fields and by resource managers. The Scientific Committee of the IWC established a Working Group on Stock Identity in 1998, to develop operational definitions of stock. NAMMCO should follow developments in this area. Collaborative, often international work is required, particularly for stock identification and abundance estimation.

Biological Parameters
Unbiased estimates of reproductive parameters are required on a population specific basis. The extent of potential biases in reproductive parameters determined from catches should be therefore be examined. In particular, unbiased and precise estimates of survival/mortality are needed.

Abundance estimates
Estimates of abundance for harbour porpoise are rarely available, and the confusion over stock identity in many areas makes interpretation difficult. No estimates are available for Newfoundland, Greenland, Faroe Islands, Iberia, NW Africa, western UK areas. Partial estimates only are available for Baltic area. Estimates from Icelandic and Norwegian surveys are more than 10 old and refer to offshore populations only. Surveys from the North Sea, Kattegat and area, and Celtic Sea are now >5 years old.

In the discussion it was emphasised that abundance surveys be carried out as part of an overall monitoring strategy with clear objectives. The objectives of the strategy often help to determine the design of the surveys. Consistency is sometimes more valuable than precision when comparing a series of abundance surveys.

Removals
Estimates of anthropogenic removals are crucial, as this is usually the only parameter that can be affected by management. Yet such estimates are difficult to obtain and are unavailable for many areas. There are no quantifiable estimates of total removals for Gulf of St. Lawrence, Newfoundland, Norway, Iceland, Baltic, Sweden, and NW Africa. Estimates of removals are available from Greenland. The North Sea, Kattegat and Irish Sea/Western UK areas have some observer coverage, but it is not complete for all fisheries. There are no recent removals off the Faroe Islands.

Estimates of bycatch may be affected by very rapid shifts in fishing effort or better methods of estimating incidental catches. It is important to involve fishermen to ensure that they understand the issue and participate in the monitoring programs. Without it there will be no acceptance of the estimates and/or mitigation methods. Projects currently underway (e.g. EPIC) may provide some methods of mitigating incidental catches.

Ecological Factors

We do not understand the relationship between environmental /ecological factors and the distribution of porpoises. Such knowledge would improve the efficiency of surveys, and might also lead to ways of mitigating bycatch. In addition, the impact of predators on porpoise population, and how changes in the abundance of predators (or prey) affect harbour porpoise population dynamics, is unknown.

Recommendations

- A standardisation of genetic techniques, for example in the use of nuclear markers and mtDNA, should be agreed upon, so that a world-wide comparison of the genetic relationships can be performed.

- It is recommended that the present satellite telemetry studies continue and that new telemetry studies are initiated in all areas where the stock structure is unclear. It is particularly important that a greater temporal range is covered.
- Results from other studies, such as geographic variation in morphometrics, pollutant levels, and fatty acids should be combined with the results of genetic and telemetry studies to provide a more complete picture of the population structure.
- The calculation of demographic parameters for all populations is recommended. Basic biological parameters are especially needed for the populations in the Gulf of St Lawrence, the Faroe Islands, Ireland and the western UK, the Iberia / Bay of Biscay and the Black Sea (See Annex 2, Fig.1).
- There is a need for integration of research plans to consider harbour porpoise distribution, prey abundance and distribution, ecotoxicology and the biological effects of pollutants simultaneously. Such collaborative efforts will make more efficient use of data and samples. An example would be the use of distribution information from satellite tagging programs to understand exposure to pollutants.
- Current estimates of abundance and removals are absent or out of date for virtually all populations. Efforts must be made to monitor fishing effort, catches and abundance on a regular basis. These are especially critical in areas that are undergoing significant changes in fisheries or ecological conditions.

The Scientific Committee noted that the approach of holding a symposium to deal with matters that did not pertain directly to management had proven valuable in this instance. However it was considered beneficial that future symposiums should, if possible, be held in cooperation with other organisations to broaden the base of participation.

9.4 and 9.5 Beluga and Narwhal

In 1997 the Council requested the Scientific Committee to "examine the population status of narwhal and beluga (white whales) throughout the North Atlantic." The Scientific Committee convened a Working Group on the Population Status of Narwhal and Beluga in the North Atlantic, 1-3 March 1999 to address this request. In considering the report from that Working Group (NAMMCO 2000), the Scientific Committee noted that index surveys conducted in the West Greenland beluga wintering area since 1982 indicated a decline of more than 60% in abundance, and that the aggregation was likely declining due to overexploitation. The Scientific Committee found that there was insufficient information to assess the status of narwhal stocks in Greenland, but noted some concern about the aggregation in the Ummannaq area, which is subject to substantial catches in some years.

At the 1999 meeting of the Management Committee of NAMMCO, the Committee noted its appreciation for the comprehensive status reports on beluga and narwhal in the North Atlantic. The Management Committee furthermore requested advice from the Scientific Committee on the level of sustainable utilisation of West Greenland beluga in different areas and under different management objectives. For narwhal, the Management Committee requested that the Scientific Committee identify the information that is lacking in order to answer the same question proposed in respect to beluga. To answer this request for advice the Scientific Committee decided to arrange for another meeting of the Working Group on the Population Status of Beluga and Narwhal in the North Atlantic. The meeting was held in Oslo during 15-17 June 2000 under the chairmanship of Professor Øystein Wiig. The report of the Working Group in contained in Annex 3.

Assessment of sustainable harvest levels of beluga in West Greenland

Stock structure

The evidence of a population structure of West Greenland beluga is equivocal. The seasonal pattern of beluga harvesting in West Greenland is illustrative of the temporal and spatial distribution of beluga in the area. Beluga are harvested in the Qaanaaq area (see Fig. 1, Annex 3) beginning in September. Subsequently they are harvested in the Upernavik district in October, Ummannaq in

November, and in the Disko Bay settlements from November through April. There is winter harvesting in communities to the south of Disko bay as far as Maniitsoq and Nuuk. The Upernavik and Qaanaaq areas again harvest beluga on a smaller scale beginning in April. The pattern is suggestive of a southward migration of beluga along the West Greenlandic coast beginning in September, overwintering in Davis Strait to the south of Disko Bay, and a return migration to the north beginning in April. Particularly the fall migrations are often very predictable in timing.

Various studies of population structure involving satellite tracking of instrumented whales, genetics, comparisons of organochlorine profiles and tooth morphology have been conducted. All evidence suggests that beluga wintering in the North Water should be treated as a separate stock, that apparently has no exchange with beluga wintering in West Greenland. All beluga that are subject to harvesting in West Greenland presumably summer in the Canadian High Arctic. For the wintering grounds in West Greenland a northern and a southern stock component has been tentatively identified with a proposed stock delineation around 67°30'N. Genetic evidence does not confirm such a splitting, but organochlorine contaminant profiles and to some extent tooth morphology provides some support for it.

The Scientific Committee nevertheless concluded that there was insufficient information to divide the stocks at present, although there is some indication that such a division may be warranted. It was noted however that division into two stocks would result in a lower sustainable yield than that from the single stock situation, and that the Scientific Committee's conclusion was not conservative in this regard. If more than one stock exists, the risk of overharvest of any one stock could be reduced by spreading the harvest throughout the present hunting area, rather than concentrating the harvest in any one area.

Harvest statistics

The data on catch statistics for beluga in West Greenland for 1862 through 1998 were reviewed. For the period 1862 to 1891 catches south of Sisimiut were assumed to consist exclusively of beluga whereas for the area north of Sisimiut it was assumed that 70% of the catches were beluga and the rest were narwhal. For the period prior to 1954, catches from Maniitsoq, Nuuk, Paamiut and Qaqortoq were excluded as these were taken outside the present range of beluga in West Greenland and may therefore have belonged to a different, now extirpated stock. After 1954, catch levels were evaluated on the basis of official catch statistics, trade in mattak (whale skin), sampling of jaws and reports from local people and other observers. Three options were given for correction of catches based upon auxiliary statistics on trade of mattak and observations of catches (low and medium options) and on likely levels of loss rates in different hunting operations (high option). The high option for the catch statistics included a correction of the drive fishery in the northern municipalities (Qaanaaq and Upernavik) with a loss factor of 10% and a loss factor in all other areas where open water hunting is practised of 30%.

It was also noted that catches in the Canadian High Arctic were high around the turn of the last century, and that some proportion of this catch may have consisted of West Greenlandic animals. However, there is no way to assess what this proportion was, and it was thought that these catches likely had little influence on the present status of West Greenland beluga.

Population Parameters

All sex and age classes of beluga are subject to harvesting in West Greenland. Sampling during ten years between 1985 and 1997 resulted in an overall mean age of 7.7 years in females and 6.5 years in males of the harvested population older than 1 year in all municipalities. In the samples more females than males were taken (712 vs. 596), but there was an equal proportion of both sexes among calves less than 1 year of age (44 females, n=89). The estimate of survival rate in West Greenland beluga is less than those determined for beluga populations in the White and Kara seas and in Alaska for comparable age truncations. Since the exploitation levels are much lower in these areas the low

apparent survival rate from West Greenland is consistent with the other evidence of a population decline there. Data on population parameters for West Greenland beluga presented in Heide-Jørgensen and Teilmann (1994) were agreed to be the best available information.

Trends in Abundance

The coastal area between Disko Island and Nuuk in West Greenland has been identified as an important wintering area for beluga. To assess trends in relative abundance of beluga, visual aerial surveys were conducted over this area in March in seven years between 1981 and 1999 (see Fig.|, Annex 3). To collect data necessary to calculate corrections of animals missed by the observers or submerged during the surveys in 1998 and 1999, continuous video surveillance of the track line was conducted. No overall changes in distribution of beluga within the surveyed area could be detected and no beluga were seen in the southernmost area between Maniitsoq and Paamiut in surveys in 1994, 1998 and 1999. In 1999, reconnaissance south to Kap Farvel revealed no beluga south of the survey area. The relative abundance of beluga within the surveyed area has declined considerably since 1981 and the recent estimates indicate an abundance that is between a third and a quarter what it was in the early 1980s. When analysing the sightings as a line transect survey and correcting the abundance estimate for whales that were either submerged or at surface but missed by the observers, an estimate of total abundance of 7,941 (95%CI: 4,264-14,789) beluga wintering in West Greenland in 1998-1999 was derived.

It was noted that there was some beluga sightings at the western edge of the survey blocks in 1998 and 1999. Additionally, belugas are known to occur in small numbers north of Disko Island. This indicates that the surveys did not cover the complete winter distribution of beluga in the area, and therefore underestimate the number of beluga to some unknown degree. Compared to surveys conducted in the 1980s, the frequency of large groups (>10) has decreased, while the frequency of small groups has increased.

Assessment models

Three assessment models of the West Greenland beluga situation were examined - each approaching the assessment from somewhat different perspectives, with differences in input data and analytical methods.

The first assessment model, using the HITTER-FITTER technique and applied by Douglas Butterworth, requires, at a minimum, a single abundance estimate for a particular year and a catch series. A stock trajectory is computed to "hit" the abundance estimate given assumptions about Maximum Sustainable Yield Rate (MSYR) and certain biological parameters. The results indicate that the stock is severely depleted, ranging from a worst case ($MSYR^{1+}$=1%, lower 5%-ile of survey abundance estimate) of 6% to a best case ($MSYR^{1+}$=4%, estimated survey abundance) of 20% of pre-exploitation size. Projections with a constant catch of 100 to 700 whales per year indicated that, with $MSYR^{1+}$=1%, a catch of 100 animals per year will not allow the stock to recover, and catches of 400 and 700 animals cause extinction of the stock within 20 years. For $MSYR^{1+}$=4%, an annual catch of 100 does allow stock recovery, while a catch of 400 does not and a catch of 700 causes extinction within 20 years.

The second assessment model – the so-called Innes model developed by the late Stuart Innes - estimated stock sizes and yields for the North Water and West Greenland aggregations of beluga in a Bayesian inference framework. The population model incorporated changes in recruitment with respect to the stock's size relative to its carrying capacity. The analysis used the series of stock index surveys conducted off the west coast of Greenland (1981 to 1998), one population estimate of the combined North Water-West Greenland stocks from 1996, and a catch series from Canada and Greenland (1862-1998) to provide an estimate of yield and stock size for the West Greenland and North Water beluga stocks.

The stock size for the beluga wintering off West Greenland in 1997 was estimated as 5,230 (3,090 – 8,910, 95% Credibility Interval (CrI)) whales, which is nearly identical to the survey estimate from 1998-99. The model indicated that, projected to 1999, this stock can sustain a landed catch of about 100 whales (96; 21 – 271, 95% CrI) with a total removal (incl. losses and underreporting) of 160 (27-489, 95% CrI). The catches of beluga from West Greenland have been higher than the estimated 97.5% Credibility Level of the maximum net productivity since about 1968 when catches, or at least reports of catches increased by an order of magnitude. These catches have reduced the West Greenland stock size to about 10% of the estimated stock size in 1861.

The third assessment model – the so-called RISKASS model developed by Carlos Alvarez and Mads Peter Heide-Jørgensen - evaluated the dynamics of a discrete logistic population model to fit estimates of absolute and relative abundance from the aerial surveys from 1991 through 1999 and using catch data from 1954 to 1998. Estimation of the intrinsic rate of increase and the depletion rate was conducted with maximum likelihood estimation and by Bayesian integration. To evaluate the effect of future catch limits, the change in population size after 5 and 10 years of harvest was measured. Two types of catch limits were applied: either constant annual removals or a harvest rate set as a proportion of the population size. The initial population size in 1954 was estimated at about 30,000 beluga. The intrinsic rate of increase was between 0.03 and 0.04. The population was consistently estimated to be under 30% of its size 50 years ago, and can be considered depleted. A high probability of extinction was calculated if harvesting continues at present levels, and even a constant catch level of 150 beluga per year resulted in a risk of 20% that the population will not recover. A catch set to be half the intrinsic rate of increase suggested a sustainable harvest of 130 beluga for the first five years and should be adjusted to new estimates of abundance thereafter. A gradual reduction of catches over 4 yrs and a constant harvest of 100 animals thereafter would have a high probability of allowing stock recovery within the next 50 years. However the uncertainty in the data is reflected in wide probability distributions for the abundance in the future, even if no catch is allowed after the gradual reduction.

Comparison of Assessment Models

The three assessment models were compared for the following key parameters:

Correction factors for surveys

This is defined as the combined effect on the survey counts of diving whales not visible to observers, and visible whales missed by observers. The estimated value from the Innes model included a correction for whales outside of the survey area. The values were very similar and it was concluded that this has a negligible influence on the conclusions of the assessment.

Killed-but-lost and underreporting

For the HITTER-FITTER and the RISKASS models, the estimates for deficiencies in the catch statistics were incorporated into the input catch series, whereas the Innes model estimated these correction factors. In comparison the correction factor derived from the model described in the Innes-model is somehow higher, but it also corrects for years in which no whales were reported killed.

Depletion rate

The estimates of depletion rate reported by the three models were very similar.

R_{max}

The estimates of R_{max}, defined as the maximum potential rate of increase of the stock, was almost identical for the Innes and RISKASS models, whereas the HITTER model resulted in lower values.

General Conclusions

All three assessment models reached the conclusion that the stock is substantially depleted and that present harvests are several times the sustainable yield, and, if continued, will likely lead to stock

extinction within 20 years. While it is conceivable that the apparent depletion of the stock could have been caused by a shift in winter distribution out of the survey area, there is no evidence to support this hypothesis. The distribution of beluga in the core index survey area has not changed over the 18 years surveys have been conducted. The surveys have been extended to the south to Paamiut and Kap Farvel, but no additional animals have been found in this area. There are no observations from other sources or surveys to indicate that beluga are occurring in significant numbers outside the survey area at the time when the surveys are conducted. It was therefore concluded that the West Greenland stock was indeed substantially depleted, and that the most likely reason for this depletion was harvesting above sustainable levels, particularly over the past 40 years. No quantitative information on hunting effort was presented, but there is little doubt that hunting effort has increased over the period, with the increasing number of boats, improved communication and navigation technology and improved landing, storage and processing facilities (Statistisk Årbog 1997).

Recommendations for sustainable harvest levels

The RISKASS assessment model was used to provide estimates of sustainable yield for the stock. It was considered however that any of the three models could provide similar and valid results, and the choice of models was based on availability at the meeting.

Catches for 1998 and 1999 were not available and it was decided to allocate a catch of 700 to 1998, given that 487 were reported caught by September 1998 and additional catches could be expected after that, and to use the same catch figure for 1999. This was done to make the estimate of abundance current to 1999.

The average of the high and medium options for catch series gave an overall correction factor of 1.2 to correct for killed-but-lost whales and underreporting. It was considered that the killed-but-lost ratio might justify a higher correction factor, but it was also noted that a significant number of ice-entrapped whales were harvested periodically. If ice-entrapped whales are fated to die, their harvest should be considered a part of natural mortality, and these catches should be subtracted from the catch statistics. Thus the factor of 1.2 was chosen as a compromise between a higher catch option incorporating a more realistic estimate of killed-but-lost whales, and a medium option which did not include killed-but-lost whales.

The primary management objective identified was to arrest the decline of the West Greenland beluga, and that all catch options should be judged against this objective. It was also decided to present options incorporating a delayed or gradual reduction in the catch, since these were considered the most realistic alternatives from a socio-economic point of view and the most likely to be adopted.

Table 3 in Annex 3 shows the probability that the stock size in 2011 will be lower than the stock size in 2001 under the various catch options considered, and Fig. 2 in Annex 3 shows the probability distributions of stock size in 2011 under these options. To address the management objective of arresting the decline in beluga numbers, the best option is to cease harvesting immediately (Option 6). This guarantees that the stock decline will cease by 2011. The worst option is to keep harvesting at present or higher rates (Option 1), which will cause continued stock decline and may cause stock extinction by 2011.

It is apparent that harvest must be reduced to about 100 animals per year to have any significant chance of stopping the decline in the stock within the next 10 years. Options 3, 4 and 5 illustrate the cost or risk of delay of management action in terms of the probability of continued stock decline. For example, for Option 3, which allows a stepwise reduction in harvest to 100 animals over a 4 year period, the risk of continued stock decline is about twice as great as that for Option 4, which

implements an immediate reduction to an annual catch of 100 whales. Option 5 shows the increased risk associated with delaying the implementation of harvest reduction compared to Option 3. The benefits of a delayed or graduated reduction in harvest must therefore be weighed against the increased risk of continued stock decline embodied in these options.

Population monitoring

In light of the uncertainties related to the allocation of the catch limits, it will be necessary to conduct frequent surveys to improve model predictions. It is suggested that surveys of the index area should be conducted every 5 years.

Allocation of harvest

The Scientific Committee, having decided to consider West Greenland beluga as one stock, decided that the most risk-averse option would be to distribute catches on three hunting areas and thereafter on municipalities in proportion to past catches. The suggested allocation is illustrated in Table 4 of Annex 3.

Seasonal closures

It is well documented that beluga occurred seasonally in large numbers in Southwest and South Greenland before 1930, and that the most simple explanation for the disappearance of these beluga is past overexploitation. . To facilitate this, the following seasonal closures are recommended for West and Southwest Greenland:

Northern area (North of 72°00'N):	June through August
Central area (67°30'N to 72°00'N):	June through October
Southern area (65°00' to 67°30'N):	May through October

For the area south of 65°00'N, it is suggested that no harvesting of beluga be allowed at any time.

It should be stressed that these seasonal and spatial closures will not halt or reverse the recent decline in beluga abundance, but are only proposed to promote the recolonisation of areas that were formerly inhabited by belugas.

Protection of cow-calf pairs

It was noted that the protection of cow-calf pairs would reduce the number of adult females harvested, which would assist in the recovery of the stock.

Recommendations for future research on beluga in West Greenland

The following studies will improve the assessment of beluga in West Greenland and should be given priority for completion within short-term:

- Investigate the impacts of ice entrapments on: (1) population (develop model to simulate effects on population) and (2) catch statistics (separate whales taken in ice entrapments from other harvest numbers and rerun models. Ice entrapment mortalities should be accounted for under R_{max} and not harvest.)
- Examine the occurrence of ice entrapment events and the relationship to sea surface temperature (or other environmental factors). Are ice entrapments predictable?
- Examine past aerial survey data for: (1) detection probabilities of small vs. large pods and (2) estimation biases due to differing pod sizes among years. Re-examine the quality of the 1981 and 1982 aerial surveys. Are these surveys useful for trend analysis?
- Review results on the potential stock structure of beluga in west Greenland, specifically evaluate tooth morphology data and tagging data that will be available late in 2000.

- Models currently assume a 50:50 sex ratio in the harvest. Include data on sex ratio of the harvest in the models; evaluate results of the model and predicted impacts on the population of beluga and on recommended quotas.
- Conduct a formal and independent review of the model (formulation and estimation techniques) developed/used by Alvarez and Heide-Jørgensen in SC/8/BN/10 (RISKASS). This research is especially needed if the NAMMCO Scientific Committee will use this model or a variation in further analyses.
- Establish a method for formally collecting "anecdotal" data on beluga distribution and abundance in Baffin Bay and Davis Strait. These observations could be from surveys conducted for other projects or from local ecological knowledge.

Whereas the short-term priorities for studies could be completed in a year and could improve the assessment a number of other important studies were also identified that may need some longer time for their completion:

- Develop age-structured model and simulate impacts of deposition of 1 or 2 growth layer groups per year in beluga teeth.
- Abundance and trend estimate needed in 3 to 5 years. Next survey should include areas to the north of Disko Island and to west of trend area. Continue to collect data as line transect and strip transect for comparison with previous years of data.
- Continue to use video for estimation of correction factors for surveys.
- Collect beluga dive data for West Greenland in March. Needed for estimating correction factors for abundance estimates.
- Further evaluate stock structure of west Greenland beluga. Determine whether hiatus in aerial survey sightings (near 67^{o} 30') in March is constant from year to year and whether the hiatus could delineate distribution of different stocks.
- Determine availability of skin samples in March from areas north and south of the hiatus (near 67^{o} 30'). If sufficient number of samples exists then conduct genetic analysis for stock structure.
- Determination whether 1 or 2 growth layer groups (GLGs) are deposited annually in beluga teeth. NAMMCO should provide support for a planned workshop on beluga ageing techniques.
- Estimate R_{max} with life history data and evaluate impacts of deposition of 1 or 2 GLGs per year in beluga teeth.

Research needed to establish sustainable harvest levels for narwhal in West Greenland

Satellite tracking and genetic studies indicate that, in general, narwhal occupy discrete local areas during the summer, and there may be relatively little exchange between these areas. During the winter, they are more dispersed. Although the total numbers of narwhal occupying Baffin Bay and East Greenland waters may be quite large, small local aggregations may still be subject to overexploitation. This was noted as a particular concern for the Ummannaq area, where large harvests occur in some years, and to a lesser extent in Qaanaaq, Melville Bay and Upernavik. The Disko Bay area appears to be a wintering area where two or more stocks may mix.

Developing recommendations on the sustainable harvest of narwhal in Greenland will require significant additional research and cannot be done at present. However, this may become a priority, particularly in West Greenland where hunting effort may switch to narwhal because of the decline in the beluga stock. The following research priorities were developed for narwhal:

Catch statistics

1. Improve the collection of current harvest statistics, including information on loss rates. Loss rate may be significant in some areas and times, and all population removals must be considered in stock assessment.
2. Review historical harvest statistics, providing, to the extent possible, corrections for underreporting and killed-but-lost animals. Also, records of harvesting of ice-entrapped

whales should be reviewed, and it should be determined if these should be included as removals or as a component of natural mortality. Modelling should be carried out to determine the possible effects of stochastic events such as ice entrapments on estimates of sustainable yield.

Stock identity

1. Sampling should be continued in hunting areas, and genetic analyses should be carried out to determine if there is annual variability in the genetic structure of narwhal in aggregation areas. This will help to determine if significant mixing between aggregation areas occurs.
2. Satellite tracking experiments should be conducted from all aggregation areas, to determine if significant mixing between aggregation areas occurs, and to identify migration routes and wintering areas.

Abundance

1. Abundance surveys should be carried out in aggregation areas, particularly in the Qaanaaq, Melville Bay and Ummannaq areas. It will be necessary to repeat abundance surveys over several years as the numbers in an area can vary significantly from year to year.

Future work on beluga and narwhal

The Scientific Committee decided that it will be important to have another meeting of the Working Group on the Status of Beluga and Narwhal in the North Atlantic when the short-term research priorities for beluga are addressed and to review the development of the research that is needed to complete the assessment of narwhal. It was suggested that such a meeting is needed within a year.

9.5 Fin whales

At the 1999 meeting of NAMMCO Council the following request to the Scientific Committee was adopted by the Management Committee:

"...that the Scientific Committee continue its assessment of fin whale stocks in the North Atlantic, focussing in the near term on the status of fin whales in Faroese Exclusive Economic Zone (EEZ) waters. The Scientific Committee should focus particularly on the following issues:

- Assess the long-term effects of annual removals of 5, 10 and 20 fin whales in Faroese EEZ waters;
- Information gaps that may need to be filled in order to complete a full assessment in this area."

To deal with this request, the NAMMCO Scientific Committee re-established its Working Group on North Atlantic Fin Whales, which met 12-13 May in Tórshavn. The report of the Working Group is included as Annex 4.

Stock structure and abundance

The Scientific Committee considered the stock structure of fin whales in the North Atlantic in some detail in 1999 (NAMMCO 2000) and noted that stock delineation was the most critical issue in fin whale assessment in the North Atlantic. While it was evident that the stock structure of fin whales is more complex than reflected by the present stock areas, the details of stock structure were not considered clear enough to identify boundaries between the different North Atlantic fin whale stocks. This applies especially for areas where there is little information on stock identity, as in the case of fin whales found in Faroese waters.

Fin whales are seen year-round in the Faroes, but there is a definite seasonal pattern to their distribution and abundance. The locations of historic catches and recent incidental observations of fin whales show the apparent seasonal changes in fin whale distribution in the area. At the beginning of the main catching season in May, whales were caught to the south. Subsequently catches were also taken west to the north-west. Whales on the western side of the island were usually observed in waters over 500 m deep. In June-July, fin whales have been observed from the Faroe Islands to

eastern Iceland. In July-August, catches were concentrated to the north and east of the isles. By October, most catches and observations were to the south-east of the Faroese plateau.

While these data show apparent seasonal migrations in the area, their interpretation requires amongst other things information on whaling/observational effort. Some information on whaling effort might be obtained from an examination of log-books. Unfortunately, it is not possible from the information available to determine whether the animals observed off the Faroe Islands comprise a separate stock or are part of one or more larger stocks that migrate through Faroese waters.

There is virtually no other new information available on the stock structure of fin whales in Faroese and adjacent waters, and it remains the most critical issue in developing assessments of fin whales in this and other areas. Given the paucity of information with which to construct stock boundaries for the Faroese area, assessments were conducted on arbitrarily defined stock areas. It is important to recognise that these areas were not intended to be realistic alternative stock areas, but are merely areas defined to explore the dynamics of the fin whale population implied by different assumptions. The following stock areas were considered (See Annex 4, Fig. 1):

1. Faroese 200 nm exclusive economic zone (EEZ)
2. Medium Area comprised of Block A as defined in NASS-95 (see NAMMCO 1998).
3. Large Area, including the eastern part of the Icelandic area (blocks 5, 6 and 8), Block A and the West Norway area (block NSC) (see (NAMMCO 1998).

Abundance estimates for the Medium and Large areas were available from the NASS 87, 89 and 95 surveys, and were calculated from published sources. For the Faroese EEZ, estimates were calculated by applying density estimates of block A as defined in NASS-95. This estimate is based on the assumption of an even density of fin whales in block A. It would have been more appropriate to conduct a restratification of survey data for this specific area, however time restrictions did not allow this to be carried out.

Catch data for fin whales was kindly provided by the IWC from their catch dataset, and sensitivity analyses were conducted under different assumption about struck and lost whales.

Assessments

It was decided to base assessments on the HITTER-with-fixed-MSYR approach (see below). This requires a single abundance estimate for a particular year, which a stock trajectory is computed to "hit". Given that three abundance estimates are available, it was agreed that the HITTER assessments would be based on an average of the three results taken to pertain to an intermediate year (1991). An inverse variance weighting approach was used, effected by weighting the logs of the abundance estimates by the squared inverses of their CV's in the weighting process.

The results indicated that the current status of the Faroese fin whale resource ranged from a worst case (Faroese EEZ, $MSYR^{1+}$=1%, lower 5%-ile of average of survey abundance estimates) estimate of depletion of 0.04 to a best case of 0.29 (Large Area, low harvest assumptions, $MSYR^{1+}$=4%, weighted average abundance). Thus under any of the scenarios considered here, the extent of depletion is substantial. The corresponding "worse-to-best" range of current replacement yield estimates is from 5 to 257.

In considering these results the Scientific Committee noted that in the worst case projections considered, combinations of extreme assumptions on MSYR (1%), stock area (Faroes EEZ) and abundance were used. Combining extremes in this manner makes for a scenario that is highly improbable. Nevertheless, even for higher MSY rates, the resource was estimated to be substantially depleted (<30%) for all cases considered.

The Scientific Committee also noted that the larger areas considered were not intended to reflect the only plausible stock hypotheses. For example, it is possible that the Faroese catch may have come from a stock that extends over a larger area that includes all or part of the East Greenland-Iceland stock area. If such was the case, the extent of depletion would not be nearly so substantial as suggested here. Unfortunately, presently available information did not allow the Scientific Committee to rule out even the least optimistic stock area scenarios.

Conclusions

The Scientific Committee noted that in attempting to respond to the Council's request for advice on the long-term effect of various catch levels in the Faroese area, it had immediately become apparent that there is insufficient information on stock identity to carry out a reliable assessment of the status of fin whales in Faroese waters, and thus provide reliable advice on the effects of various catches.

The Scientific Committee therefore strongly recommends that a research programme is undertaken to elucidate the stock structure of fin whales in this area. Highest priority should be given to the determination of whether the animals found in Faroese waters comprise a separate local stock. Under this scenario, the results reveal a severely depleted (11% or less of initial) stock, that even with no catches would take over 20 years, and perhaps much longer, to recover to half its initial estimated abundance.

It should be recognised that this represents a worst case scenario. Should the research programme reveal that these animals do not comprise a separate stock, then the results from the other scenarios show that the depletion level would not be so great. However, a reliable assessment would require elaboration of the relationship of fin whales found in Faroese waters to those in adjacent waters.

Recommendations for future research

1. Biopsies should be collected in Faroese and adjacent waters for studies into stock structure using a suite of genetic methods as well as analyses of pollutants, fatty acids and stable isotope profiles. Within season sampling is particularly important in attempting to determine whether fin whales found in Faroese waters comprise a separate local stock. A biopsy sampling component should be added to ongoing and planned sightings surveys in Faroese and nearby areas.
2. Recent advances in satellite tracking technology suitable for large whales will likely make this technique useful and cost effective in studies of stock delineation. Satellite telemetry may prove particularly useful to discriminate between the many plausible interpretations of seasonal fin whale distribution around the Faroes.
3. Careful examination of Faroese catch records is encouraged as these may help to discriminate between the different scenarios examined at this meeting as well as resolve the discrepancies between the catch data supplied by the IWC and that derived from Faroese archival sources.

9.6 White-beaked, white-sided and bottlenose dolphins

At its 8th meeting in Oslo in September 1998 the Council recommended that the Scientific Committee should undertake an assessment of distribution, stock identity, abundance and ecological interactions of white-beaked and white-sided dolphins in the North Atlantic area. The Scientific Committee responded in 1999 by concluding that there was insufficient information on stock structure, abundance and feeding ecology to carry out a meaningful assessment of these species at that time.

In 1999, the Council tasked the Scientific Committee with facilitating the requested assessment of these species, with an emphasis on the following:

- to analyse results from NASS 95 and other sightings surveys as a basis for establishing abundance estimates for the stocks;

- to coordinate the efforts of member countries to conduct research to fill the noted information gaps, taking advantage in particular of the sampling opportunities provided by the Faroese catch, as well as dedicated sampling in other areas.

Furthermore, the Council agreed that, in connection with the updated request for advice from the Scientific Committee on white-sided and white-beaked dolphins, that bottlenosed dolphins also be included in this assessment.

Members of the Scientific Committee reported on progress in research on these species from their respective member countries.

Sightings surveys

Sightings surveys have been planned and conducted for specific target species, and the target species have varied by member country. The target species influences the design of the survey, and if a survey is optimized for a certain species, it will not be as effective for others. In some instances, it may be impossible to derive reliable estimates of absolute abundance for non-target species.

The Norwegian components of the NASS surveys have been optimized for minke whales. The surveys were conducted in passing mode, so the identification of individual dolphin species was usually not possible. It will not be possible to derive estimates of absolute abundance from these data, even for the aggregated category of ”dolphins”, as the estimation of school size is not reliable for these species for surveys conducted in passing mode. However it will be possible to produce maps showing the relative abundance and distribution of aggregated dolphin species. It was considered that the results may warrant no further analysis than the distribution maps already published in NAMMCO (1998).

The target species of the Faroese component of the NASS surveys was the long-finned pilot whale. The surveys were conducted in passing mode with a random sample collected in delayed-closure mode to estimate school sizes. In most cases, dolphins were identified to species. While these data have not been analyzed, it was considered important to provide distribution maps for dolphins in this area and, if feasible, to derive species-specific abundance estimates.

The Icelandic shipboard components of the NASS surveys were optimized for minke, fin and sei whales. The surveys were conducted in delayed-closure mode, but closures were not generally conducted for dolphin species. Therefore the identification of dolphins was often uncertain. Nevertheless, preliminary abundance estimates from the NASS-95 survey for white-sided, white-beaked and unknown spp. dolphins have already been published (Sigurjónsson and Víkingsson 1997).

The Scientific Committee noted that previous NASS surveys in the Faroes and Icelandic areas offered the best available opportunities to develop information on the distribution and at least relative abundance of these species. The Icelandic and Faroese members therefore agreed to provide a costed proposal to analyze these data. The Working Group on Abundance Estimates, which will meet later in year 2000 (see Item 10.2), will consider this proposal

Other research

It was noted from the outset that these species have not been of high priority for research in NAMMCO member countries. They are taken sporadically in drive hunts in the Faroe Islands, and there is some bycatch in Iceland. They are very rarely taken in Norway or Greenland, so sampling opportunities have been limited in these areas. There is very little published literature on white-beaked and white-sided dolphins, and almost nothing is known about their distribution, abundance and ecology.

In Norway, biopsies are being collected on an opportunistic basis during surveys for other species. To date, few samples have been collected, and there are no plans for analysis until sufficient numbers of samples have been collected. In Iceland, sampling has been conducted on bycaught white-sided and white-beaked dolphins over several years. It was noted that some aspects of these analyses, such as feeding and life-history studies, are nearing the publication stage. The Faroes is the only location where directed catching for white-sided, white-beaked and bottlenose dolphins is carried out, and as such could provide an excellent opportunity for sample collection. It was noted that these species have been priority species for research in the Faroes, but that there are insufficient resources to carry out sample collection on an *ad hoc* basis.

The Scientific Committee considered that it would be difficult to co-ordinate the efforts of member countries to conduct research on these species, as the interests of member countries appeared to vary widely. Although some concerns have been expressed by the Norwegian fishing industry that small dolphins potentially compete with fisheries in some areas, the general interest in these species in Norway and Greenland is very low, and it is likely that research there would proceed very slowly. Bycatch of white-sided and white-beaked dolphins in Iceland, and directed catching for white-sided, white-beaked and bottlenose dolphins in the Faroes offer better opportunities for research. The Scientific Committee therefore made the following recommendations:

1. that the analysis and publication of Icelandic studies on white-sided and white-beaked dolphins be completed as soon as possible;
2. that a sampling program be initiated in the Faroe Islands for white-sided, white-beaked and bottlenose dolphins, primarily to collect information on feeding ecology, life history and stock delineation;
3. that sample collection in other areas continue on an opportunistic basis.

10. NORTH ATLANTIC SIGHTINGS SURVEYS

10.1 Status of analyses and presentations of previous NASS surveys

At its 1999 meeting, NAMMCO Council noted that abundance estimates from NASS-95 have not been completed for some species. Council therefore recommended that the Scientific Committee complete abundance estimates for all species, as part of its efforts to monitor the abundance of all species in the North Atlantic.

The present status of analyses and publications from NASS-95, 89 and 87 as well as West Greenlandic aerial surveys is shown in Table 1. For the most recent survey (NASS-95), only the abundance estimate for minke whales in the Norwegian survey area has been published in the primary scientific literature. Abundance estimates for some other species have been calculated and accepted by the NAMMCO Scientific Committee. For other species, no abundance estimates have been calculated or published. Abundance estimates have been published from the earlier NASS surveys for most species. Only abundance estimates for the target species (minke and fin whales) of the West Greenland aerial surveys have been published.

The Scientific Committee agreed that further analyses of the abundance of non-target species (i.e. all but minke, pilot, fin and sei whales) from the NASS-95 survey should be conducted if they are warranted. However, as the survey was not optimised for these species, it was recognised that the design and conduct of the survey would make this possible to a varying degree, depending on both the species and area in question. In some cases, a general description of the spatial distribution of sightings may be the only analysis warranted.

10.1.9 *Prospects for a NAMMCO Publication of previous surveys*

In 1997, the NAMMCO Scientific Committee decided to publish the major findings from the NASS-95 survey in a volume of *NAMMCO Scientific Publications* to be edited by Nils Øien and Jóhann

Sigurjónsson. Nils Øien reported that the abundance estimates for minke whales in the Norwegian survey area had already been published, and it was now planned to publish the abundance estimates for harbour porpoise elsewhere.

Considering that few primary papers would be available for a volume of the *NAMMCO Scientific Publications*, the Scientific Committee now considered that there was little prospect in continuing with a co-ordinated publication of the results from NASS-95. The Committee therefore urged the relevant National Institutes to proceed with the analysis and publication of NASS-95 results through other avenues.

10.2 Co-ordination of future sighting surveys, their analyses and presentation

At its 1999 meeting, NAMMCO Council recommended that the Scientific Committee continue its efforts to co-ordinate future sighting surveys and analyses of the results from such surveys in the North Atlantic. Priority species should be minke whales and fin whales, and Council recommended that the survey design be optimised for these species. The survey should also be optimised to cover those areas where abundance estimates are most urgently required.

The Faroes and Iceland have plans for conducting sightings surveys in 2001, with minke whales and fin whales as the major target species. These surveys were postponed from 2000 to take advantage of simultaneous surveys in adjacent areas to improve coverage. Survey design will be similar to that used in 1995, and further planning and coordination with other surveys is ongoing.

Table 1. Status of analysis and publication of results from the North Atlantic Sightings Surveys and the West Greenland aerial surveys, 1987-1995.

SURVEY	SPECIES	AREA/STOCK	ESTIMATE AVAILABLE? (Yes/No Ref.)	COMMENTS
NASS-95	minke	Norwegian survey area, Northeast Atlantic stock.	Yes (Schweder *et al.* 1996, IWC 1997, NAMMCO 1998)	An estimate with CV has been accepted by the IWC Scientific Committee and by the NAMMCO Scientific Committee.
NASS-95	minke	Icelandic and Faroese survey areas, Central Atlantic stock.	Yes (NAMMCO 1998)	An estimate with CV has been accepted by the NAMMCO Scientific Committee. The result has not been published in a peer-reviewed journal. Survey considered partial due to coverage and timing.
NASS-95	fin	Norwegian survey area, North Norway stock.	Yes (NAMMCO 1998)	An estimate with CV has been accepted by the NAMMCO Scientific Committee. The result has not been published in a peer-reviewed journal.
NASS-95	fin	Norwegian survey area, West Norway and British Isles stocks.	Yes (NAMMCO 1998)	As above.
NASS-95	fin	Icelandic and Faroese survey areas, East Greenland-Iceland Stock	Yes (NAMMCO 1998)	As above.
NASS-95	sei	Norwegian survey area, Eastern Stock.	Yes (NAMMCO 1998)	As above.
NASS-95	sei	Icelandic survey area, Iceland-Denmark Strait stock.	Yes (NAMMCO 1998)	As above. Estimate considered partial due to coverage and timing.
NASS-95	pilot	Northeast and central Atlantic.	Yes (NAMMCO 1998)	An estimate with CV has been accepted by the NAMMCO Scientific Committee. The result has not been published in a peer-reviewed journal.
NASS-95	humpback	Northeast and central Atlantic.	No	Distribution map in NAMMCO (1998).

SURVEY	SPECIES	AREA/STOCK	ESTIMATE AVAILABLE? (Yes/No Ref.)	COMMENTS
NASS-95	blue	Northeast and central Atlantic.	No	As above.
NASS-95	sperm	Northeast and central Atlantic.	No	As above.
NASS-95	killer	Northeast and central Atlantic.	No	As above.
NASS-95	northern bottlenose	Northeast and central Atlantic.	No	As above.
NASS-95	harbour porpoise	Northeast and central Atlantic.	No	As above.
NASS-95	small delphinidae	Northeast and central Atlantic.	No	As above.
NASS-89	minke	Norwegian survey area, Northeast Atlantic stock.	Yes (Schweder *et al.* 1997)	
NASS-89	minke	Icelandic survey area, Central Atlantic stock.	Yes (Gunnlaugsson and Sigurjónsson 1991)	Partial for area not covered in 87.
NASS-89	fin	Eastern Atlantic, North Norway stock.	Yes (Christensen *et al.* 1992)	
NASS-89	fin	Eastern Atlantic, West Norway and British Isles stocks.	Yes (Christensen *et al.* 1992)	
NASS-89	fin	Icelandic and Faroese survey area, EGI stock.	Yes (Buckland *et al*. 1992)	
NASS-89	sei	Northeast Atlantic, Eastern Stock.	No (Christensen *et al.* 1992)	No sightings.
NASS-89	sei	Icelandic and Faroese survey area, Iceland-Denmark Strait stock.	Yes (Cattanach *et al*. 1993)	
NASS-89	pilot	Northeast and central Atlantic.	Yes (Buckland *et al.* 1993, NAMMCO 1998)	

SURVEY	SPECIES	AREA/STOCK	ESTIMATE AVAILABLE? (Yes/No Ref.)	COMMENTS
NASS-89	humpback	Norwegian survey area.	Yes (Christensen *et al.* 1992)	
NASS-89	humpback	Icelandic survey area.	No	
NASS-89	blue	Norwegian survey area.	No (Christensen *et al.* 1992)	Too few sightings to derive an estimate.
NASS-89	blue	Icelandic survey area	Yes (Sigurjónsson and Víkingsson 1998)	Partial estimate for north of 60
NASS-89	sperm	Norwegian survey area.	Yes (Christensen *et al.* 1992)	
NASS-89	sperm	Icelandic survey area	Yes (Sigurjónsson and Víkingsson 1998)	Partial estimate for north of 60
NASS-89	killer	Northeast and central Atlantic.	Yes (NAMMCO MS 1993)	An estimate with CV has been accepted by the NAMMCO Scientific Committee. The result has not been published in a peer-reviewed journal.
NASS 87+89	northern bottlenose	Northeast and Central Atlantic	Yes (NAMMCO 1996)	
NASS-89	harbour porpoise	Norwegian survey area.	No	
NASS-89	harbour porpoise	Icelandic survey area.	Yes (Sigurjónsson and Víkingsson 1998)	Partial estimate for north of 60, offshore.
NASS-89	small delphinids	Norwegian survey area	No	
NASS-89	white-beaked dolphin	Icelandic survey area	Yes (Sigurjónsson and Víkingsson 1998)	Partial estimate for north of 60, offshore.
NASS-89	white-sided dolphin	Icelandic survey area	Yes (Sigurjónsson and Víkingsson 1998)	As above.
NASS-89	unid. dolphins	Icelandic survey area.	Yes (Sigurjónsson and Víkingsson 1998)	As above.

SURVEY	SPECIES	AREA/STOCK	ESTIMATE AVAILABLE? (Yes/No Ref.)	COMMENTS
NASS-87	minke	Norwegian survey area, Northeast Atlantic stock.	Yes (Øien 1989)	Partial coverage.
NASS-87	minke	Icelandic aerial survey area, Central stock.	Yes (Hiby *et al.* 1989)	
NASS-87	fin	Eastern Atlantic, North Norway stock.	Yes (Christensen *et al.* 1992, IWC 1992)	
NASS-87	fin	Icelandic and Faroese survey areas, East Greenland-Iceland Stock	Yes (Butterworth and Punt 1992, Gunlaugsson and Sigurjónsson 1990, IWC 1992)	
NASS-87	sei	Northeast Atlantic, Eastern Stock.	No (Øritsland *et al.* 1987)	Insufficient sightings to derive estimate.
NASS-87	sei	Icelandic and Faroese survey area, Iceland-Denmark Strait stock.	Yes (Gunlaugsson and Sigurjónsson 1990)	
NASS-87	pilot	Northeast and central Atlantic.	Yes (Buckland *et al.* 1993)	
NASS-87	humpback	Norwegian survey area.	No (Øritsland *et al.* 1987)	Insufficient sightings to derive estimate.
NASS-87	humpback	Icelandic and Faroese survey areas	Yes (Gunlaugsson and Sigurjónsson 1990)	
NASS-87	blue	Norwegian survey area.	No (Øritsland *et al.* 1987)	Insufficient sightings to derive estimate.
NASS-87	blue	Iceland and Faroese survey area	Yes (Gunlaugsson and Sigurjónsson 1990)	
NASS-87	sperm	Norwegian survey area.	No (Øritsland *et al.*	29 sightings.

SURVEY	SPECIES	AREA/STOCK	ESTIMATE AVAILABLE? (Yes/No Ref.)	COMMENTS
			1987)	
NASS-87	sperm	Iceland and Faroese survey area	Yes (Gunlaugsson and Sigurjónsson 1990)	Uncorrected for diving
NASS-87	killer	Norwegian survey area.	No (Øritsland *et al.* 1987)	19 sightings.
NASS-87	killer	Iceland and Faroese survey area	Yes (Gunlaugsson and Sigurjónsson 1990)	
NASS-87	harbour porpoise	Northeast and central Atlantic.	No	
NASS-87	small delphinidae	Northeast and central Atlantic.	No	
West Greenland Aerial 1987 and 1988	minke	West Greenland	Yes (Hiby *et. al.* 1989, IWC 1990)	An estimate with CV has been accepted by the IWC Scientific Committee.
West Greenland Aerial 1987 and 1988	fin	West Greenland	Yes **(Hiby *et. al.* 1989, Hiby and Lovell 1990, IWC 1990, 1992)**	As above.
West Greenland Aerial 1993	minke	West Greenland	Yes (Larsen 1995, IWC 1998)	As above.
West Greenland Aerial 1993	fin	West Greenland	Yes **(Larsen 1995, IWC 1995)**	As above. Estimate considered partial due to low coverage.

The Scientific Committee noted that future surveys in Norway and Greenland would be conducted according to requests set by the Scientific Committee of the IWC. However, to the extent possible, the surveys will be co-ordinated among the four NAMMCO countries. Surveys in the Norwegian area will continue with partial coverage in every year over a six-year cycle, with minke whales as the target species. The IWC Scientific Committee is developing a plan for future surveys of minke whales and fin whales in Greenland.

The Scientific Committee decided to activate the Working Group on Abundance Estimates to assist in planning and co-ordinating the surveys. In addition, the Working Group will be tasked with co-ordinating any further analysis and publication of the results from NASS-95 that is warranted. The Working Group will meet in fall 2000, and again in spring 2001 if required.

11. NAMMCO SCIENCE FUND

At the 9th meeting of NAMMCO Council in 1999, the Chairman of the Scientific Committee, Dr Mads Peter Heide-Jørgensen, proposed that the Scientific Committee be given the option of

conducting its own research with funding provided by Council. This would facilitate closer cooperation between members intersessionally, and enable the Scientific Committee to play a more active role in addressing questions put to it by Council. Projects could include the development of new assessment procedures, addressing key questions on stock delineation, multispecies interactions, or generally to address the priorities of both the Scientific Committee and Council.

Council asked the Scientific Committee to develop a full proposal for a scientific research program within the Scientific Committee, and to bring it to Council for consideration at the next annual meeting. A draft proposal was developed by the Chairman and the Scientific Secretary, and was presented to the Scientific Committee as SC/8/8.

The purpose of the Science Fund would be to enable the NAMMCO Scientific Committee to conduct research projects that would assist in the deliberations of the Scientific Committee. The projects could either be directly relevant to specific requests, or of importance for the development of techniques, methods, models or background information pertinent to the work of the Scientific Committee. A project could also involve the development and formulation of a primer for a larger project. Proposals could either be developed with the involvement of Scientific Committee members, or by others at the invitation of the Scientific Committee. Uninvited proposals would not be accepted. The Scientific Committee would administer the Science Fund, and would be responsible for proposal approval, funding and project monitoring.

Applications for funding would be considered annually at the annual meeting of the Scientific Committee. Projects that were considered urgent by the Chairman could be dealt with intersessionally through conference calls or correspondence. The Scientific Committee would evaluate project proposals against specific and listed criteria. If a member were an applicant, that member would not be involved in the evaluation of any proposals in that year.

Approved and funded projects would be monitored by a steering committee established by the Scientific Committee, which would monitor the progress of the project, make decisions about contracts and the release of funding instalments, specify the reports and reporting schedule required by the Scientific Committee, and report back to the Scientific Committee on the progress of the project. The Scientific Committee would report annually to the Council on the progress of projects supported by the Science Fund.

Council would approve funding for the Science Fund as an addition to the Scientific Committee budget. Unused funds could be carried over from year to year. It was proposed that the initial funding level for 2001 would be NOK 1,000,000. SC/8/8 also provided details of application procedures, proposal evaluation and administrative and reporting requirements.

The Scientific Committee was generally positive to the proposal for a Science Fund, and felt that it could be very useful in enabling the Scientific Committee to respond to requests from Council in a timely and efficient manner. However, the Committee stressed that funding for the Science Fund must be in addition to the general operational budget of the Scientific Committee. With this proviso, the Scientific Committee agreed to forward a proposal for a NAMMCO Science Fund to the Council of NAMMCO.

12. DATA AND ADMINISTRATION

Storage and handling of marine mammal catch data in the Secretariat

The Scientific Secretary presented document SC/8/9, which detailed the status of catch databases held by the Secretariat.

In 1998, NAMMCO Council agreed to instruct the Secretariat to prepare a report on the storage and handling of marine mammal catch data in the Secretariat. This report, prepared by the Scientific Secretary, outlined existing procedures for data submission and handling, and assessed the implications of different types and extent of data storage in the Secretariat.

The issue was considered by Council at their meeting in 1999. While noting the conclusion of the Scientific Committee that the Catch Database was not detailed enough for use in stock assessment, and that such data should be compiled on a case-by-case basis by national research institutes, Council decided that a catch database should be maintained at the Secretariat. This was to enable the Secretariat to respond to enquiries about the harvesting activities of member countries. Council further decided that the catch database be expanded to include species not covered so far, that catch data be transmitted to the Secretariat on an annual basis through the National Progress Reports.

The Scientific Committee took note of the Council decision of a continued need for catch data in the national Progress Reports.

13. PUBLICATIONS

13.1 NAMMCO Scientific Publications

The following volumes of NAMMCO Scientific Publications are presently in progress:

i. Minke whales, harp and hooded seals: Major predators in the North Atlantic ecosystem:

Co-editor Gísli A. Víkingsson informed the Scientific Committee this volume was now in the final printing stage, and that it will be available within weeks.

ii. Sealworm Infections

Co-editor Geneviève Desportes informed the Scientific Committee that 8 of 10 papers have been completed and reviewed. She anticipated that the volume could be ready for publication late in the year 2000.

iii. Harbour Porpoises in the North Atlantic:

Co-editor Tore Haug informed the Scientific Committee that up to 20 contributions are expected for this volume, which resulted from the recent International Symposium on North Atlantic Harbour. Some papers have already been approved and are out for review. It is expected that this volume will be ready for publication sometime in 2001.

iv. Population Status of Narwhal and Beluga in the North Atlantic

Co-editor Mads Peter Heide-Jørgensen noted that some contributions for this volume have been received and are out for review. The volume is expected to be published in 2001 or early in 2002.

The Scientific Committee considered the idea of publishing all or part of the NAMMCO Scientific Publications series on the internet. This would make the papers in the volumes available to a wider audience. However, it might also negatively affect the sale of the volumes themselves, and make their publication less viable. Also, it was noted that most authors still preferred to have their papers published in a printed format. The Scientific Committee agreed as an experimental approach to publish the titles and abstracts of the first two volumes on the NAMMCO web site, and directed the Secretariat to pursue this as soon as was practical.

14. BUDGET

The Scientific Secretary presented a draft budget for the Scientific Committee for 2000. He noted that the budget allocation of the Scientific Committee was fully committed, with the major part of the expenses attributable to the travel of invited experts to working group meetings. Any increase in the activities of the Scientific Committee will require an increase in budget allocation.

The Scientific Committee with minor changes accepted the draft budget.

15. FUTURE WORK PLANS

15.1 Scientific Committee

It was decided that Norway will host the next meeting of the Scientific Committee, at a location yet to be determined. The Scientific Committee noted that the short separation between the meetings of the NAMMCO Council in 1999 and the Scientific Committee in 2000 allowed inadequate time to respond to requests for advice from Council. It was therefore decided that the next Scientific Committee meeting should occur in mid-September 2001, to precede the meeting of Council.

15.2 Working groups

Working Group on the Economic Aspects of Marine Mammal-Fishery Interactions
See item 8.1.

Working Group on North Atlantic Fin Whales
This WG will await future requests for advice.

Working Group on the Population Status of Narwhal and Beluga in the North Atlantic
See items 9.4 and 9.5.

Working Group on Abundance Estimates
See item 10.2.

Harbour Porpoise Symposium Steering Committee
This Committee will continue to act as the editorial board for the volume of NAMMCO Scientific Publications on North Atlantic harbour porpoises.

15.3 Other matters

No other matters were identified.

16. ELECTION OF OFFICERS

Gísli Víkingsson was elected as chairman of the Scientific Committee, and Nils Øien was elected as vice-chairman.

17. ANY OTHER BUSINESS

On behalf of the Committee, the Chairman thanked Dorete Bloch for arranging to have the meeting at such a beautiful location. He also thanked the Secretariat for their assistance with practical arrangements, reporting and contributions to the meeting.

The Scientific Committee and Secretariat thanked the Chairman for efficiently leading the way through the agenda, and for his 3 years of outstanding service as chairman.

18. ADOPTION OF REPORT

The report was adopted by correspondence on 25 July 2000.

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Appendix 1

EIGHTH MEETING OF THE SCIENTIFIC COMMITTEE

LIST OF PARTICIPANTS

Faroe Islands

Dorete Bloch
Museum of Natural History
Fútalág 40, FR-100 Tórshavn, Faroe Islands
Tel.: +298 318 588
Fax: +298 318 589
Email: doreteb@ngs.fo

Geneviève Desportes
Fjord and Belt Centre
Margrethes Plads 1
DK-5300 Kerteminde, Denmark
Tel.: +45 65 32 57 83
Fax: +45 65 32 42 64
Email: genevieve@fjord-baelt.dk

Greenland

Mads Peter Heide-Jørgensen (Retiring chairman),
Greenland Institute of Natural Resources,
c/o National Marine Mammal Laboratory,
National Marine Fisheries Service/NOAA,
7600 Sand Point Way NE,
Seattle, WA 98115 USA
Tel.: +1 206 526 6680
Fax: +1 206 526 6615
Email: madspeter.heide-joergensen@noaa.gov

Aqqalu Rosing-Asvid
Greenland Institute of Natural Resources
Dalgas Have 50 B 2. lejl. G
2000 Frederiksberg, Denmark.
Tel.: +45 35 32 12 92
Fax: +45 35 32 21 99
Email: ARosing-Asvid@zi.ku.dk

Lars Witting
Greenland Institute of Natural Resources
P.O.Box 570,
DK-3900 Nuuk, Greenland
Tel.: +299 32 10 95
Fax: +299 32 59 57
Email: larsw@natur.gl

Iceland

Þorvaldur Gunnlaugsson
Marine Research Institute,
PO Box 1390,
IS-121 Reykjavik, Iceland
Tel.: +354 5331363
Fax: +354 5623790
Email: thg@halo.is

Droplaug Ólafsdóttir
Marine Research Institute,
PO Box 1390,
IS-121 Reykjavik, Iceland
Tel: +354 5520 240
Fax: +354 5623 790
e-mail: droplaug@hafro.is

Gísli A. Víkingsson (Chairman)
Marine Research Institute
P.O. Box 1390
IS-121 Reykjavik, Iceland
Tel.: +354 55 20240
Fax: +354 5 623790
Email: gisli@hafro.is

Norway

Tore Haug
Norwegian Institute of
Fisheries and Aquaculture
N-9291 Tromsø, Norway
Tel.: +47 77 62 92 20
Fax: +47 77 62 91 00
Email: toreh@fiskforsk.norut.no

Nils Øien (Vice Chairman)
Institute of Marine Research
P.O.Box 1870 Nordnes,
N-5024 Bergen, Norway
Tel.: +47 55 23 86 11
Fax: +47 55 23 86 17
Email: nils@imr.no

Ex-Officio Members

Grete Hovelsrud-Broda,
General Secretary,
North Atlantic Marine Mammal Commission,
University of Tromsø,
N-9037 Tromsø, Norway
Tel: +47 77 64 59 08
Fax: +47 77 64 59 05
email: gretehb@nammco.no

Daniel Pike,
Scientific Secretary,
North Atlantic Marine Mammal Commission,
University of Tromsø,
N-9037 Tromsø, Norway
Tel: +47 77 64 63 05
Fax: +47 77 64 59 05
email: daniel.pike@nammco.no

Appendix 2

AGENDA

1. Chairman's welcome and opening remarks
2. Adoption of Agenda
3. Appointment of Rapporteur
4. Review of available documents and reports
   - 4.1 National Progress Reports
   - 4.2 Working Group Reports
   - 4.3 Other reports and documents
5. Cooperation with other organisations
   - 5.1. IWC
   - 5.2 ICES
   - 5.3 Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga
6. Incorporation of the users knowledge in the deliberations of the Scientific Committee- reply from Council
7. Update on Status of Marine Mammals in the North Atlantic
8. Role of marine mammals in the marine ecosystem
   - 8.2 Economic aspects of marine mammal-fishery interactions
   - 8.3 Other matters
9. Marine mammal stocks -status and advice to the Council
   - 9.1. Harp seals
     - 9.1.1 Update on progress
     - 9.1.2 Future work
   - 9.2. Hooded seals
     - 9.2.1 Update on progress
     - 9.2.2 Future work
   - 9.3. Harbour porpoise
     - 9.1.1 Update on progress
     - 9.1.2 Future work
   - 9.4. Narwhal
     - 9.2.1 Update on progress
     - 9.2.2 Future work
   - 9.5 Beluga
     - 9.3.1 Update on progress
     - 9.3.2 Future work
   - 9.6 Fin whales
     - 9.4.1 Update on progress
     - 9.4.2 Future work
   - 9.7 Minke whales
     - 9.5.1 Update onprogress
     - 9.5.2 Future work
   - 9.8 White-beaked, white-sided dolphins and bottlenose dolphins
     - 9.6.1 Update on progress
     - 9.6.2 Future work
10. North Atlantic Sightings Surveys
    - 10.1 Status for analyses and presentations of previous NASS surveys
      - 10.1.1 Minke whales
        - 10.1.1.1 Minke whales in the East Atlantic (Norway)
        - 10.1.1.2 Minke whales in central Atlantic (Iceland)
        - 10.1.1.3 Minke whales in West Greenland
      - 10.1.2 Fin whales

10.1.2.1. Fin whales in the East Atlantic (Norway)
10.1.2.2. Fin whales in central Atlantic (Iceland)
10.1.2.3. Fin whales in West Greenland
10.1.3 Other baleen whales
10.1.4 Harbour porpoises
10.1.5 Dolphins and bottlenosed whales (other surveys included)
10.1.6 Killer whales
10.1.7 Pilot whales
10.1.8 Other toothed whales
10.1.9 Prospects for a NAMMCO Publication of previous surveys
10.2 Coordination of future sighting survey, their analyses and presentation
11. NAMMCO Science Fund
12. Data and administration
13. Publications
13.1 NAMMCO Scientific Publications
13.2 Other publications
14. Budget
15. Future work plans
15.1 Scientific Committee
15.2 Working groups
15.3 Other matters
16. Election of officers
17. Any other business

Appendix 3

LIST OF DOCUMENTS

SC/8/1	List of Participants
SC/8/2	Provisional Annotated Agenda (Draft)
SC/8/3	List of Documents
SC/8/NPR-F	National Progress Report – Faroe Islands
SC/8/NPR-G	National Progress Report – Greenland
SC/8/NPR-I	National Progress Report – Iceland
SC/8/NPR-N	National Progress Report – Norway
SC/8/4	Status of Marine Mammals in the North Atlantic – Update
SC/8/5	Report of the Scientific Committee Working Group on the Economic Aspects of Marine Mammal – Fishery Interactions
SC/8/6	NAMMCO International Symposium on Harbour Porpoises in the North Atlantic – Proceedings
SC/8/7	Report of the Scientific Committee Working Group on North Atlantic Fin Whales
SC/8/8	Proposal for a research fund to be administered by the Scientific Committee
SC/8/9	Catch Database – Update on status
SC/8/10	Scientific Committee – Budget 2000