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North Atlantic Marine Mammal Commission

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Faroe Islands	(F)	Kaj Mortensen
Greenland	(G)	Einar Lemche
Iceland	(I)	Arnór Halldórsson
Norway	(N)	Halvard P. Johansen

Council

Chairmen - 1995-97 Halvard P. Johansen (N)
- 1997… Arnór Halldórsson, (I)

NAMMCO/7 - Seventh Meeting of the Council - 26-30 May 1997, Hotel Føroyar, Tórshavn

Management Committee

Chairman - 1995… Einar Lemche (G)

Sixth Meeting of the Management Committee - 28 May 1997, Hotel Føroyar, Tórshavn

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Chairmen - 1995-97 Tore Haug (N)
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Chairman Geneviève Desportes (F)

Scientific Committee Working Group on Abundance Estimates

Chairman Nils Øien (N)

The NAMMCO Fund

Chairman of the Board Ulla S. Wang (F)

Secretariat

General Secretary	Kate Sanderson
Assistant Secretary (1993-97)	Jens Paulsen
Scientific Secretary	Sidsel Grønvik
Administrative Assistant	Tine Richardsen

SECTION 1 – COUNCIL

REPORT OF THE SEVENTH MEETING OF THE COUNCIL

The Seventh Meeting of the Council of NAMMCO was held at the Hotel Føroyar, Tórshavn, Faroe Islands from 27-30 May 1997. The meeting was attended by delegations from the member countries, the Faroe Islands, Greenland, Iceland and Norway, as well as observers from the governments of Canada, Denmark, Japan and the Russian Federation. A number of inter-governmental and non-governmental organisations were also represented by observers. Participants are listed in Appendix 1.

The meeting of the Council was convened by the Chairman, Halvard P. Johansen.

1. OPENING PROCEDURES

1.1 Address of welcome

The Chairman introduced the Minister of Fisheries of the Faroe Islands, John Petersen, who welcomed the Council of NAMMCO to the Faroe Islands for its Seventh Meeting. The full text of the Minister's address is contained in Appendix 4.

1.2 Invited presentation

The Chairman introduced Chief Tom Mexsis Happynook, hereditary whaling chief of the Huu-Ay-Aht tribe of the Nuu-Chah-Nulth Nation (British Columbia, Canada) and Chairman of the recently formed World Council of Whalers. Chief Happynook gave a presentation on the whaling traditions of the Nuu-Chah-Nulth people, and described the establishment and aims of the World Council of Whalers. The text of Chief Happynook's presentation is contained in Appendix 5.

At the conclusion of his presentation, and as a token of gratitude and friendship, Chief Happynook presented the Fisheries Minister, Mr Petersen, the Chairman of the Council and the Secretary with traditional, hand-crafted baskets from his tribe.

In appreciation of Chief Happynook's presentation and as a memento of his visit to the Faroe Islands, the Minister, Mr Petersen presented Chief Happynook with a hand-crafted Faroese whaling knife.

1.3 Opening statements

Opening statements were made by the heads of delegations from Greenland and Norway and by the Minister of Fisheries of Iceland, Mr ψorsteinn Pálsson. Statements were also made by Deputy Minister of Fisheries of Canada, Mr Fernand Robichaud and on behalf of the Government of Japan by Mr Kazuo Shima. Opening statements are contained in Appendix 4.

1.4 Admission of observers

Representatives of a number of intergovernmental and non-governmental organisations were admitted as observers to the Council (see Appendix 1).

1.5 Adoption of agenda

The agenda, as contained in Appendix 2, was adopted.

1.6 Meeting arrangements

The Secretary outlined the practical and social arrangements for the meeting, which included a reception co-hosted by NAMMCO and the Nordic Atlantic Cooperation (NORA) on Tuesday 27 May in the Faroese Museum of Art in Tórshavn, and a dinner hosted by the Minister of Fisheries of the Faroe Islands, Mr John Petersen, at Hotel Føroyar on Thursday 29 May.

2. ADMINISTRATION & FINANCE

2.1 Report of the ad hoc Working Group on Finance and Administration

The Chairman of the *ad hoc* Working Group on Finance and Administration, Arnór Halldórsson (Iceland) reported to the Council on the meetings and recommendations of the Working Group. The Working Group held a telephone meeting on 25 February 1997 to review the accounts for 1996 and to develop a draft budget for presentation to the Council. The report of this meeting, to which were appended the 1996 audited accounts, was circulated to the Council as NAMMCO/7/4. The Council subsequently adopted the draft budget for 1997 by correspondence in March 1997 (see below under 2.2).

The Working Group met again in Tórshavn on 27 May 1997 to further review and develop forecast budgets for 1998 and 1999, and to discuss administrative and budgetary matters related to the work of the Commission and the Secretariat, including staffing, information, a headquarters agreement, and various procedural matters. As a basis for its discussions, the Working Group had also referred to a summary report from the Secretary outlining activities in the Secretariat since the Sixth Meeting of the Council in 1996 (NAMMCO/7/FA/7). The report of the *ad hoc* Working Group on Finance and Administration meeting was circulated to the Council as NAMMCO/7/10.

2.1.1 Audited Accounts 1996

The Council noted that the *ad hoc* Working Group on Finance and Administration had reviewed the audited accounts at its meeting in February and that these had been approved by the Council through correspondence in March (see Appendix 6).

2.1.2 Staffing

The Council noted the Working Group's review of staffing arrangements in the Secretariat and plans for the recruitment of a professional employee to replace Jens Paulsen, Assistant Secretary, who would be leaving the Secretariat later in the year. Sidsel Grønvik had been offered a one-year contract as Scientific Secretary, and the Council **agreed** to the recommendation of the Working Group that this contract should also allow for the possibility of extension for a further three years.

It was also noted that the position of office assistant had been vacated in December 1996 and the Secretariat had employed Tine Richardsen in January 1997 as administrative assistant on a one-year basis.

The Council **agreed** to the recommendation of the Working Group that draft guidelines and procedures for the hiring of Secretariat staff be prepared by the Secretary for the

review of the Council.

2.1.3 Information

The Council noted the activities of the Secretariat with respect to general information on NAMMCO, as reported to the *ad hoc* Working Group on Finance and Administration (NAMMCO/7/FA/7). These included the following:

- The publication in June 1996 of a collection of papers presented to the NAMMCO International Conference on Marine Mammals and the Marine Environment (Shetland, 20-21 April 1995), as "Marine Mammals and the Marine Environment", Special Issue, *The Science of the Total Environment*, Volume 186, Nos 1-2, edited by Kate Sanderson and Geir Gabrielsen;
- The publication of the *NAMMCO Annual Report 1996* in 300 copies.
- The regular production and distribution of *Selected Cuts*, a selection of items from the international media on issues concerning the conservation and utilisation of marine mammals and related topics. This is sent to a list of some 50 contacts in member countries and elsewhere.

In addition, members of the Secretariat staff took part in a number of meetings at which information on NAMMCO was presented. These included: the 1996 annual meeting of the Norwegian minke whalers' association, at which Jens Paulsen gave a presentation on the NAMMCO Joint Control Scheme; a meeting of the Canadian Northern Co-Management groups in Yellowknife, Canada in November 1996, at which Kate Sanderson gave a briefing on NAMMCO; and the seminar "Whaling in the North Atlantic" in Reykjavik in March 1997, organised by the Fisheries Research Institute of the University of Iceland and the High North Alliance, at which Kate Sanderson gave a paper on NAMMCO's first five years. This paper was circulated to the Council as NAMMCO/7/INFO/1 (since published in Pétursdóttir 1997).

The Council noted the Working Group's discussion of the possibility of reclaiming costs in connection with the circulation of NAMMCO publications and other material, such as the press clippings service, *Selected Cuts*. It was **agreed** that the Secretariat should investigate the requirements for such payment procedures.

The Council **agreed** that the development of newsletters and fact sheets should be given priority, and that this kind of information would be an important part of the function of a NAMMCO web site on the Internet, which was currently being developed.

2.1.4 Host Agreement

The Council noted that a joint letter from the Faroes, Greenland and Iceland had been sent in early May 1997 to the Ministry of Foreign Affairs in Norway concerning the continued lack of a host agreement between Norway and NAMMCO. No response from the Ministry had yet been received.

The Council reiterated its view, also expressed at its Sixth Annual Meeting, that there is a need to resolve the details of an agreement as soon as possible, both with regard to clarifying the legal status of the organisation, as well as the financial implications for the

organisation and its staff.

It was also once again noted that payments made through NAMMCO to Norway amount to significantly more than the extra annual contribution of NOK 250,000 paid by Norway in lieu of tax concessions. It was noted that as the responsibilities of the organisation increase, so too will the financial consequences of a lack of host agreement. An agreement, including financial elements, would enable the organisation to utilise the contributions paid by member countries much more effectively.

2.1.5 The status of the Working Group

The Council **agreed** to the recommendation that the *ad hoc* Working Group be established as a permanent group with the following terms of reference:

- to review annual accounts and develop budgets and forecast budgets for the Council;
- to review administrative matters related to the activities of the Commission;
- to consider any other financial and administrative matters which the Council may decide to forward to it.

It was envisaged that the Group would, until otherwise decided, elect its own Chairman from among its members, who should be officially appointed to the group by respective member countries.

2.2 Forecast budgets 1998 & 1999

The Council referred to document NAMMCO/7/5-rev 1, containing the adopted budget for 1997 and draft budgets for 1998 and 1999.

It was noted that the budget for 1997 had been **approved** by the Council by correspondence in March.

The Council **agreed** to the proposal of the *ad hoc* Working Group on Finance and Administration that, beginning with the present meeting, the Council should approve the budget for the following year at its annual meetings. This procedure would take into account budgeting procedures in respective member countries and allow contributions to be paid at the beginning of the financial year.

It was also **agreed** that wherever possible, future budgets should not be developed with a surplus.

The Council **adopted** the budget for 1998, as contained in NAMMCO/7/5 - rev 1.

In adopting the 1998 budget, it was noted that as a result of the decision to implement the International Observation Scheme in 1998 (see below under 4.1.4), funds already allocated for the implementation of the Scheme in the adopted budget for 1997 would not now be used in this financial year, resulting in an empty post under this item for 1998.

3. SCIENTIFIC COMMITTEE

3.1 Report of the Scientific Committee

The Chairman of the Scientific Committee, Tore Haug, presented the Report of the Scientific Committee, which had met in Tromsø, Norway from 10 to 15 March 1997. The Report was available to the Council as NAMMCO/7/6 and is contained in Section 3 of this volume.

The Scientific Committee met to address both new and outstanding requests for advice forwarded to it by the Council. The Committee decided to deal with the new requests for advice on food consumption of minke whales, harp seals and hooded seals in the North Atlantic, and the review of the current state of knowledge of sealworm infestation in fish, by establishing separate expert *ad hoc* Working Groups. These Working Groups convened during the week of the Scientific Committee meeting in Tromsø and included participation from a broad range of external expertise represented by scientists from Canada, Denmark and the UK in addition to Norway, Iceland, Greenland and the Faroe Islands (see under item 3.1.1 below).

National Progress Reports for 1996 from Norway, Iceland and the Faroes, and for 1995 from Greenland were submitted to the Scientific Committee. These are contained in Section 4 of this volume.

The Council noted the Scientific Committee's discussions regarding the admission of observers to its meetings (See Section 3.1, item 5.8), and **endorsed** the Scientific Committee's recommendation that, in order to provide the Scientific Committee and the Council with a proper basis on which to decide their admission, prospective observers to meetings of the Scientific Committee should submit a written request to the Secretariat stating their affiliations and reasons for wishing to attend.

3.1.1 Role of marine mammals in the ecosystem

i) Food consumption of minke whales, harp and hooded seals in the North Atlantic

Haug reported to the Council on the major conclusions and recommendations of the Scientific Committee with respect to the Council's request to the Committee to -

".. focus its attention on the food consumption of three predators in the North Atlantic: the minke whale, the harp seal and the hooded seal, with a particular emphasis on the study of the potential implications for commercially important fish stocks." (*NAMMCO Annual Report 1996*: 28)

In order to address this request, the Scientific Committee had established an *ad hoc* Working Group on the Role of Minke Whales, Harp Seals and Hooded Seals in North Atlantic Ecosystems, which was chaired by Gísli Vikingsson (Iceland). The report of the Working Group was reviewed by the Scientific Committee (for further details see Section 3.1, item 7.1 and Section 3.2).

Feeding ecology and estimates of consumption

Available knowledge on the feeding ecology of the three marine mammal species across the North Atlantic was reviewed, and some estimates of total consumption of various prey items were also presented. It was noted, however, that a number of uncertainties were identified in relation to the estimates of consumption in the different stocks and areas, and that all given estimates should therefore be used with caution.

Except for the Northeast Atlantic, the diet composition of minke whales was poorly documented. Recent studies off northern Norway (in the Barents Sea and around Spitsbergen) in years with low capelin abundance have shown herring and krill to be the most important food items, followed by cod and various other fish species. Based on abundance estimates from 1995, minke whales in this area are estimated to consume annually 1.8 million tons of prey during their feeding period, which lasts from April to October. Of this estimate, 633,000 tons were herring, corresponding to about 70% of the total 1995 fishery for that species. Consumption of cod and haddock was 256,000 and 142,000 tons, respectively, while the amount of krill was similar to the herring component.

From the little available information, minke whales in Icelandic waters appear to feed on fish and krill in roughly equal amounts. The identified fish species were capelin, sand eel and cod. The total consumption of the species in this area, (based on abundance estimates from the 1987-1989 surveys) was estimated as 391,000 tons, of which 198,000 tons were fish. In Greenland waters capelin is the most important food species for minke whales. Among other identified prey species were Atlantic cod, polar cod, Greenland cod, herring, sand eel and crustaceans. In the Northwest Atlantic off Canada, capelin appears to be the dominant prey species of minke whales, while other identified food items include squid, salmon, herring, cod and crustaceans. A preliminary estimate indicates that the consumption of minke whales in Canadian waters is relatively low compared to that of harp seals, although it may be larger than the consumption of hooded, grey or harbour seals in the area.

In general the most important prey groups for harp seals in the Barents Sea are crustaceans, capelin, polar cod and herring. The total consumption of the Barents Sea harp seal stock was estimated as 1.1-1.7 million tons. The large range is due to uncertainties in the choice of input parameters in the model. Under certain assumptions about energy expenditure, the estimated annual consumption by harp seals is 428,200 tons of crustaceans, 258,200 tons capelin (in years of high capelin abundance), 212,500 tons polar cod, 69,600 tons herring and 32,200 tons cod. In years of low capelin abundance, capelin consumption seemed to be replaced by other fish species, notably polar cod.

Most of the examined harp seals from the Greenland Sea pack ice during spring and early summer had empty stomachs but analysis of the intestines revealed the pelagic amphipod, *Themisto sp*. as the major food item. No information is available about Greenland Sea harp seal diet in the most important feeding period (June-February). The main prey species identified in harp seals collected during February-May in coastal North Icelandic waters were sand eels, cod fishes and capelin.

The food composition of harp seals in West Greenland waters is variable, with pelagic

crustaceans, capelin and polar cod as the most important prey types. Although commercially important fish species are a small part of the diet, the total consumption of these may be of the same order of magnitude as the commercial fishery in the region.

Harp seals are considered the most important pinniped predators in Atlantic Canadian waters. In the northern Gulf of Maine and NAFO areas 2J3KL they were estimated to have consumed over 150,000 tons of Atlantic cod, 1.1 million tons of capelin, 600,000 tons of polar cod, 130,000 tons of Greenland halibut, 107,000 tons of redfish and 104,000 tons of herring in 1996. The greatest source of uncertainty in the estimates of consumption by harp seals in the Northwest Atlantic is related to limited information on seasonal distribution of the species and potential spatial and temporal variations in the diet. Haug reported that studies addressing these questions are under way.

The diet composition of hooded seals is not generally as well known as that of harp seals. The majority of hooded seals sampled in the Greenland Sea pack ice during spring and early summer had empty stomachs, but the major food item found in the intestines was the squid *Gonatus fabricii*. Redfish, cod and other fish species were the main prey species identified in a small number of hooded seals investigated off northern Iceland. In Greenland waters, larger demersal fish species like Greenland halibut, redfish, cod and wolffish are apparently important prey items for hooded seals, in addition to the species also taken by harp seals in the area. In Atlantic Canada hooded seals were estimated to consume 129,000 tons of Greenland halibut, 36,000 tons of Atlantic cod and 19,000 tons of redfish in 1996.

Multispecies modelling of interactions

Haug reported on the Scientific Committee's subsequent discussions and conclusions related to the interactions between these three major predators and commercially important fish stocks, in particular with respect to results from applications of a number of multispecies models.

A multispecies model for the Barents Sea (MULTSPEC) describes the interactions between minke whales, harp seals, herring, capelin and cod in the Barents Sea. The main effects identified were: the herring stock increased as predation from marine mammals decreased; the development of the capelin stock was mainly determined by changes in the herring and cod stocks (both of which prey on capelin); the cod stock generally increased or decreased when marine mammal stocks decreased or increased; decreasing the preference for herring by cod had much larger effects than changing some of the marine mammal preferences. It was noted that the model might be improved by including polar cod and taking account of seasonal variation in prey preferences. Recent studies of Barents Sea harp seals may indicate that the latter is important.

Another model investigated the effect on fish stocks of tuning the Revised Management Procedure (RMP) for minke whales in the Barents and Norwegian Seas from the current level of 72% of k (carrying capacity) to 60% k. Assuming an abundance of 100,000 minke whales and a Maximum Sustainable Yield Rate (MSYR) of between 1% and 2%, the main effect of changing the RMP target from 72% to 60% was an increase of some 14% in the cod catches.

Investigations on interactions between three whale species, two seal species and two fish species in Icelandic waters indicate that natural mortality of cod from marine mammal predation is twice that which is due to cannibalism and thus may be a major proportion of natural mortality in the younger age classes.

The Scientific Committee noted that the effects of marine mammals are at present not included in models routinely used in multispecies management (e.g. such as by ICES). A number of potential uses of multispecies models were identified, as well as the most important gaps in knowledge and data requirements for the modelling work (see Section 3.2, item 5.5 in this volume), some of which were reflected in the Scientific Committee's recommendations for future work (see below).

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The Council noted the conclusion of the Scientific Committee that minke whales, harp seals and hooded seals in the North Atlantic may have substantial direct and/or indirect effects on commercial fish stocks. In order to better understand these effects, the Council **endorsed** the recommendations from the Scientific Committee for future work in this area, as outlined in Section 3.1, item 7.1.3 of this volume.

Greenland noted that the Scientific Committee's review of major prey consumption estimates by marine mammals, as well as their discussion and recommendations related to multispecies models which include marine mammals, would also be of interest to regional fisheries management bodes, such as NEAFC, NAFO and NASCO. The Council **agreed** that the pertinent sections of the Scientific Committee report should be brought to the attention of these and other relevant fisheries management bodies.

ii) Sealworm infection

Haug referred to the Council's request to the Scientific Committee -

"... to review the current state of knowledge with respect to sealworm infestation and to consider the need for comparative studies in the western, central and eastern North Atlantic coastal areas, taking into account the priority topics recommended by the Scientific Committee and its *ad hoc* Working Group on grey seals." (*NAMMCO Annual Report 1996*: 28; 111-116)

To address this request, the Scientific Committee had established an *ad hoc* Working Group on Sealworm Infection under the chairmanship of Geneviève Desportes (Faroes), which was attended by a number of scientific experts from Canada, Iceland, Norway and the UK who had been invited to contribute working papers to the Working Group's review of sealworm infection in the North Atlantic (see Section 3.1, item 7.2 and Section 3.3 of this volume).

The Scientific Committee reviewed available information on the life cycle of the sealworm as well as environmental and behavioural factors influencing the life cycle. In response to a question from Norway, Haug pointed out that transmission of sealworm is not only related to the occurrence of cod or their feeding patterns, as sealworm is present in many different fish species.

Influence of seal abundance on the level of sealworm infection in fish
Haug noted that from a management perspective, the most relevant sealworm question reviewed by the Committee was how seal abundance may influence the level of sealworm infection in fish. The Council noted the following conclusions of the Scientific Committee:

- The presence of either grey seals or harbour seals can lead to sealworm infections in fish over the entire North Atlantic region. Reduction of either species may not therefore result in a significant reduction in sealworm infections in fish;

- Although harbour seals are less abundant than grey seals in many areas, they could be responsible for high local infections in fish because of their limited foraging range;

- At least in the short and medium term, sealworm infection levels in intermediate hosts are not necessarily directly correlated with seal abundance. They may be mitigated by other factors such as environmental temperature and intermediate host abundance and distribution;

- Individual worm levels in seals vary to such an extent that a few seals could still maintain high infection levels in fish.

The Scientific Committee also concluded that modelling was now a priority in order to bring together and analyse the considerable amount of data collected since 1990. The Scientific Committee also identified the need for comparable datasets in the western, central and eastern North Atlantic coastal areas, as well as the need to categorise habitat types in order to compare infection rates between seal and fish populations.

The Council **endorsed** the Scientific Committee's recommendations for future work on sealworm infection (see Section 3.1, items 7.2.2 and 7.2.3). These included: intensified research in both the Northeast and Northwest Atlantic with respect to sealworm biology and dynamics; an intensive survey in Iceland of sealworm in grey seal stomachs to coincide with a planned Icelandic survey of sealworm in Atlantic cod: a workshop on modelling of sealworm infection.

3.1.2 Marine mammal stocks - status and advice to the Council

Long-finned pilot whales
Haug presented the findings and conclusions of the Scientific Committee in response to the Council's request for:
- an assessment of the state of the pilot whale stock in the Northeast Atlantic, based on information sampled from the Faroese drive fishery and the NASS sightings surveys; and
- an analysis of the effects of the pilot whale drive hunt in the Faroe Islands on North Atlantic pilot whales, especially whether the numbers taken are consistent with sustainable utilisation.

The first part of the request had been forwarded to ICES in 1992, in response to which ICES had established a Study Group on Long-finned Pilot Whales. The Scientific Committee based its review of both questions and the development of its advice to the Council on the findings of the ICES Study Group, as well as on its own recent review of the results of NASS-95.

i) Population assessment

Stock identity and seasonal movements of pilot whales were addressed using available new information about distribution, genetics and morphometric measurements. The Scientific Committee discussed the three stock identity hypotheses formulated by the ICES Study Group, and concluded that of these, the two extreme scenarios of a single North Atlantic population or one stock restricted to the vicinity of the Faroe Islands, could both be ruled out. This left the general conclusion that there is more than one population of pilot whales in the North Atlantic.

With respect to social structure and behavioural factors, it was noted that the total number of animals in the aggregations investigated was still less than the average size of schools landed in the Faroe Islands, and that further investigation of this matter was necessary. The effects of harvesting whole groups of animals which are genetically related should also be further explored.

In discussing the estimates of abundance for pilot whales in the Eastern North Atlantic, the results of the NASS surveys were of crucial importance. It was noted that the coverage of the three surveys (NASS-87, 89 and 95) was not identical and thus yielded substantially different estimates of total abundance. It was, however, concluded that given the mobility of the species, the apparent between-year shifts in distribution and the relatively thorough and extensive coverage of NASS-89, the estimate of 778,000 derived from this joint survey was the most appropriate. No estimate of abundance for pilot whales based on systematic sightings is available for the Western North Atlantic

The Council **endorsed** the Scientific Committee's recommendation for future research requirements, as listed by the ICES Study Group on Long-finned Pilot Whales in its 1996 report (ICES C.M.1996/A:6), and further **endorsed** the Scientific Committee's recommendation that two of these should, in particular, be given priority:

- A long-term research and population monitoring strategy should be developed related to the Faroe Island fishery, based on an in-depth review of previous and current fishery monitoring procedures and the extensive research conducted in the Faroe Islands since the mid 1980s. The aims of such a programme should include both longer-term monitoring which would help improve understanding of the status of the harvested population, and short-term monitoring to detect more rapid changes as might occur.
- In order to gain more information on the size of the population subjected to the Faroese fishery, the movements of individual pods of pilot whales that approach the Faroe Islands should be monitored by use of satellite tags. Several animals within a pod should be tagged, ideally with tags designed to be active over varying time periods.

With respect to the second of these recommendations, the Faroe Islands informed the Council that plans were under way to attempt the attachment of satellite tags on pilot whales in the Faroe Islands in 1997.

ii) Sustainability of the Faroese catch

Haug reported to the Council that in discussing the sustainability of the Faroese catch, the Scientific Committee focused on the population trajectories developed by the ICES Study Group, which are included as Appendix 6 to the Scientific Committee Report (see Section 3.1). Based on the catch history, the population trajectories predict the changes in the population size since 1840 under various assumptions of maximum population growth rates and for various stock areas, based on the population estimate resulting from NASS-89. A plausible range of maximum population growth rates of 1.4% to 5.7% per annum was applied to three probable stock areas: Rockall-Iceland; Mid-Atlantic Ridge-Faroes; NASS-89 survey area.

From the performed calculation exercises the Scientific Committee concluded that the effects of historic and present catches in the Faroes Islands have had a negligible effect on the long-term trends in the pilot whale stock. It was noted that an annual catch of 2,000 individuals in the eastern North Atlantic corresponds to an exploitation rate of 0.26% of the present best estimate of 778,000 pilot whales (from NASS-89) in the Northeast Atlantic.

In conclusion, Haug informed the Council that the Scientific Committee now considered its work complete with respect to the development of advice on this species, while noting the recommendations for further research which had been endorsed by the Council.

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The Chairman of the Council thanked the Scientific Committee for their work in providing their final response to this long-standing request for advice. The Council also noted with appreciation the contribution of the ICES Study Group on Long-finned Pilot Whales, under the chairmanship of Doug Butterworth, whose work had provided such a comprehensive basis for both the NAMMCO Scientific Committee and ICES in developing their advice to the Council. It was noted, however, that the Scientific Committee had taken their findings further than the official advice received from ICES

(NAMMCO/7/8), which had not had the benefit of the most recent review of data from NASS-95.

Killer whales

The Council noted the Scientific Committee's decision to postpone further consideration of the request for advice on this species until the results of on-going studies became available.

Harp and hooded seals

Haug reported that the Scientific Committee had little new information to add to last year's comprehensive review of available data on harp and hooded seals, in particular in the Northwest Atlantic (see *NAMMCO Annual Report 1996*: 104-107).

It was noted, however, that the ICES/NAFO Joint Working Group on Harp and Hooded Seals would be meeting again later this year to look in particular at outstanding aspects of NAMMCO's request with respect to harp and hooded seals in the West Ice and harp seals in the East Ice. It was therefore expected that the Committee would be in a position to return to these items at its next meeting in 1998 (see below under 4.2.1).

Harbour porpoises
Although no specific request for advice on harbour porpoises had been forwarded from the Council, the Scientific Committee noted that this species was common to all NAMMCO member countries, and that the extent of current research activities and expertise in member countries and elsewhere across the North Atlantic would provide an excellent basis for undertaking a comprehensive assessment of the harbour porpoise throughout its range, should the Council decide that this is an appropriate task for the Scientific Committee (see below under 4.2.1).

Central North Atlantic minke whales
Haug reported on the status of work by the Scientific Committee to address the Council's most recent request for advice:

"In the light of the new survey abundance results the Scientific Committee is requested to undertake an assessment of the status of the Central North Atlantic minke whale stock, including to evaluate the long term effects of past and present removal levels on the stock."

The task of assessing the status of the Central North Atlantic minke whale stock was assigned to the Scientific Committee's Working Group on Management Procedures, under the chairmanship of Nils Øien (Norway). Although the Council had requested the Scientific Committee to provide this advice in time for its present meeting, it had not yet been possible for the Scientific Committee to finalise an assessment. It was reported, however, that the Group was currently working by correspondence on the various issues which the Scientific Committee had identified as necessary to address in such an assessment.

These included: a summary of completed work and ongoing studies of the stock discreteness of Central North Atlantic minke whales; examination of past history of exploitation under varying assumptions of recent population size, maximum population growth rate and stock areas; and an examination of a range of management scenarios of present removals under most likely stock areas and with results from NASS-87, -89 and -95. In order to carry out this work, the Scientific Committee would contract the relevant expertise to summarise genetic results and to run population trajectories

…….

Iceland commended the progress made so far in addressing this request and expressed their desire for the Scientific Committee to complete the necessary work towards providing this stock assessment as soon as possible (see also Section 2.1, item 4 in this volume).

3.1.3 Review of results of NASS-95

Haug reported on the work of the Scientific Committee to address the following request from the Council:

"The 1995 North Atlantic Sightings Survey (NASS-95) would provide updated abundance estimates for a number of whale species in the North Atlantic, and the Scientific Committee was requested to review results in the light of recent assessments of North Atlantic whale stocks" (*NAMMCO Annual Report 1995:* 23).

The Scientific Committee reviewed the findings of its Working Group on Abundance Estimates, the report of which is contained in Section 3.4 of this volume. The synoptic distributions of the cetacean species encountered during NASS-95 were described, and abundance estimates were developed for minke, fin, sei and pilot whales, which were the target species of the survey.

Minke whales

It was agreed that the NASS surveys gave a complete picture of the summer distribution of minke whales in the Northeast Atlantic. The overall estimate for the Norwegian survey blocks was 118,000 (CV 0.10); for the Icelandic shipboard surveys 17,900 and the Icelandic aerial survey 55,900 (CV 0.31). This gives a total estimate (corrected by excluding from the shipboard estimates the part that overlaps the aerial survey area) of 184,000 minke whales for the total NASS-95 area (NAMMCO/7/6: Annex 3, Table 2). Distributed according to assumed stocks, this means 72,000 in the Central North Atlantic and 112,000 in the Northeast Atlantic.

It was noted that minke whale estimates from Icelandic aerial surveys show a great increase from 1987 to 1995, although the total number of sightings is about the same in both years. Although more of the effort in 1995 is in low density areas, so given the same number of sightings, a larger estimate would be expected, the difference is to a large degree a function of different methodology as well as different observers. Thus, reanalysis of the 1987 aerial survey data gives more than twice the estimate obtained by the earlier methods.

Fin whales

The total abundance of fin whales for the areas covered by NASS-95 was 22,800 (CV 0.15). The total estimate for the Norwegian survey area is 3,100 fin whales (CV 0.25) and for the Icelandic/Faroese survey area 19,700 fin whales (CV 0.17). The estimate for the East Greenland-Iceland stock, 18,900, is the largest to date. In particular, the abundance is considerably higher in the area between East Greenland and Iceland than in the 1987 and 1989 surveys. This may reflect a true increase in the stock, while discontinuity in distribution towards the south of the survey area may indicate that the 1995 survey captured the peak of the fin whale migration to these waters better than earlier surveys.

Sei whales

The total estimate of sei whales from NASS-95 was 9,249 animals (95% confidence interval: 3,700 - 23,116. Although the majority (about 70%) of the 1989 estimate (10,600, CV 0.27) was derived from survey blocks south of the 1995 survey, the two surveys are

not inconsistent in the light of the wide confidence limits and difference in timing.

It is unlikely that any of the NASS surveys covered the total distribution of the sei whale stock and the species is known for relatively large between-year variations in abundance in northern waters.

Pilot whales
The total abundance of pilot whales over all blocks in 1995 is 215,000 animals (CV 0.26). Previous surveys of long-finned pilot whales had been conducted in 1987 and 1989, and a total estimate of 778,000 (CV 0.29) has been calculated based on 1989 data when the survey had its largest extension. By comparing comparable survey blocks, it appears that the 1995 estimate is broadly comparable to the 1987 and 1989 estimates. The 1995 estimate is therefore consistent and not significantly different from previous estimates for the area covered. The 1989 estimate if therefore still regarded as the best estimate for this population.

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The Council noted the conclusion of the Scientific Committee that the updated abundance estimates for the target species as reviewed by the Scientific Committee Working Group on Abundance Estimates represented the best available estimates for the stocks concerned.

3.1.4. Monitoring of marine mammal stock levels and trends

Haug reported on the Scientific Committee's discussion of the following request from the Council:

"In relation to the importance of the further development of multispecies approaches to the management of marine resources, the Scientific Committee was requested to monitor stock levels and trends in stocks of all marine mammals in the North Atlantic."

It was clarified that the purpose of this request was to ensure that data on marine mammals was available for input into multispecies models for management. The Management Committee had suggested that the Scientific Committee present this information annually in the form of a table (*NAMMCO Annual Report 1995:* 47). The value of such a table was discussed by the Scientific Committee, and it was agreed that, given the differences in survey methodologies and areas on which estimates of abundance are based, such a table would not be a reliable reference for management.

Instead, the Scientific Committee agreed that updated information on abundance and indications of trends in abundance of stocks of marine mammals in the North Atlantic should be clearly described in a new document for the internal reference of the Council, to replace the List of Priority Species. This document would be entitled Status of Marine Mammals in the North Atlantic, and should include those cetacean and pinniped species already contained in the List of Priority Species, as well as other common cetacean species in the NAMMCO area for which distribution and abundance data is also available (fin, sei, humpback, blue and sperm whales). It was also suggested that it would be useful to

include an indication of research needs for each species/stock, as well as references to relevant general review literature and working group reports.

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The Council **endorsed** the suggestion of the Scientific Committee regarding the development and contents of the Status of Marine Mammals in the North Atlantic, noting that this would be further developed by the Secretariat and reviewed by the Scientific Committee, using the present List of Priority Species as a starting point.

3.1.5 Publications

Recalling the Council's decision at its last meeting to begin a NAMMCO series of scientific publications, Haug reported on progress with the first edition on ringed seals, which was currently being edited by Mads Peter Heide-Jørgensen and Christian Lydersen (Polar Institute, Norway). It was expected to be completed in late 1997.

The Council **endorsed** the Scientific Committee's view that the most recent work of the Scientific Committee provided material which would also be valuable to publish in this series, and noted that the Scientific Committee had already tentatively assigned editors from among its members for future volumes on the following subjects:

- Role of minke whales, harp seals and hooded seals in North Atlantic ecosystems (ed. Gísli Víkingsson, Iceland)
- Sealworm infection (ed. Geneviève Desportes, Faroes)
- Results of the 1995 North Atlantic Sightings Survey (NASS-95) (ed. Jóhann Sigurjónsson, Iceland).

3.1.6 Election of officers

Haug informed the Council that the Scientific Committee had elected Mads Peter Heide-Jørgensen as its new Chairman, and Dorete Bloch (Faroes) as Vice-Chairman, for the next two years.

The Chairman of the Council thanked the outgoing Chairman of the Scientific Committee for his report to the Council, and for his efforts over the past two years in co-ordinating the important work of the Committee.

3.2 Cooperation with the International Council for the Exploration of the Sea (ICES)

The Council noted with appreciation the report received from ICES in January 1997 on the status of the long-finned pilot whale in the North Atlantic (NAMMCO/7/8). This was the official ICES response to NAMMCO's request to "provide an assessment of the state of the pilot whale in the north eastern Atlantic, based on the information sampled from the Faroese drive fishery and the NASS (North Atlantic Sighting Survey) sighting surveys", which had been forwarded to ICES in 1992. The final advice from ICES had been prepared jointly by the ICES Advisory Committee on Fishery Management (ACFM) and the Advisory Committee on the Marine Environment (ACME) at their meetings in 1996 (see also under item 3.1.2 above, and Section 3.1, item 8.1).

Memorandum of Understanding with ICES

At its sixth meeting in Tromsø in March 1996, the Council agreed that the form and terms of a formal cooperative agreement between ICES and NAMMCO should be negotiated between respective Secretariats. The Secretary reported to the Council on correspondence related to this matter that had been exchanged with the ICES General Secretary in the interim. In response to a first draft Memorandum of Understanding (MoU) developed by ICES in May 1996 along the lines of their agreement with, for example, the Oslo and Paris Commissions, NAMMCO had suggested in June 1996 the development of a more general kind of cooperative agreement, acknowledging the need for cost recovery by ICES in cases where this is necessary.

ICES subsequently responded in May 1997 with the option for NAMMCO to consider one of the two kinds of MoUs with which ICES prefers to operate. The one kind involves collaboration on scientific areas of mutual interest, where the costs of such collaboration are covered, as appropriate, jointly by ICES and the other party, and which precludes information and advice being requested from ICES. The other type of MoU involves both scientific collaboration as well as the provision of information and advice by ICES, and which formalises the obligation of the organisation requesting advice to cover the costs incurred by ICES in providing such advice.

The Council **agreed** that the Secretariat should further investigate both of the options for a formal agreement as presented by ICES, and report back to the Council at its next annual meeting. While not wishing to rule out the option of an agreement which provides NAMMCO with the opportunity to seek advice from ICES, and recognising the cost recovery policies of ICES, it was suggested that the Secretariat look into the specifics of the cost implications for NAMMCO of such an agreement. It was also suggested that it might be useful to consult other regional management bodies with whom ICES has similar agreements.

3.3 Other business

The Council noted discussions in the *ad hoc* Working Group on Finance and Administration concerning the level of funds available to cover the costs of invited expertise in its work, and **endorsed** the recommendation that the present level of funding be maintained in future budgets (see also 2.2 above). However, it was also noted that, according to items II.5 and IV.3 of the Scientific Committee Rules of Procedure, the nomination of external experts to participate in meetings of the Scientific Committee and its working groups is subject to the approval of the Council. The Council encouraged the Secretariat to ensure that these procedures be followed by informing the Council of the Scientific Committee's plans for the involvement of external experts in its work.

4. MANAGEMENT COMMITTEE

4.1 Report of the Management Committee

The Chairman of the Management Committee, Einar Lemche (Greenland) reported to the Council on the meeting of the Management Committee which was held in Tórshavn from 28 to 30 May. A draft of the major conclusions and recommendations of the Management Committee was circulated during the Council meeting. The final report of the

Management Committee was completed by correspondence and is contained in Section 2.1 of this volume.

4.1.1 Matters arising from the Scientific Committee

The Management Committee noted the revised abundance estimate of 72,000 for this stock as the best available, and also noted the progress made so far by the Scientific Committee in providing the requested assessment of the status of the stock (see also under items 3.1.2 and 3.1.3 above).

4.1.2 Earlier proposals for conservation and management

The Council noted the Management Committee's review of updated information with respect to management conclusions and recommendations previously made in relation to species and stocks for which advice had been sought through the Scientific Committee. These included Northern bottlenose whales, Atlantic walruses and harp and hooded seals in the Northwest Atlantic (see Section 2.1, item 5.1 in this volume).

4.1.3 New proposals for conservation and management

Long-finned pilot whales

The Council noted the Management Committee's review of the comprehensive advice which had now been provided by the Scientific Committee in response to requests from the Council (see above under item 3.1.2).

It was noted that the Faroe Islands wished to continue to utilise pilot whales in the manner they had done for centuries. Due to the opportunistic nature of the catch, it was further noted that the application of total allowable catches was not considered an appropriate management measure for this form of utilisation.

The Council noted the conclusion of the Management Committee that the drive hunt of pilot whales in the Faroe Islands is sustainable. This conclusion was based on the findings and conclusions of the Scientific Committee, through its review of the ICES Study Group Report and the analysis of data from NASS-95 with respect to the abundance and stock identity of long-finned pilot whales in the North Atlantic (see Section 3.1, item 8.1), as well as the conclusions of the Scientific Committee that the effects of the drive hunt of pilot whales in the Faroe Islands have had a negligible effect on the population, which is estimated as 778,000 in the Central and North East Atlantic.

4.1.4 Implementation of the Joint NAMMCO Control Scheme

National Inspection Schemes for Coastal Whaling (Part A - Joint NAMMCO Control Scheme)

With reference to the adoption at its Sixth Meeting of the Provisions for the Joint NAMMCO Control Scheme for the Hunting of Marine Mammals (see *NAMMCO Annual Report 1996*, 29; 69-75), the Council noted the information provided by members of the Management Committee in relation to progress in implementing Part A of the Joint Control Scheme - Common elements for national inspection schemes for coastal whaling in NAMMCO member countries (see Section 2.1, item 7.1).

International Observation Scheme (Part B - Joint NAMMCO Control Scheme)
The Council noted that the necessary guidelines for implementation of Part B of the Joint Control Scheme, the International Observation Scheme, had been developed by the Management Committee's *ad hoc* Working Group on Inspection and Observation, and that these had been adopted by the Management Committee in February 1997, according to the provisions of Section C (Implementation) of the Joint Control Scheme. The Guidelines are contained in Section 2.2 of this volume.

The Council **agreed** to the recommendation from the Management Committee that the International Observation Scheme be implemented in 1998, according to the adopted guidelines and the specified procedures for planning the scope of observation activities and appointing observers. It was further **agreed** that an amount of NOK 120,000 be allocated for the Scheme in 1998 (see also under item 2.2 above). It was noted in this connection that according to article B.7 of the Joint NAMMCO Control Scheme, the possibility also exists for different arrangements for covering costs related to the activities of NAMMCO observers, which can be agreed between NAMMCO and the country sending the observer.

It was further noted that the Management Committee had requested the Working Group on Inspection and Observation to complete the outstanding practical documentation for observers, drafts of which had been prepared by the Secretariat.

The Council also reiterated the view of the Management Committee that the Secretariat should maintain active consultation with the relevant authorities in member countries when developing proposals for the scope and range of observation activities.

4.2 Research recommendations & requests for advice

The Council **agreed** to forward the following requests for advice and research recommendations to the Scientific Committee (under 4.2.1 and 4.2.2 below). In so doing, the Council also **agreed** that priority should be given to the tasks outlined under 4.2.1 below prior to the next meeting of the Council, drawing on all relevant expertise to address these requests.

4.2.1 Short-term priorities

Harp and hooded seals
With respect to the Council's earlier request for advice on harp and hooded seals (see *NAMMCO Annual Report 1996:*132-33), it was noted that at its 1996 meeting, the Scientific Committee had reviewed the latest information on the Northwest Atlantic stocks of these species (see also above under 3.1.2), but that a number of issues regarding the status of stocks of hooded seals in the Greenland Sea and harp seals in the Greenland, Barents and White Seas still remained to be addressed.

It was noted that at its Copenhagen meeting in August/September 1997, the Joint ICES/NAFO Working Group on harp and hooded seals will in particular address the status of the harp seals stock in the Greenland Sea and the Barents and White Seas and the hooded seal stock in the Greenland Sea. The ecological role of these stocks will also be

discussed. Aware that aerial surveys have been carried out in 1997 to assess both the Greenland Sea hooded seal stock and the Barents/White Sea harp seal stock, updated abundance estimates for these two stocks are expected. An updated stock estimate for the Barents/White Sea stock of harp seals will make it possible to establish a more reliable estimate of the annual food consumption of this stock. Current knowledge about the feeding habits of harp and hooded seals in the Greenland Sea are, however, insufficient to facilitate calculation of food consumption of these stocks.

It was anticipated that the Scientific Committee would review this new research at its next meeting.

Harbour porpoises
The Council noted that the harbour porpoise is common to all NAMMCO member countries, and that the extent of current research activities and expertise in member countries and elsewhere across the North Atlantic would provide an excellent basis for undertaking a comprehensive assessment of the species throughout its range. The Council therefore **requested** the Scientific Committee to perform such an assessment, which might include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals.

Ringed seals
The Scientific Committee was **requested** to advise on what scientific studies need to be completed to evaluate the effects of changed levels of removals of ringed seals in West and East Greenland.

Economic aspects of marine mammal-fisheries interactions
The Council **requested** that special attention be paid to studies related to competition and the economic aspects of marine mammal-fisheries interactions.

4.2.2 Long-term priorities
Narwhal and beluga
The Scientific Committee was **requested** to examine the population status of narwhals and belugas (white whales) throughout the North Atlantic.

Role of marine mammals in the ecosystem
The Council encourages scientific work that leads to a better understanding of interactions between marine mammals and commercially exploited marine resources, and **requested** the Scientific Committee to periodically review and update available knowledge in this field.

Monitoring of stocks and trends in stocks of marine mammals in the North Atlantic
The Scientific Committee was requested to continue its work to monitor stock levels and trends in all stocks of marine mammals in the North Atlantic in accordance with previous recommendations (see *NAMMCO Annual Report 1996*:131-132). In this context the Scientific Committee was encouraged to prioritize calculation of the abundance of species covered by NASS-95, in particular those species presently harvested and species

considered to be important with respect to interactions with fisheries.

4.2.3 Recommendation to Member Countries

The Council **recommended** that NAMMCO member countries study the ecological interaction between dolphin species (e.g., *Lagenorhynchus* spp.) and fisheries, with the view to future assessments of such interactions.

4.3 Other business

National Progress Reports

The Council **agreed** to the recommendation of the Management Committee that National Progress Reports submitted to the Scientific Committee each year should also be available to the Management Committee, and that these should contain information on annual catch levels, as well as research activities and management measures.

National Progress Reports submitted to the Scientific Committee in 1997 are contained in Section 4 of this volume.

The Council further **agreed** to the Management Committee's recommendation that the Governments of Canada and the Russian Federation be invited to provide NAMMCO with similar information on catch levels and management strategies with respect to shared stocks of marine mammals.

By-catch of marine mammals

The Council noted the decision of the Management Committee to establish a Working Group to work intersessionally to consider how the issue of by-catches of marine mammals could be addressed at its next meeting, noting the duties of States under article 61.4 of UNCLOS in this respect.

Management Committee Rules of Procedure

The Council **agreed** to the recommendation from the Management Committee to amend Article IV, paragraphs a), b) and c) of the Management Committee Rules of Procedure with respect to the specified deadlines for the development, circulation and amendment of the Committee's agenda prior to its meetings (see Section 2.1, item 8, and Section 2.3 of this volume).

5. HUNTING METHODS

The Chairman of the Working Group on Hunting Methods, Amalie Jessen (Greenland) informed the Council that no meeting of the Working Group had taken place since its last meeting in January 1996. Members of the Working Group had agreed to meet again prior to the next meeting of the Council in 1998.

In the meantime, further developments with respect to hunting methods in member countries would continue to be reported to the Secretariat as agreed last year, with the purpose of maintaining an updated overview of existing regulations on equipment, hunting and hunters in member countries. This would provide a basis upon which to consider potential coordination initiatives as well as to enhance mutual knowledge of hunting

methods in member countries (see *NAMMCO Annual Report 1996*: 31).

6. ENVIRONMENTAL QUESTIONS

Greenland drew attention to the fact that the Arctic Monitoring and Assessment Programme (AMAP) under the Arctic Environmental Protection Strategy (AEPS) had recently completed a major assessment of the levels of anthropomorphic pollutants and their effects in the Arctic environment (AMAP 1997). This report would be officially presented at an international symposium on environmental pollution in the Arctic in Tromsø in early June. The preliminary programme for this symposium was circulated as NAMMCO/7/INFO/3. The AMAP assessment provides a comprehensive review of the sources, pathways, levels, trends and effects of contaminants in the Arctic, and identifies the geographical areas of concern, as well as outlining human exposure, potential threats and gaps in current understanding.

The Council recalled the NAMMCO International Conference on Marine Mammals and the Marine Environment in Shetland in April 1995 (Sanderson and Gabrielsen 1996), which focussed in particular on the sources and levels of contaminants in marine mammals, as well as health issues related to the high level of marine mammal foods in the diet of many people in northern regions. It was noted that attention to environmental matters remained a permanent part of the Council's agenda and was an important area in which the Commission should continue to follow international developments in research and policy.
Greenland pointed out that concern about the exposure and associated risk to human health deriving from high levels of persistent pollutants in the marine environment had recently become more explicit in national policy statements related to health and the environment, and that there was a growing recognition of the need to be more aware of contaminant levels in marine food and their possible consequences for human health in the long-term. It was further recognised that the major sources of pollutants in Arctic areas were the industrial activities of countries to the south of the North Atlantic region.

Against this background, the Council **agreed** to a number of steps which it considered appropriate for NAMMCO to take in relation to concerns about contaminant levels in the marine environment. NAMMCO should:

- contact the Arctic Monitoring and Assessment Programme (AMAP), commending the work carried out and urging the continuation of such work in the future;
- communicate its concerns to the relevant international bodies responsible for dealing with pollution reduction (such as the Oslo and Paris Commissions), and request information on progress with respect to the reduction of emissions;
- seek an exchange of information and advice with the United Nations Food and Agriculture Organisation and the World Health Organisation with regard to the effects of marine pollution levels on food quality and human health.

In addition, Norway encouraged all NAMMCO member governments to follow closely discussions and developments related to pollution and marine mammals in the relevant international fora in which they participate.

The Faroe Islands drew the Council's attention to a forthcoming international symposium on human health and exposure to heavy metals which would take place in Tórshavn from 22 -26 June 1997. A preliminary programme was made available for the information of delegates and observers.

7. THE NAMMCO FUND

7.1 Annual Report of the NAMMCO Fund

The Annual Report of the NAMMCO Fund was presented to the Council by Einar Lemche (Greenland) and distributed as NAMMCO/7/9. The Board of the NAMMCO Fund conducted its meetings in 1996 and 1997 primarily by telephone.

7.1.1 Focus on seals and sealing

With reference to the decision at its Sixth Meeting that funds in the NAMMCO Fund in 1996 should be used to focus on seals, sealing and the interaction between seals and fisheries, the Council noted the process of consultation and discussion which had taken place through the Board of the NAMMCO Fund to identify the possibilities for a single international project related to seals and sealing.

After determining the extent of existing plans for international seal-related projects, the Fund initiated a process of consultation with regard to an idea for a major international publication on seals and sealing. Based on feedback received from a broad range of contacts, the Board of the Fund agreed that it would be better to reduce the scope of the idea to a more immediate project which would be possible to implement within a shorter time-frame, such as a collection of essays on topical issues related to sealing and seal management.

After further discussions it was agreed that the idea should be further developed for a conference to focus on sealing, which would draw all interested parties together across the North Atlantic, both commercial and subsistence, including user groups, industry representatives and policy makers. The aim of the conference would be to share information and experiences and explore the potential for international cooperation on trade and management issues.

Based on the positive responses received to this idea, it was finally decided that the Secretariat should proceed with plans for an international conference on sealing, and that the NOK 200,000 earmarked for the NAMMCO Fund in 1996 should be put towards organising this forum (see further 7.2 below).

7.1.2 Other projects supported by the Fund

In the course of its meetings to develop a project on seals and sealing, the Board of the Fund also reviewed updated information on progress with projects which had been supported or earmarked for support but which were not yet complete. These included:

Mammals in the North Atlantic: a text book with illustrations by Dorete Bloch, to be published by Skúlabókagrunnurin, Faroe Islands. With reference to this project, the Secretary drew the attention of participants to the marine mammal illustrations on display in the meeting room, These were created especially for inclusion in this publication by Faroese artist Edvard Fuglø.

Socio-economic aspects of whaling in Greenland: edited by Milton Freeman, published by the Canadian Circumpolar Institute publication. An edited collection of documents related to the socio-economic aspects of whaling in Greenland (since published as Stevenson, Madsen and Maloney, 1997).

ICC and the Whaling Agenda: a background report by the Inuit Circumpolar Conference on whaling in an historical and contemporary perspective in connection with the development of an ICC whaling strategy for Inuit/circumpolar whaling.

Whales in Norwegian waters: an information poster by Tore Dillingøen, Oslo. To be produced in Norwegian and English versions, and co-sponsored by the Norwegian Ministry of Fisheries.

Marine Hunters: information brochure by High North Alliance on marine mammal utilisation in the North Atlantic (c. 30pp. in English, German and Swedish).
It was finally reported that the Board was currently considering a request for support for a film on minke whaling by Norwegian documentary film-maker Knut Skoglund.

7.2 International Conference on Sealing - 1997

With reference to 7.1.1 above, the Secretary informed the Council of progress towards the planning of the sealing conference. An invitation had been received from the Government of Newfoundland and Labrador, Canada to hold the Conference in St John's, and dates had been set for 25-27 November 1997. It was noted that the Nordic Atlantic Cooperation had agreed in 1996 to grant NOK 100,000 to NAMMCO for the development of a project on seals and sealing, and that it had since been confirmed by NORA that these earmarked funds could be used to support the planned conference in 1997.

The Secretary reported that a first announcement outlining the main themes of the Conference, which was entitled *Sealing the Future*, had been widely distributed in April, and a further, more detailed programme was currently under development. Plans were also under way to set up a special Conference Exhibition to highlight seal products and information on sealing, which would coincide with the programme of presentations and panel discussions. In addition to cooperation with the Nordic Atlantic Cooperation, Conference partners also included the Inuit Circumpolar Conference (ICC), the Nordic Council of Ministers (Programme on Arctic Cooperation), and the High North Alliance.

The Council commended the progress made so far with planning for the Conference, and in particular expressed its appreciation for the invitation from the Government of Newfoundland and Labrador to host the event in St John's.

Greenland underlined the importance of ensuring that the Conference programme allow ample time for participants to establish contacts and discuss matters informally, with a clear focus on seal product development and marketing and trade issues.

(Section 5 of this volume contains the final Conference Programme, Press Release and panel recommendations from the NAMMCO International Conference, *Sealing the Future.*)

8. EXTERNAL RELATIONS

8.1 Observers' reports

The Secretary informed the Council of the meetings of other international organisations at which NAMMCO had been officially represented by an observer since the last meeting of the Council.

International Whaling Commission (IWC)

The Secretary represented NAMMCO at the 48th annual meeting of the International Whaling Commission, which was held in Aberdeen in June 1996. NAMMCO submitted an opening statement and supplementary information on its activities to the IWC and special attention was drawn to the publication of proceedings from the 1995 NAMMCO Conference on Marine mammals and the Marine Environment, a copy of which was presented to the IWC Secretariat. In addition, in accordance with a request by the Council in 1996, the Provisions for the Joint NAMMCO Control Scheme for the Hunting of Marine Mammals were forwarded to the IWC as background information for the IWC's own attempts to agree on a suitable inspection and control scheme for commercial whaling operations. The 49th annual meeting of the IWC was scheduled to take place in Monaco 20-24 October 1997.

Northwest Atlantic Fisheries Organisation (NAFO)

The Council decided in 1995 to delegate its observer status at annual meetings of NAFO to Iceland. NAMMCO was not, however, officially represented at the 1996 annual meeting, which had been held in St Petersburg in the Russian Federation in September. The Secretary would pursue the matter with the NAFO Secretariat to ensure that the relevant information on annual meetings of NAFO was received on a regular basis.

North-East Atlantic Fisheries Commission (NEAFC)

In line with the Council's decision to delegate NAMMCO's observer status at NEAFC to Norway, Bente Angell Hansen reported to the Council on the Fifteenth Annual Meeting of NEAFC in London, 20-22 November 1996, to which an observer's report on the activities of NAMMCO for the previous year was also submitted. In addition, Arnór Halldórsson of Iceland represented NAMMCO at an extraordinary meeting of NEAFC held in Brussels in March 1997 to discuss the adoption of recommendations for regulatory measures for Norwegian spring-spawning herring in waters beyond the fisheries jurisdiction of the Contracting Parties.

The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS)

The Secretariat reported that the 2nd Meeting of the Parties to ASCOBANS was scheduled for November 1997 in Bonn, Germany, to which NAMMCO receives a standing invitation. In addition, it was reported that Arne Bjørge, observer for Norway in the Advisory Committee of ASCOBANS, had submitted information on the work of the NAMMCO Scientific Committee to the Advisory Committee meeting in November 1996. The Secretariats continued a regular exchange of reports and information on respective meetings.

International Union for the Conservation of Nature (IUCN)
The Secretary reported on her attendance as NAMMCO Observer at the 20th General Assembly of the IUCN, which was held in Montreal, Canada from 17 to 23 October 1996. A written report had been circulated to Council members separately, outlining some of the issues of interest to NAMMCO. These included: further discussion of the criteria for listing in the *IUCN Red List of Threatened Animals* (Baillie and Groombridge 1996), where cod and haddock had recently been included as "vulnerable"; recognition of the work of the IUCN Sustainable Use Specialist Group and its initiatives through regional networks; and the rejection of an application for IUCN membership by the International Fund for Animal Welfare.

The Council noted the importance of following the work and policies of the IUCN, in particular with respect to their development of reviews of the conservation status of species and stocks world-wide. The Council reiterated the concerns expressed by the Scientific Committee with regard to the inappropriateness of producing status assessments on a global/species basis rather than on a stock basis.

8.2 Cooperation with other international organisations

The Council noted that other than those organisations with whom an exchange of observers was normally reciprocated, NAMMCO had also established contacts with a number of other organisations which also received invitations to send observers to NAMMCO Council meetings. Prior to NAMMCO/7, notification had been received from the UN Food and Agriculture Organisation (FAO), the Convention on Migratory Species (CMS - Bonn Convention), the Arctic Monitoring and Assessment programme (AMAP) and the IUCN that these bodies were unable to send observers to NAMMCO/7. (With regard to cooperation with ICES, see under item 3.2 above; with AMAP see under item 6 above).

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
The Secretary informed the Council that the CITES Secretariat had requested scientific advice and views from NAMMCO on the Norwegian proposal to the forthcoming 10th Conference of the Parties of CITES (Harare, Zimbabwe, June 1997) to transfer the Northeast Atlantic and North Atlantic Central stocks of minke whales from Appendix I to Appendix II. This had been received in accordance with Article XV, paragraph 2 of the CITES Convention, which requires the CITES Secretariat to consult other relevant international bodies on downlisting proposals to the Conference of the Parties.

The Secretariat had prepared a response to this request, informing CITES of the revised

abundance estimates for the Central North Atlantic stock agreed by the NAMMCO Scientific Committee in March 1996. Reference was also made to the NAMMCO Scientific Committee's work related to the role of marine mammals (including minke whales) as predators of commercially important fish species in North Atlantic ecosystems, as well as to the recently adopted Joint Nammco Control Scheme for the Hunting of Marine Mammals. The Norwegian proposal to CITES and associated correspondence between CITES and NAMMCO was circulated for information as NAMMCO/7/INFO/2. A position paper fromthe Government of Japan regarding a proposal to establish a marine fish species working group at the 10th meeting of CITES was also circulated for information as NAMMCO/7/INFO/7.

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

The Secretary informed the Council that reports were now being exchanged on a regular basis with the Joint Commission. The Scientific Working Group and the Commission had last met in 1995, and would convene again in 1997, after analysis of data from a recent survey of belugas was complete.

Arctic Council

The Secretary referred the Council to the Declaration on the Establishment of the Arctic Council, signed in Ottawa in September 1996 (circulated as NAMMCO/7/INO/4). In addition, NAMMCO had approached the Secretariat of the Arctic Council in Canada in connection with the signing of the Declaration to suggest the establishment of a formal exchange of observers with the Arctic Council in the future. It was noted that the Arctic Council Declaration included provisions for the establishment of a sustainable development programme, a category of permanent participants in addition to state membership, and decision-making by consensus.

The suggestion for an exchange of observers would be further pursued in connection with the forthcoming Fourth AEPS Ministerial Conference in Norway in June 1997.

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The Chairman noted that, as was now established procedure, the appointment of NAMMCO observer representatives to other international bodies would be coordinated through the Secretariat in consultation with the Chairman of the Council or directly with those Member Countries to whom observer status was already delegated.

9. RULES OF PROCEDURE

The Council acknowledged the need for formal Rules of Procedure, which would outline and clarify specific procedures related to, for example, the arrangement and conducting of its meetings, admission of observers and election of officials. It was **agreed** that a draft proposal should be developed by the Committee on Finance and Administration for the consideration of the Council. It was also stressed that Rules of Procedure for the Council should be kept as simple as possible, reflecting the basic procedures already established in practice by the Council, while allowing for flexibility in the future conduct of Council business.

10. ELECTION OF OFFICERS

10.1 Election of Chairman 1997/98

The Council elected Arnór Halldórsson of Iceland as its Chairman for the next two years (1997/98).

Arnór Halldórsson thanked the Council for entrusting him with this important task, and expressed his appreciation on behalf of all Council members to the outgoing Chairman, Halvard P. Johansen, for his devoted work over the past two years towards the further development of NAMMCO.

10.2 Election of Vice-Chairman 1997/98

The Council elected Amalie Jessen of Greenland, as its Vice Chairman for the next two years (1997/98).

11. ANY OTHER BUSINESS

Before concluding the meeting, the retiring Chairman, Halvard P. Johansen, took the final opportunity as Chairman of the Council to make some closing remarks. He recalled that upon taking up the Chairmanship in 1995, he had stressed the importance of the principle of sustainable use as the basis for the common management of marine resources among the NAMMCO member countries, and was pleased to note that the organisation had adhered to this principle. He also commended the decision to begin a series of publications deriving from the work of the NAMMCO Scientific Committee, as well as the regular publication of the NAMMCO Annual Report, noting that these were important means of maintaining an open and informative approach to the work of the Commission.

He noted with appreciation the efforts of the Secretary, Kate Sanderson and her acceptance of a further four-year term with NAMMCO and thanked Assistant Secretary Jens Paulsen, on behalf of the Council, for his contribution to the establishment and smooth running of the Secretariat since 1993, and wished him all the best for the future. Finally, the retiring Chairman wished his successor, Arnór Halldórsson, every success in taking the work of NAMMCO forward.

12. CLOSING ARRANGEMENTS

12.1 Next meeting

The 1998 annual meeting would be held in Norway. The location and specific dates would be announced at a later date.

12.2 Adoption of press release

The final press release, as contained in Appendix 7, was adopted.

13. REFERENCES

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Appendix 1

LIST OF PARTICIPANTS

DELEGATES

Faroe Islands
Dorete Bloch
Ingibjørn Eldevig
Karstin Hansen
Hans J. Hermansen
Marius Jacobsen
Regin Jespersen
Tryggvi Johansen
Kaj Mortensen (HD)
Ivan Klein Olsen
Jústines Olsen
Knút Olsen
Jógvan Ósá
John Petersen (Minister)
Maria Róin
Ulla Wang
Jákup Weihe

Greenland
Pâviâraq Heilmann (Minister)
Jesper Koldborg Jensen
Amalie Jessen
Einar Lemche (HD)
Bjørn Rosing

Iceland
Ari Edwald
Konráð Eggertsson
Arnór Halldórsson (HD/Vice Chairman)
Kristín Haraldsdóttir
Árni Kolbeinsson
Guðjón A. Kristjánsson
Helgi Laxdal
Kristján Loftsson
Þorsteinn Pálsson (Minister)
Jóhann Sigurjónsson
Óskar Vigfússon
Gísli Víkingsson

Norway
Bente Angell-Hansen (A-HD)
Halvard P. Johansen (Chairman)
Jan Birger Jørgensen
Inger Lavik Opdahl
Lisbeth W. Plassa
Øyvind Rasmussen
Johán Williams
Inger Winsnes

Scientific Committee
Mads Peter Heide-Jørgensen
Tore Haug

OBSERVERS

Governments
Canada
Guy Côte
Dan Goodman
Fernand Robichaud (Secretary of State, Agriculture, Agri-food, Fisheries & Oceans)
Earl Wiseman

Denmark
Henrik Fischer

Japan
Yasuo Lino
Kazuo Shima

Russian Federation
V.N. Prohorov
Yu. B. Ryanzantesey (I)
V.N. Solodovnik
G.V. Tishkov
F.M. Troyanovsky
V.K. Zilanov (Deputy Chairman, Fisheries Committee)

Intergovernmental organisations:

ASCOBANS
Henrik Fischer

International Whaling Commission
(IWC)
Henrik Fischer

Nordic Atlantic Cooperation (NORA)
Kjartan Hoydal

Nordic Council of Ministers
Jesper Heldbo
Reidar Hindrum

North-East Atlantic Fisheries
Commission
(NEAFC)
Bente Angell-Hansen

Northwest Atlantic Fisheries
Organization
(NAFO)
Lisbeth W. Plassa

Non-governmental organisations:

High North Alliance
Rune Frøvik
Geir Wulff Nilsen
Jan Odin Olavsen
Hansi Kreutzman

Inuvialuit Game Council
Robert Bell
Duane Smith

Inuit Circumpolar Conference
Alfred Jakobsen

North Atlantic Salmon Fund
Orri Vigfússon

World Council of Whalers
Tom Happynook
Matt Stabler

Researchers:

Steinar Andresen
(Fridtjof Nansen Institute, Norway)

HD = Head of Delegation;
A-HD = Acting Head of Delegation;
I = Interpreter

Appendix 2

AGENDA

1. Opening procedures
   - 1.1 Welcome address: Mr John Petersen, Minister of Fisheries of the Faroe Islands
   - 1.2 Invited presentation: Chief Tom Mexsis Happynook, Chairman, World Council of Whalers
   - 1.3 Opening statements
   - 1.4 Admission of observers
   - 1.5 Adoption of agenda
   - 1.6 Meeting arrangements

2. Administration and finance
   - 2.1 Report of the Finance and Administration Group
   - 2.2 Forecast budgets 1998/99

3. Scientific Committee
   - 3.1 Report of the Scientific Committee
   - 3.2 Cooperation with ICES
   - 3.3 Other business

4. Management Committee
   - 4.1 Report of the Management Committee
   - 4.2 Requests for advice
   - 4.3 Other business

5. Hunting Methods

6. Environmental questions

7. The NAMMCO Fund
   - 7.1 Annual Report of the NAMMCO Fund
   - 7.2 International Conference on Sealing, 1997
   - 7.3 Other business

8. External relations
   - 8.1 Observers' reports
   - 8.2 Cooperation with other international organisations
   - 8.3 Other matters

9. Rules of Procedure

10. Election of Officers
    - 10.1 Election of Chairman 1997/98
    - 10.2 Election of Vice-Chairman 1997/98

11. Any other business

12. Closing arrangements
    - 12.1 Next meeting
    - 12.2 Adoption of press release

Appendix 3

LIST OF DOCUMENTS

Meeting documents

NAMMCO/7/1	List of participants
NAMMCO/7/2-rev1	Agenda
NAMMCO/7/3-rev1	List of documents
NAMMCO/7/4	Report of the Finance and Administration Working Group
NAMMCO/7/5-rev1	Adopted budget 1997 and forecast 1998/99 budgets
NAMMCO/7/6	Report of the Scientific Committee
NAMMCO/7/7	Report of the Management Committee
NAMMCO/7/8	ICES ACFM/ACME advice on Long-finned Pilot Whales
NAMMCO/7/9	Annual Report of the NAMMCO Fund
NAMMCO/7/10	Report of the *ad hoc* Working Group on Finance and Administration

Opening statements

NAMMCO/7/OS - Canada
NAMMCO/7/OS - Faroe Islands
NAMMCO/7/OS - Greenland
NAMMCO/7/OS - Iceland
NAMMCO/7/OS - Japan
NAMMCO/7/OS - Norway

Information documents

NAMMCO/7/INFO/1	The North Atlantic Marine Mammal Commission - In Principle and Practice - Paper by K. Sanderson to Whaling Seminar, Reykjavik, 1.3.97
NAMMCO/7/INFO/2	CITES & minke whales - Proposal submitted by Norway to CITES to transfer the Northeast Atlantic and North Atlantic Central stocks of minke whale from Appendix 1 to Appendix II; Response from NAMMCO to CITES for advice on this proposal.
NAMMCO/7/INFO/3	Provisional Programme for the AMAP International Symposium on Environmental Pollution of the Arctic and Third International Conference on Radioactivity in the Arctic-Tromsø, 1-5 June 1997.
NAMMCO/7/INFO/4	Declaration on the Establishment of the Arctic Council (August 6, 1996)

NAMMCO/7/INFO/5	World Council of Whalers: Press Release, 26 February 1997.
NAMMCO/7/INFO/6	Discussion paper on feeding ecology (submitted by Japan)
NAMMCO/7/INFO/7	Government of Japan: Position Paper concerning the Proposal to Establish Marine Fish Species Working Group at the 10th meeting of the CITES Conference of the Parties.

Appendix 4

ADDRESSES AND OPENING STATEMENTS TO THE COUNCIL BY MEMBER DELEGATIONS AND OBSERVER GOVERNMENTS

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FAROE ISLANDS - ADDRESS OF WELCOME

The Minister of Fisheries of the Faroe Islands, John Petersen

It is my great pleasure, on behalf of the Government of the Faroe Islands, to welcome NAMMCO to the Faroe Islands for its Seventh Meeting. It hardly seems like five years since we had the honour of hosting the Inaugural Meeting of the NAMMCO Council in September 1992, and I am pleased to see how much progress has been made to build up the organisation since then, and to note the growing interest in NAMMCO's activities from a wide range of organisations and regions. I would like to welcome the North Atlantic Fisheries Ministers and their representatives who also have this opportunity to attend NAMMCO's opening session. I would also like to extend a special welcome to Chief Tom Happynook, and look forward to hearing his presentation on the whaling traditions of his people on the west coast of North America.

The Government of the Faroe Islands places great value on an enhanced cooperation between the North Atlantic countries on matters related to the rights of coastal states to use marine resources, including whales and seals.

The Government of the Faroe Islands has full competence in questions concerning the management of marine resources, including whales and seals. Management measures for whales are taken in accordance with the special whaling act which was adopted by the parliament in 1984, and any quotas agreed internationally must be approved by the parliament.

The Government bases its resource management policies on the principle of rational and sustainable use of all marine resources. This also covers whales and seals. The Government also emphasises a holistic, ecosystem approach to the management of marine resources. It is the conviction of the Faroese Government that, in the case of seals and whales in particular, pollution from industrial centres and the degradation of marine habitat - and to a certain extent also by-catches in fisheries - pose the real threats to marine mammals today, rather than the limited hunting of these animals that is carried out in coastal communities in our region. This is clearly seen in the North and Baltic seas, where hunting is certainly not the reason why one so seldom sees whales in these waters.

The Government of the Faroe Islands also places great value in regional cooperation with

respect to all factors which have a bearing on the conservation status of whales and seals, as well as the influence of marine mammals on other components of the ecosystem. By working through NAMMCO on the conservation and management of marine mammals in the North Atlantic, the Faroese Government fulfils its commitments for international cooperation as stated in Article 65 of the UN Convention on the Law of the Sea. Through NAMMCO we have established a framework for scientific cooperation which will ensure that utilisation of marine mammals in the Faroese fisheries zone continues to be sustainable in accordance with Section II, Chapter 9 of Agenda 21.

It is particularly appropriate that it should be at this meeting here in the Faroes that NAMMCO's Scientific Committee will present their well-founded and thorough conclusion on the status of the pilot whale population and the sustainability of the Faroese pilot whale hunt. Not only does this provide us with a solid, international basis for our national management policies, but it also serves to confirm the competence of NAMMCO as an appropriate body for the conservation and management of small whales in the North Atlantic.

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OPENING STATEMENT BY GREENLAND

The Greenlandic delegation is very pleased to participate in this 7th meeting of NAMMCO here in Tórshavn, for the first time since NAMMCO's inaugural meeting in 1992.

To Greenland, the Faroe Islands are like a smaller but earlier matured brother in the family of the Danish Kingdom. The Faroese people have for centuries recognised marine mammals, such as the pilot whale, as an important part of their diet. Not only for their nutritious value but also as a part of a cultural heritage.

This is reality for all the NAMMCO members - and for Canada and Russia as well.

Through the years we have carried out a great deal of work together in NAMMCO. Though there are differences in management practices among us, these are not so great that they cannot be overcome in a constructive working process - through the strength of our similarities.

The nutritious and health value of marine mammals is being assessed through the AMAP programme. Next week, AMAP (the Arctic Monitoring and Assessment Programme) will present its first assessment of the state of the Arctic environment.

Pollution from sources south of NAMMCO is now of such an extent that we must deal with the consequences in our countries. We dealt with this at the NAMMCO Conference on Marine Mammals and the Marine Environment in the Shetland Islands a few years ago. These problems have special attention in Greenland, given the importance for our people

of marine mammals in Greenlandic food. The Greenland delegation considers that NAMMCO should touch upon these issues again this week.

Finally, we would like to thank the Faroese Government for the invitation and the hospitality we are enjoying.

…….

ICELAND - OPENING STATEMENT

The Minister of Fisheries of Iceland, ψorsteinn Pálsson

It is with pleasure I take the floor to thank my Faroese colleague for hosting this meeting. First of all I should say how much we have enjoyed this stay in Tórshavn.

Here we have once again be reminded of where the North Atlantic roots are, and where the basis of our livelihoods is. It has been a pleasure to visit you in the Faroe Islands and see what good progress you are making in preserving your identity, natural heritages and values.

There are several countries that share your values. The sentiment of understanding the needs and values of the Northern communities who rely upon the sustainable use of marine living resources, is a message which we need to bring forward to the world society. Generally, I believe that in the years to come an increased tolerance towards different ethical and cultural values will be common practice. But we, the NAMMCO countries, need to understand that we have cultural and strategic allies in communities dependant on marine resources in the other Northern areas. This, for example, enables us to understand Russian frustration regarding the lack of understanding of the needs of the people in the Chuckotka area. The same applies to the aboriginal communities in Canada.

Now we are celebrating the 5-year anniversary of NAMMCO, which provides an opportunity to recall the reason for establishing this organisation. There was a need for an umbrella organisation that would cover all the different marine mammal populations in this large ocean area and their interrelationships with other marine living resources upon which we so much depend.

In this light Iceland is particularly interested to see NAMMCO developing and flourishing in the same spirit and fashion for the next five years as it has done for the last five years.

…….

NORWAY - OPENING STATEMENT

The Minister of Fisheries of Norway, Karl-Eirik Schjøtt-Pedersen

The Norwegian delegation is very pleased to participate in the 7th meeting of the Council. The Agreement on Cooperation in Research, Conservation and Management of Marine Mammals in the North Atlantic was signed in 1992. In September the same year the parties had the first meeting of the Council right here in Tórshavn. I would like to thank our Faroese hosts for inviting us to Tórshavn and for their hospitality.

The Norwegian delegation looks forward to fruitful discussions and decisions in the Council. We must continue to build NAMMCO as an organisation that promotes the needs of the coastal communities of the North Atlantic.

It is, in my view, useful from time to time to evaluate the organisation and its accomplishments. What has NAMMCO then achieved in its first five year period of operation?

Experience from other international organisations and resource management regimes indicates that we should not expect much of substance to take place within such a short time-span. I think, however, NAMMCO has been quite successful, as a lot has been accomplished on the scientific side. Procedures for management and for observation and inspection are already in place. To my mind the NAMMCO Annual Report gives ample evidence to substantiate this view. The work done has a positive effect when building public confidence in our organisation outside the member countries.

The important question now is therefore: Where does NAMMCO go from here?

We do not want NAMMCO to be just a discussion club. According to the agreement we shall cooperate in research, conservation and management of marine mammals in our area. Norway is ready to make management decisions within NAMMCO. Specific management decisions on the baleen whales, however, would in our view be counterproductive to the further building of the organisation. Thus, Norway being a member of the IWC, will not participate in making such decisions concerning minke whales in the NAMMCO Management Committee. We are still of the opinion that NAMMCO should continue to concentrate on cooperation on the management of seal stocks and small cetaceans.

The scientific work on the interactions between marine mammals and fish stocks in the ecosystem of the North Atlantic is of equal importance. NAMMCO should also continue to play an important role in dissemination of relevant information on the conservation and management of marine mammals in order to educate the public.

Let me close this statement by reiterating that Norway would like to welcome other countries in our region with a genuine interest in conservation and management of all marine mammals as members of NAMMCO. We therefore hope that both Russia and Canada will soon join NAMMCO as members.

I look forward to a successful meeting.

…….

CANADA – OPENING STATEMENT

Fernand Robichaud, Secretary of State for Agriculture and Agri-food, Fisheries and Oceans

As members of the Council will know, Canada has been more than just an observer to NAMMCO. We were participants in the international conferences going back to 1988 which led to the establishment of NAMMCO, and Canadian scientists have made substantial contributions to the work of NAMMCO's Scientific Committee. In addition, both government officials and representatives of Inuit organisations in Canada have attended all of the Council of NAMMCO.

All of the marine mammal species that have been the subject of NAMMCO's attention occur in Canadian waters and most importantly, we share with NAMMCO members, a commitment to the principles of conservation and sustainable use of marine resources and the regard for the needs of coastal communities and indigenous peoples that are the foundation of this organisation.

Mr. Chairman, it is our view that NAMMCO has indeed become an effective organisation for co-operation in the conservation and management of marine mammals in the North Atlantic and we appreciate the invitation of the Council to become a full Party to the NAMMCO Agreement. As you know, this matter is still under consideration in Ottawa.

…….

JAPAN - OPENING STATEMENT

Kazuo Shima, Observer for the Government of Japan

It is my great pleasure to come back again to the NAMMCO Council's Meeting and this beautiful city of Tórshavn. This is my second visit to the Faroe Islands. It is a great honour for me to address the meeting, because I was one of the first to welcome the birth of NAMMCO.

First of all, I congratulate NAMMCO on her Seventh Council meeting. NAMMCO is the international organisation which advocates conservation and sustainable utilisation of the marine ecosystem. I express my great concern that there still remains a movement in the world which wishes to give a sacred status to marine mammals. Such a movement will not achieve the conservation and rational utilisation of all marine living resources.

The world population is expected to reach 10 billion by the year 2050. Against this it has been estimated that the environmental carrying capacity of the earth can support only 7 billion people. The task now facing us, therefore, is to seek every possible means to secure enough food to accommodate the ever-increasing world population. When we consider the food problem from a global point of view, we naturally have to take into account how

to manage marine living resources, including whales, effectively as food for present and future generations. Seen from the perspective of bio-diversity, to grant excessive protection to a particular element of the marine ecosystem will lead to disruption of the biological balance in the same manner as excessive harvesting. In order to both utilise and conserve species of marine living resources, as well as the ecosystem, each element of the ecosystem should be utilised properly and proportionally.

As you know, two thirds of the surface of this planet is covered with ocean. Almost all, 97% of water on the earth is seawater. But the ocean may remain not fully developed. It is estimated that marine mammals, all over the world, are consuming approximately 700 million tons (only cetaceans 500 million tons) a year. If proportionally and appropriately managed, fishery production could possibly be increased, although FAO has estimated that fishery production would reach around 80 million tons at its best.

In the face of this situation, the forthcoming 10th meeting of CITES Conference of Parties will consider two significant issues: the downlisting of 6 stocks of 3 species of whales from Appendix I to Appendix II, proposed respectively by Japan and Norway; and the establishment of a marine fish species working group proposed by the U.S.

As for the former, I hope for the strong support of NAMMCO members for the Japanese and Norwegian proposals for the downlisting of whales. At present CITES categorises most large whale species as "threatened with extinction". I believe that the current listing practice of Appendix I should be improved to ensure rational utilisation of marine living resources based on scientific findings. CITES should have an independent standpoint based on scientific evidence.

As for the U.S. proposal, I would remind you of the nature of CITES. Its purpose is to regulate international trade in endangered species so that it can contribute to the conservation of such species. Of course such regulations must be subject to scientific findings. No marine fish species subject to large-scale commercial fisheries and international trade satisfy the requirements for listing in CITES Appendices. The appropriate organisation to address these species is not CITES but FAO. The 22nd meeting of the Fisheries Committee of the FAO reaffirmed that it was the mandate of FAO and of regional fisheries management bodies to take responsibility for collecting data, formulating research needs and recommending management options. We support such a confirmation and are opposed to the proposal to establish within CITES a marine fish species working group as proposed by the U.S.

NAMMCO has been making efforts to develop a multi-species management model through researching the feeding habits of marine mammals. If it is successful in building up a useful scheme, it must also be helpful in resolving the problems of a global range, such as the food supply and the conservation of the environment.

From such a viewpoint I have been paying attention to the activities of NAMMCO and I am looking forward to its successful results in contributing to the global benefit.

I express our sincere thanks to the Government of the Faroe Islands and the NAMMCO Secretariat for inviting us to this meeting. Thank you very much for your attention.

Appendix 5

INVITED PRESENTATION:

THE WHALING TRADITIONS OF THE NUU-CHAH-NULTH NATION AND THE ESTABLISHMENT OF THE WORLD COUNCIL OF WHALERS

Chief Tom Mexsis Happynook, Chairman of the World Council of Whalers
and Head Whaling Chief of the Huu-Ay-Aht tribe of the Nuu-Chah-Nulth Nation
(B.C., Canada)

1. NUU CHAH NULTH WHALING - HISTORIC PERSPECTIVE

"The Nuu-Chah-Nulth" - Whaling peoples of the Pacific North West

The Nuu Chah Nulth nations are a seafaring people who inhabit the west coast of Vancouver Island in the Pacific North West. We consist of 15 first nations, which include the Makah nation from Washington state in the USA.

Since the beginning of time we have lived on the ocean and fully occupied and utilised the resources that the ocean and our lands provided for us. Each of the Nuu Chah Nulth hereditary chiefs was responsible for a resource and each had his own territory. The Nuu Chah Nulth had great respect for all the resources that were available to them and the hereditary chiefs were raised from birth to look after and care for these resources. This was to ensure they could provide for our communities forever.

This was how the Nuu Chah Nulth government was structured. It was based on, and rooted in, the natural resources that surround us in Nuu Chah Nulth country.

One of the many resources that we fully utilised and respected was the whale. This majestic mammal was looked upon as one of the greatest gifts granted to us by the creator and was treated as such by the Nuu Chah Nulth whaling chiefs.

Traditional Whaling Equipment

The Nuu Chah Nulth whaling chiefs went out in large dugout cedar canoes that were 36 feet in length. The eight crew members each had a unique paddle. These paddles were carved from the yew tree which is very hard and heavy. These paddles were designed so they would bend while paddling to give extra thrust but had to be strong enough so they would not break. The harpoon shaft was also made from the yew tree and was about 16 feet long and 4 inches in diameter. The harpoon shaft was constructed in three sections and bound together using a tree bark The bark of this tree would grow around the tree rather then straight up. Because it grew like this it had the natural shape for wrapping and was perfect for tying the harpoon shaft together.

The harpoon head was made from a Mussel shell which was fashioned into an arrowhead shape. This was then tied onto an elk antler barb using sinew or gut and covered with spruce sap to give it strength. The harpoon tip was then fitted and secured to the harpoon shaft. Off the harpoon tip came a cord that was several fathoms long and was made by braiding three or four strands of sea lion gut together. This cord would then be attached to a rope made from cedar bark. The cedar bark rope was also made by braiding three or four strands of cedar bark together. Finally, seal skin floats were fastened to the cedar bark rope at intervals of several fathoms and inflated.

The handling of this equipment was forbidden. Only the whaling chief or his designated people could touch or handle the whaling equipment. To ensure this law was adhered to the whaling chiefs stored their equipment in secret caves so no one could get at it. We have histories, stories and legends that tell about people who have died because they did not heed the warnings and foolishly handled the sacred whaling equipment.

Preparation and the hunt

The preparation began up to nine months before the whales went by Vancouver Island on their migration north to the Bering Sea. This preparation included fasting, bathing and praying. It also included secret rituals and sacred ceremonies which were performed in conjunction with the moon. These rituals and ceremonies where held in undisclosed areas, caves and pools throughout the tribal territory.

The Nuu Chah Nulth whaling chiefs had special places throughout the territory where they would go to get the cedar trees for the dug-out canoes, the yew wood for the harpoon shafts, the mussel shells for the harpoon tips and the different tree bark or plants that they needed for tying or making the ropes. They had special places where they gathered the secret family medicines, plants and trees. They had sacred songs, prayer chants and amulets that they used during the preparation, during the hunt and during the celebrations after the hunt.

All of these secret and sacred belongings were a necessary part of the preparation because we believe that it is imperative to make a connection to the spirit of the whale in order to address it with the proper respect and that it is essential for the whaling chief to connect to the supernatural. These connections allowed the chiefs to overcome the largest mammal on earth using the method and equipment that they used.

The Nuu Chah Nulth whaling chiefs would begin their preparation on the top of a mountain, and over the months work their way down to a cave beside the ocean. There were foods that they could not eat during these months of preparation and tests that they had to endure to ensure they had prepared properly. If they had not prepared properly they would not go hunting. During the time that the whaling chiefs were preparing, the whaling crews were also preparing and getting in shape for the rigours of the whale hunt. The crew was made up of eight men in each of the whaling canoes. When the chief had prepared properly and the whales were migrating, he then went to his secret cave to collect his whaling equipment.

The whaling canoes were brought down from their storage place by the crew members. The canoe could not touch mother earth, either when they were putting it in the water for the hunt or taking it out of the water after the hunt. This was because the liquid from a special plant had been applied to the bottom and sides of the canoe. When the crew and canoes were ready, the whaling equipment was in order and the food and water had been stored properly, they would set out. On the way out the seal skin floats would be inflated and the songs of the whaling chiefs would be sung.

There were two whaling canoes and one smaller canoe. The smaller canoe was used as the look-out, watching for the whale to show up. When the whale was sighted, the whaling chief would be signalled and the smaller canoe would head for home to let the village know they could begin to make the necessary arrangements.

As the whaling chief and his crews left the village the whaling chief's wife had a very significant role to play. She had to lie very still on a cedar mat, not move and face the mountains. This was to keep the whale from heading off shore. She had a special stone on which she would put a snail. If the snail moved off the stone, this indicated the whale would be rambunctious; if the snail stayed on the stone this indicated that it would be a clean, safe hunt.

The whaling crews could paddle these large canoes at around eight knots. The yew wood paddles were designed and carved so the sides were sharp and the tip pointed. This allowed them to paddle silently. The initial approach would be on the left side of the whale. The steersman had the responsibility to tell the chief when to throw the harpoon. He had to make sure the head of the whale was under the water as well as the tail before signalling the whaling chief to throw the harpoon. This was to make sure the canoe would not be hit by the tail when the whale sounded. When the conditions were right the steersman yelled to the chief and the paddler right behind the whaling chief would tap him on the back of the leg with the top end of his paddle. This was just in case the whaling chief did not hear the steersman signal. If the harpoon had not penetrated deep enough the paddler on the right front seat would grab the harpoon shaft and push it in as hard as he could before the rest of the crew back paddled to move the canoe away from the tail. At about the same time the other canoe would harpoon the whale from the right side. When the whale sounded, the harpoon shaft would release from the harpoon tip and the crew would pick the shaft up as it floated by. As the whale sounded the cedar bark rope with the inflated seal skin floats would be let out and the chase would begin.

When the whale had tired the hunters would go in for the kill. They would puncture the heart and lungs using a 6 foot yew wood lance. After the whale had been killed one of the crew members would dive into the water and, using a bone knife and sinew or gut, he would sew the mouth of the whale shut. This was to ensure it did not sink on them. They would sometimes, if necessary, cut the ends off of a bulb kelp and use this as a breathing tube if the diver could not hold his breath for very long. Most of these men could hold their breath for several minutes and dive down as far as 16 fathoms. Many hours were spent practising for their part in the hunt.

When the whaling crews and the whale reached the village the crews very carefully lifted the whaling canoes out of the water without allowing them to touch mother earth and put them back in their storage places. The chief would return his equipment to his secret cave for safe storage. Now began the sacred ceremonies surrounding the cutting and distribution of the whale. The whale represented the whole territory of the tribe and had to be cut and distributed according to strict tribal laws. Because all of the hereditary chiefs and their territories together made up the whole tribal territory, the cuts to the whale had to be precise. A cut could not be made in the piece that belonged to another chief. Once these cuts were made and distributed to the chiefs, the rest of the whale was processed and shared throughout the community. This could go on for days and included ceremonies, songs, celebrating and feasting.

The blubber was eaten, smoked, dried and rendered for the oil. The oil was used everyday with our meals. The meat was also eaten, smoked, dried and preserved. The bones were made into tools and weapons. The community took what was needed and the rest of the whale products were stored for barter and trade.

The Nuu-Chah-Nulth and the whale

The Nuu Chah Nulth whaling chiefs on the west coast of Vancouver Island were held in high esteem for the discipline, spirituality, rituals, medicines, songs, prayer chants and the connection to the supernatural that they possessed. They played a significant role within their Government structures because of the responsibility they had for the whale resource. Part of their responsibility was to ensure that this resource would be there for the whaling chiefs seven generations on. They were also responsible for making sure that all the knowledge pertaining to whales was passed on to the eldest son, who would eventually become the next hereditary whaling chief.

Each of the hereditary chiefs within our nations was responsible for a resource, and because of this responsibility their participation within our government structure was essential. They held the knowledge. The whale was the basis of our economic structure and the foundation of our economic system. It was our Fort Knox. Tribes and people came from all over the Pacific North West to trade and barter for our whale products, for the blubber, the oil, the meat and the tools and weapons that we made from the bones.

The reason that it played the largest role in our economic structure and economic system was because the Nuu Chah Nulth are the only tribal group (to my knowledge) who hunted the whale in the Pacific North West, until you reached Alaska. Most of the tribes had access to fish, seafood and wildlife but it was the Nuu Chah Nulth whaling chiefs who hunted the whale, and the whale products that brought the people to Nuu Chah Nulth country.

Besides the whale being the foundation of our economic system it was the cornerstone of our religion, spirituality and physical well-being. From before the whaling chief began his preparation to after the whale was hunted and the ceremonies were concluded, the whale strengthened our people and our communities in a number of ways. It strengthened community governance because the whaling chiefs were fulfilling their responsibility to

the head chief, the community and their families. They were also fulfilling their role within their nations government structure. It strengthened the economic structure and economic system of communities by providing very valuable products to sell, trade and barter. It strengthened our tribal laws, ceremonies, rituals, prayer chants, songs, values, teachings and culture because all of these elements were practised and used throughout the whaling operation, right from the beginning to the end. It strengthened the communities' religion and spirituality through the example of spiritual discipline that the whaling chiefs exemplified in their months of bathing, praying and fasting. It strengthened the relationships between communities because it brought people from all around the Pacific North West to Nuu Chah Nulth country to buy, trade and barter, which often produced intertribal relationships and marriages. It strengthened the relationships between families within our communities because everyone participated in the processing of the products, the celebrations and the feasting after the hunt. It strengthened the relationship between family members in the community because the whale was shared with all of your family members and your relatives. And finally, it strengthened our people physically and mentally because of the scientifically proven nutritional value that the whale products provide and the rigorous training that took place prior to the hunt.

How do we know that the whale played a significant role within Nuu Chah Nulth life? You only have to look at our art and the designs used in our carvings, paintings and basketry and you will begin to understand that the whale truly inspired and influenced the Nuu Chah Nulth way of life.

In closing, I want to share with you some of the things that I was taught when I was a little boy. These were teachings passed on to me by my great grandmothers. I was taught that the resources were put there for us to use, to provide food for our people, to benefit the community and to sustain our economies. At that time it was not currency as we know it today, but it was still economics.

I have been taught that we are dominant over nature but that we are part of nature and we are here to help to ensure that the balance in nature is kept. I have been taught to remember that we are not only responsible to our people and our communities but most importantly to the resource itself. These teachings were told to me over and over again so I would never forget what my role is. If you look at modern history and how the resources have been managed you will clearly see that first they have been plundered then protected. Is this keeping the balance?

2. THE WORLD COUNCIL OF WHALERS

The ways of my people always ensured that our resources were cared for, and an excessive harvest would never have even been considered; this would have been in direct contravention to our understanding of how life on this earth worked - together, inter-related and in harmony. Therefore, you probably can imagine my people's dismay when the great ships arrived in our homeland. On the one hand they brought useful items as gifts, but on the other they pillaged our resources in a manner most incomprehensible. To our horror, the greatest gift of the sea, our foundation, whales, were slaughtered to the point that many thought they would never return. In a matter of a few scant years, the

resource that had been our mainstay for centuries seemed to be hunted to extinction or driven from our waters. There was great sorrow amongst our people, for this loss was indeed a great one.

In time, the numbers of whales off British Columbia were so low that the ships finally stopped pursuing them. We learned that some distant organisation had decided the whales should be protected, and were happy that the end of the wasteful harvest was at hand. Little did we know how this would impact us within a generation. We watched, and as the numbers of whales returning to our waters each year increased, we celebrated. We celebrated for we knew the day when we could return to our traditional harvest was getting closer each passing year. In order to ensure that the numbers of whales were at a level at which our harvest would again be in keeping with conservation, we began to seek information from various sources, to verify what we were seeing with our own eyes. To our amazement, there were many groups telling us that those numbers would never be high enough to allow us to harvest. There was a group calling itself the International Whaling Commission or IWC which, although apparently established to ensure whaling was conducted in a sustainable fashion (a practise with which we whole-heartedly agreed), was in function opposed to whale harvesting even when the best scientific advice suggested it presented no conservation concerns. The mixed messages and negative attitude towards whaling peoples such as ourselves confused us. We were, and are, proud of our way of life, our association with the sea, and mostly our ability to interact with the greatest animal created - the whale.

About the same time we were making these discoveries, other groups of whaling peoples were meeting and discussing their common interests. In 1992, the Mayor of Oshika Township in Japan, where a small whaling village is located, convened an informal meeting of whalers during the IWC meeting being held in Glasgow, Scotland. This group consisted of people from Canada, Norway, St.Vincent and the Grenadines, Japan, Greenland, Iceland, and the Faroes. This group, about thirty-five in all, made a decision to hold a more formal, full day session the following year.

In 1993, the Japanese Small-Type Whaling Association organised a one day meeting prior to the opening of the IWC meeting in Kyoto. This time, over sixty people from those same nations attended, and a number of resolutions were adopted, including an agreement to meet yet again in the future. The 1993 meeting was entitled the "Second World Conference on Community-Based Whaling".

Some years passed, and the people who were at these first two meetings corresponded, met occasionally amongst themselves, and began to plan for the next time they could all get together. Some from this group learned that we had put whaling on the Treaty table as a substantive issue, and extended an invitation for us to participate in that next meeting. In June 1996, together with another of my people's whaling chiefs, Jerry Jack, I made my way to Berkeley, California to attend the meeting entitled the "Third International Conference on Community-Based Whaling". Both Jerry and I were pleasantly surprised by the warmth and camaraderie extended us by those in attendance, whaling peoples from over ten different nations. Through the course of that meeting, it became apparent that we had a remarkable number of common interests. Truly brothers of the sea and the hunt,

collectively we discussed a wide range of topics, ranging from the pride we took in our cultures, to the external influences that seemed hell-bent on destroying many of our chosen lifestyles. It was also during that meeting that those gathered expressed a desire to form a more formal relationship, one that could and would work for the betterment and survival of us all. Jerry and I were impressed by the actions and desires being expressed, and after consulting with our people back home, offered to provide housing for the proposed whaling organisation on the land of our people.

The reaction to our offer was supportive, and a small core of determined individuals began to lay out the groundwork for the establishment of a new Whaling Organisation. An organisation completely owned, managed and working for whalers the world over. By the end of 1996 a draft Constitution had been prepared, and invitations to the founding Board meeting had been sent. During early January of this year, representatives from five countries gathered in Vancouver, and finalised a working Constitution. Plans were made to incorporate, inform our kindred whalers, and set up a Secretariat.

I must admit that we struggled with the name for some time. Finally, recognising the need to be inclusive of all those peoples engaged in sustainable whaling, the choice was made and the World Council of Whalers was born. I am very pleased to inform you today that our offer of accommodation was accepted, that a functioning Secretariat now exists for this new organisation, that the incorporation has been accomplished, and that we are open for business.

The underlying theme of the World Council of Whalers is the support and promotion of communities engaged in sustainable whaling. The WCW intends to promote the sustainable and equitable use of living marine resources, to protect the cultural, social, economic and dietary rights of whaling peoples, and to address their concerns. This new group plans not to sit idly by and act solely as an advocacy group, but rather to become directly involved in matters of real concern to us all.

Four Committees have been organised, or are in the process of being established. Although their titles speak loudly as to their function, I would like to take a brief moment to review these with you. An Education Committee has been set up to encourage school students in whaling communities to correspond with students elsewhere in order to increase understanding of the social, cultural, economic, and environmental circumstances of coastal communities; and to help raise funds in order to establish an annual international prize for the best student essays on the benefits of sustainable use of marine mammal resources. A Human Rights Committee is being developed to monitor actions taken by governments, public interest groups, and international organisations relative to the obligations of states to protect the rights of user-community individuals and groups under international law; and to bring questionable actions of such bodies to the notice of national and United Nations agencies concerned with human rights violations. A Legal Issues Committee is being formed to upon request, inform user communities and states of their legal rights under international ocean, fisheries, and resources law when actions are taken by outsiders that may infringe upon those rights. And last, but certainly not least, a Nutrition and Health Committee is being set up to assist whaling communities and other interested parties in determining the nutritional and health benefits and in some cases,

potential risks associated with the consumption of whale products; and to facilitate research related to health problems associated with dietary change in traditional whaling communities, and disseminate the results of such research.

As you can see, we do not plan to be idle. Some may say the WCW has even bitten off too much, but I don't think so. Collectively we, the whalers of the world and our allies, are a foundation to be reckoned with. This new organisation offers us for the first time a truly global umbrella, an opportunity to be united in strength, in actions as well as words. Individually, a few of us have the ability to face the obstacles and encumbrances in our path and deal with matters from science to cultural, but sadly many do not. United, looking after each other and our common interests, we cannot be defeated. I invite those of you involved with whaling to join us.

I am very proud to have been selected as founding Chairman for the World Council of Whalers. I clearly see the road in front of me and the WCW, and despite the obstacles, am certain that together, we will forge a lasting, meaningful alliance. We will be holding an Annual General Assembly of members later this year. I hope, and I trust to see many of you there.

I would like to thank NAMMCO for inviting me here to speak with you today. I am sure that I will learn a great deal over the next few days, and welcome the opportunity to discuss the WCW with any and all who are interested. I extend to you my sincere wish that your meetings here are successful, and look forward to working with many of you in the future.

Appendix 6

AUDITED ACCOUNTS FOR 1996

1. PROFIT AND LOSS ACCOUNT (NOK)

	1996	***1995***
Income		
Contributions	2,730,000	*2,480,825*
Interest received (netto)	63,000	*103,743*
Total income	2,793,000	*2,584,568*
Expenditure		
Secretariat costs	2,189,000	*2,118,450*
Meetings	40,000	*6,694*
Scientific Committee	309,000	*199,162*
Projects, NAMMCO Fund	0	*77,917*
NASS-95	0	*800,000*
Conference	0	*283,705*
Total operating expenses	2,538,000	*3,485,928*
Operating result	**255,000**	***-1,005,103***

2. BALANCE SHEET 31 DECEMBER 1996 (NOK)

		1995
Current assets		
Bank deposits (restricted: 66,931)	1,564,069	*1,371,408*
Pre-payment, office rent	0	*36,750*
Total assets	1,564,069	*1,408,158*
Current liabilities		
Employees tax deduction & tax	86,918	*53,940*
Creditors	22,351	*35,687*
Total current liabilities	109,269	*89,627*
Restricted equity		
Relocation fund	200,000	*200,000*
NAMMCO Fund	319,664	*238,722*
Total restricted equity	519,664	*438,722*
Distributable equity (General reserve)	935,136	*879,809*
Total equity	1,454,800	*1,318,531*
Total liabilities and equity	1,564,069	*1,408,158*

Appendix 7

PRESS RELEASE

At the Seventh Annual Meeting of NAMMCO - the North Atlantic Marine Mammal Commission - in Tórshavn, Faroe Islands from 27-30 May, it was concluded that the pilot whale hunt in the Faroe Islands is sustainable. The Management Committee of NAMMCO based its conclusion on the Scientific Committee's review of the status of the population in the Central and Northeast Atlantic, which reaffirmed the earlier abundance estimate of 778,000 as the best available.

Not only does this conclusion provide the Faroe Islands with a solid scientific basis for the continued utilisation of pilot whales for food, but it also reaffirms NAMMCO's important role in providing management advice, in accordance with Article 65 of the International Convention for the Law of the Sea.

NAMMCO also agreed to begin an exchange of international observers in sealing and whaling activities of member countries in 1998. Such an exchange is provided for in the Joint NAMMCO Control Scheme for the Hunting of Marine Mammals which was adopted by the Council at its last meeting in 1996.

The revised abundance estimate of 72,000 for the Central North Atlantic stock of minke whales, resulting from the Scientific Committee's review of recent sightings data, provides the basis for the Council's request to the Scientific Committee for an assessment of the status of this stock. This assessment, which includes an evaluation of the long-term effects of past and present removals, is currently being carried out by the Scientific Committee.

Having already provided thorough assessments on a number of marine mammal species and stocks as well as questions related to the role of marine mammals in the ecosystem, such as fish consumption by whales and seals, and sealworm infection, the Council requested the Scientific Committee to give priority to the following matters:

- New abundance estimates for harp seals in the Greenland, Barents and White Seas and hooded seals in the Greenland Sea are expected to be available in 1997 and the Scientific Committee's review of new information will provide a basis for further management discussion of these stocks in 1998.
- The harbour porpoise is found in the waters of all NAMMCO member countries and the Scientific Committee was asked to undertake a comprehensive assessment of this species throughout its range.
- The Scientific Committee was asked to provide advice on what scientific studies need to be completed to evaluate the effects of changed levels of removals of ringed seals in West and East Greenland.

- NAMMCO encourages scientific work that leads to a better understanding of interactions between marine mammals and commercially exploited marine

resources. It was agreed that special attention should be paid to studies related to competition and the economic aspects of marine mammal-fisheries interactions.

The Council invited Canada and Russia to provide NAMMCO with information on catch levels and management strategies with respect to shared stocks of marine mammals.

The Council noted the health concerns related to high levels of pollution in marine mammals, and agreed to approach relevant international bodies for information on what measures are being taken to reduce emission levels affecting the marine environment.

NAMMCO has established working relations with a number of other intergovernmental organisations dealing with management and conservation issues. NAMMCO has recently provided scientific advice to CITES (Convention on the International Trade in Endangered Species of Fauna and Flora) on a proposal from Norway to transfer the Central and Northeast Atlantic stocks of minke whale from Appendix 1 to Appendix II.

NAMMCO's plans for an major international Conference on Sealing, with a focus on products and markets, are well under way, and the Council noted with appreciation the invitation from the Government of Newfoundland and Labrador in Canada to host the Conference in St. John's in November this year.

In 1998, a total of 200,000 NOK has been earmarked for the NAMMCO Fund, the purpose of which is to provide support for information projects which contribute to the understanding of the conservation and management of marine mammals.

The Council elected Arnór Halldórsson of Iceland as its new Chairman for the next two years, and Amalie Jessen of Greenland as its Vice Chairman for the same period.

Tórshavn, 30 May 1997

SECTION 2 – MANAGEMENT COMMITTEE

2.1
REPORT OF THE MANAGEMENT COMMITTEE

The Management Committee met in Tórshavn, Faroe Islands from 28-30 May 1997 and was attended by delegations and observers present at the Council meeting (see Section 1, Appendix 1).

1.-3. OPENING PROCEDURES

The Chairman of the Management Committee, Einar Lemche, welcomed delegations from all member countries to the meeting. On behalf of the Committee he also welcomed the attendance of observers present at the meeting of the Council as observers in the Management Committee. It was noted in this connection that until more detailed criteria had been developed for admission procedures, it was the practice of the Management Committee to decide upon the admission of observers at each meeting.

The Chairman recommended the establishment of a drafting group (Agenda item 6.3) consisting of scientific advisers from member delegations in order to ensure clarity and accuracy in the formulation of requests and recommendations developed by the Management Committee. It was **agreed** to establish such a group at this meeting.

The draft agenda, as contained in Appendix 1, was adopted without amendment, and the Secretary, Kate Sanderson, was appointed rapporteur.

4. MATTERS ARISING FROM THE SCIENTIFIC COMMITTEE

The Chairman noted that the Council had thoroughly reviewed the Report of the Fifth Meeting of the Scientific Committee and had endorsed a number of recommendations for further research related to its findings.

In this connection the Chairman also referred to agenda items 5 and 6, where matters arising from the Scientific Committee are also dealt with in relation to proposals for conservation and management (item 5), or as recommendations for further scientific research (item 6).

With respect to the Central North Atlantic minke whale stock, the Management Committee noted the revised abundance estimate of 72,000 for this stock as the best available. The Management Committee further noted the progress made so far by the Scientific Committee in addressing the requested assessment of the status of the stock, and commended their efforts to complete the work as soon as possible. The Management Committee looks forward to receiving the results of this work when they become available and if the Council so decides.

5. PROPOSALS FOR CONSERVATION AND MANAGEMENT

5.1 Earlier proposals

The Committee reviewed earlier proposals and conclusions made with respect to stocks and species for which the Council has requested advice (see Appendix 2). The Chairman requested comments and any new information member countries may wish to provide on developments regarding these earlier conclusions.

Northern bottlenose whales (Appendix 2, item 1):
The Faroe Islands informed the Management Committee that with respect to northern bottlenose whales, no changes had yet been made to existing Faroese management policies for this species in Faroese waters.

Atlantic walrus (Appendix 2, item 2):
With respect to the Atlantic walrus, Greenland informed the Management Committee of developments in implementing legislation in Greenland with the view to further reducing the level of walrus catches in West Greenland. Further to information provided to the Management Committee at its last meeting (see *NAMMCO Annual Report 1996*, p. 80), Greenland reported that new regulations were currently being finalised which would further limit catches of walruses on the west and east coasts of Greenland, and which included the establishment of protected areas.

Ringed seals (Appendix 2, item 3) - see under 6.2.1 *ii).*

Harp seals in the Northwest Atlantic (Appendix 2, item 4):
With respect to harp seals in the Northwest Atlantic, the Management Committee noted the increased catches of harp seals in Canada in 1996 and 1997 and that the combined catches in Canada and Greenland now approximate the estimated replacement yield.

Hooded seals in the Northwest Atlantic (Appendix 2, item 5):
With respect to hooded seals in the Northwest Atlantic, the Management Committee noted that the Scientific Committee had nothing new to add to information reviewed at its last meeting. The catch of hooded seals in Canada was approximately 25,000 in 1996.

Finally, it was **agreed** that in the future, an updated list of proposals for conservation and management made by the Management Committee should be prepared in advance of each meeting for the reference of delegates and for subsequent inclusion as an appendix to the final report of the Management Committee (Appendix 2).

5.2 New proposals

Long-finned pilot whales
The Faroe Islands informed the Management Committee of their wish to continue to utilise pilot whales in an opportunistic manner as has been done for centuries. Catches of pilot whales may vary from year to year and total allowable catches are not considered appropriate for this form of hunt. In some years catches may exceed 2,000 whales, and in other years they may be much smaller, while the average annual catch since 1971 (1971-96) has been c. 1,400.

The Management Committee noted the findings and conclusions of the Scientific Committee, through its review of the ICES Study Group Report and the analysis of data from NASS-95 with respect to the status of long-finned pilot whales in the North Atlantic (see Section 3.1, item 8.1), which also confirmed that the best available abundance estimate of pilot whales in the Central and Northeast Atlantic is 778,000. With respect to stock identity it was noted that there is more than one stock throughout the entire North Atlantic, while the two extreme hypotheses of i) a single stock across the entire North Atlantic stock, and ii) a discrete, localised stock restricted to Faroese waters, had been ruled out.

The Management Committee further noted the conclusions of the Scientific Committee that the effects of the drive hunt of pilot whales in the Faroe Islands have had a negligible effect on the population, and that an annual catch of 2,000 individuals in the eastern Atlantic corresponds to an exploitation rate of 0.26%.

Based on the comprehensive advice which had now been provided by the Scientific Committee to requests forwarded from the Council, the Management Committee **concluded** that the drive hunt of pilot whales in the Faroe Islands is sustainable.

6. RECOMMENDATIONS FOR SCIENTIFIC RESEARCH

6.1 Former recommendations

i) Harp and hooded seals

With respect to the Council=s request for advice on harp and hooded seals (see *NAMMCO Annual Report 1996:*132-33), the Management Committee noted that at its 1996 meeting, the Scientific Committee had reviewed the latest information on the Northwest Atlantic stocks of these species (see also above under 5.1), but that a number of issues regarding the status of stocks of hooded seals in the Greenland Sea and harp seals in the Greenland, Barents and White Seas still remained to be addressed.

It was noted that at its Copenhagen meeting in August/September 1997, the Joint ICES/NAFO Working Group on harp and hooded seals will in particular address the status of the harp seals stock in the Greenland Sea and the Barents and White Seas and the hooded seal stock in the Greenland Sea. The ecological role of these stocks will also be discussed. Aware that aerial surveys have been carried out in 1997 to assess both the Greenland Sea hooded seal stock and the Barents/White Sea harp seal stock, updated abundance estimates for these two stocks are expected. An updated stock estimate for the Barents/White Sea stock of harp seals will make it possible to establish a more reliable estimate of the annual food consumption of this stock. Current knowledge about the feeding habits of harp and hooded seals in the Greenland Sea are, however, insufficient to facilitate calculation of food consumption of these stocks.

In anticipation of the Scientific Committee review of this research in early 1998, the Management Committee **agreed** to return to this matter at its next meeting.

ii) Monitoring of stocks and trends in stocks of marine mammals in the North Atlantic

The Management Committee **recommended** that the Scientific Committee continues its work to monitor stock levels and trends in all stocks of marine mammals in the North Atlantic in accordance with previous recommendations (see *NAMMCO Annual Report 1996*:131-132). In this context the Management Committee **recommended** that the Scientific Committee be encouraged to prioritize calculation of the abundance of species covered by NASS-95, in particular those species presently harvested and species considered to be important with respect to interactions with fisheries.

6.2 New recommendations for scientific research

The Management Committee agreed to make the following further recommendations for scientific research:

6.2.1 Stocks/species

i) Harbour porpoise

The Management Committee noted that the harbour porpoise is common to all NAMMCO member countries, and that the extent of current research activities and expertise in member countries and elsewhere across the North Atlantic would provide an excellent basis for undertaking a comprehensive assessment of the species throughout its range. The Management Committee **recommended** that the Scientific Committee be requested to perform such an assessment, which might include distribution and abundance, stock identity, biological parameters, ecological interaction, pollutants, removals and sustainability of removals.

ii) Ringed seal

The Management Committee **recommended** that the Scientific Committee be requested to advise on what scientific studies need to be completed to evaluate the effects of changed levels of removals of ringed seals in West and East Greenland.

iii) Narwhal and beluga

The Management Committee **recommended** that the Scientific Committee examine the population status of narwhals and belugas (white whales) throughout the North Atlantic.

6.2.2 Marine mammals/fisheries interactions:

i) The Management Committee encourages scientific work that leads to a better understanding of interactions between marine mammals and commercially exploited marine resources, and **recommended** that the Scientific Committee periodically review and update available knowledge in this field.

ii) The Management Committee **recommended** that NAMMCO member countries study the ecological interaction between dolphin species (e.g., *Lagenorhynchus* spp.) and fisheries, with the view to future assessments of such interactions.

iii) The Management Committee **recommended** that special attention be paid to studies related to competition and the economic aspects of marine mammal-fisheries interactions.

6.3 Priority of recommendations

The Management Committee discussed the work load for the Scientific Committee related to the above recommendations, and **recommended** that prior to the next meeting of the Management Committee, the Scientific Committee should pay special attention to the following of the above recommendations:

Harp and hooded seals (6.1 *i)*); harbour porpoise (6.2.1 *i)*), ringed seals (6.2.1 *ii)*), and studies related to competition and economic aspects of marine mammal-fisheries interactions (6.2.2 *iii)*). The Scientific Committee should draw on all relevant expertise to this end.

The Management Committee noted that the recommendation under 6.2.2 *ii)* with respect to interactions between dolphin species and fisheries is directed to member countries.

7. IMPLEMENTATION OF THE JOINT NAMMCO CONTROL SCHEME

The Chairman referred to the Council=s decision at its last meeting to adopt the Joint NAMMCO Control Scheme for the Hunting of Marine Mammals (as contained in the *NAMMCO Annual Report 1996:* 69-75), and noted that according to Section C of the Control Scheme, Ait was the intention of the member countries to implement the Scheme or parts thereof at the beginning of the hunting season in 1997.≅

7.1 Implementation of Section A - Common elements for national inspection schemes for coastal whaling

The Chairman requested updates from members of the Management Committee in relation to progress in implementing Part A of the Joint Control Scheme - Common elements for national inspection schemes for coastal whaling in NAMMCO member countries.

With respect to the Faroe Islands and Iceland, it was noted that there were not at present any whaling activities carried out in these countries of the type to which provisions under Section A applied, i.e. hunting of whales from vessels with a harpoon gun.

Greenland reported that although there had been some delays in implementing revised regulations in accordance with Section A of the Joint Control Scheme, Greenland Home Rule authorities were currently preparing a new directive in connection with the hunting of large whales from vessels using a harpoon gun.

Norway reported on national measures with respect to inspection of Norwegian minke whaling and sealing operations, in which an inspector is present on board each vessel. It was also reported that a new mechanism for electronic surveillance of whaling activities (cf. Joint Control Scheme, article A.3.3) was currently being examined.

7.2 Implementation of Section B - International Observation Scheme

The Chairman noted that according to Section C of the Control Scheme, as adopted by the Council in 1996, further work on necessary guidelines for implementation of Section B -International Observation Scheme - was to be undertaken by the Management Committee.

The Chairman referred to NAMMCO/7/MC/3, the Report of the Working Group on Inspection and Observation (5-7 November 1996), which contained as Appendix 3 the Guidelines to Section B of the Joint NAMMCO Control Scheme. It was noted that the Management Committee had instructed the Working Group to develop these guidelines, and that they had been adopted by the Management Committee by correspondence in February 1997. The Guidelines for the International Observation Scheme are contained in Section 2.2 of this volume.

The Management Committee **recommended** that the International Observation Scheme be implemented in 1998, according to the adopted guidelines and the specified procedures for planning the scope of observation activities and appointing observers. It was further **recommended** that an amount of NOK 120,000 be allocated for the Scheme in 1998. It was also noted in this connection that according to article B.7 of the Joint NAMMCO Control Scheme, the possibility also exists for different arrangements for covering costs related to the activities of NAMMCO observers, which can be agreed between NAMMCO and the country sending the observer.

The Management Committee drew the Council=s attention to the fact that, as a result of the recommendation to implement the Observation Scheme in 1998, funds already allocated for the implementation of the Scheme in 1997 would not now be used in this financial year.

The Management Committee also **agreed** to request the Working Group on Inspection and Observation to complete the outstanding practical documentation for observers, drafts of which had been prepared by the Secretariat.

Finally, the Management Committee stressed the need for the Secretariat to maintain active consultation with the relevant authorities in member countries when developing proposals for the scope and range of observation activities.

8. RULES OF PROCEDURE

The Management Committee **recommended** an amendment in the Rules of Procedure under Article IV, paragraphs a), b) and c) with respect to specified deadlines for the development, circulation and amendment of the Committee=s agenda prior to its meetings. These would now read 45 days, 30 days and 15 days respectively. It was noted that this amendment was proposed for practical reasons related to the Secretariat=s coordination of preparations for meetings. The revised Rules of Procedure for the Management Committee are contained in section 2.3 of this volume.

9. ANY OTHER BUSINESS

i) Information on marine mammal management and utilisation

The Management Committee noted the value of having an updated overview of marine mammal utilisation and management in member countries in the context of its deliberations. It was therefore **recommended** that National Progress Reports submitted

to the Scientific Committee each year should also be available to the Management Committee, and that these should contain information on annual catch levels, as well as research activities and management measures.

The Management Committee **recommended** that Canada and Russia be invited to provide NAMMCO with similar information on catch levels and management strategies with respect to shared stocks of marine mammals.

ii) By-catches of marine mammals

The Management Committee noted the duties of States under article 61.4 of UNCLOS in respect of by-catches and **agreed** to establish a Working Group to consider how this matter could be addressed at its next meeting.

10. ADOPTION OF REPORT

A draft report of the Management Committee was reviewed and adopted on 30 May 1997 and finalised by correspondence in June 1997.

11. LIST OF DOCUMENTS

Management Committee:

NAMMCO/7/MC/2	Agenda
NAMMCO/7/MC/3	Report of the Fifth Meeting of the Working Group on Inspection and Observation (Copenhagen, November 1996) including as Appendix 3 the Guidelines to Section B - International Observation Scheme - of the Joint NAMMCO Control Scheme.
NAMMCO/7/MC/4	Rules of Procedure for the Management Committee

Council:

NAMMCO/7/6	Report of the Scientific Committee

REFERENCES

NAMMCO Annual Report 1996. North Atlantic Marine Mammal Commission, Tromsø, 1997 227pp.

Appendix 1

AGENDA

1. Chairman's opening remarks
2. Adoption of agenda
3. Appointment of rapporteur
4. Matters arising from the Scientific Committee
5. Proposals for conservation and management
   - 5.1 Earlier proposals

5.1 New proposals
6. Recommendations for scientific research
   6.1 Recommendations from the Scientific Committee
   6.2 Other recommendations
   6.3 Establishment of drafting group for scientific recommendations
7. Implementation of the Joint NAMMCO Control Scheme
8. Rules of Procedure for the Management Committee
9. Any other business
10. Adoption of report

Appendix 2

LIST OF PROPOSALS FOR CONSERVATION AND MANAGEMENT

(Up to and including NAMMCO/7 - 1997)

Northern bottlenose whales

The Management Committee discussed the advice of the Scientific Committee on the status of the northern bottlenose whale and noted that this was the first conclusive analysis on which management of the northern bottlenose whale could be based.

The Management Committee accepted that the population trajectories indicated that the traditional coastal drive hunt in the Faroe Islands did not have any noticeable effect on the stock and that removals of fewer than 300 whales a year were not likely to lead to a decline in the stock (*NAMMCO Annual Report 1995*: 48)

Atlantic walruses

The Management Committee examined the advice of the Scientific Committee on Atlantic Walrus and noted the apparent decline which the Scientific Committee identified in respect to "functional" stocks of walrus of Central West Greenland and Baffin Bay.

While recognizing the over all priority of further work to clarify and confirm the delineation and abundance of walrus stocks in the North Atlantic area, the Management Committee recommends that Greenland take appropriate steps to arrest the decline of walrus along its west coast.

Taking into account the views of the Scientific Committee that the Baffin Bay walrus stock is jointly shared with Canada and that the West Greenland stock might be shared, the Management Committee encourages Canada to consider working cooperatively with Greenland to assist in the achievement of these objectives (*NAMMCO Annual Report 1995*: 49).

Ringed seals

The Management Committee noted the conclusions of the Scientific Committee on the assessment of ringed seals in the North Atlantic, which had been carried out through the Scientific Committee Working Group on Ringed Seals. In particular, the Management Committee noted that three geographical areas had been identified for assessing the status of ringed seals, and that abundance estimates were only available for Area 1 (defined by Baffin Bay, Davis Strait, eastern Hudson Strait, Labrador Sea, Lancaster, Jones and Smith sounds - see *NAMMCO Annual Report 1996*:149 (Fig.1)).

While recognising the necessity for further monitoring of ringed seal removals in Area 1, the Management Committee endorsed the Scientific Committee=s conclusions that

present removals of ringed seals in Area 1 can be considered sustainable (*NAMMCO Annual Report 1996*: 81).

Harp seals in the Northwest Atlantic

The Management Committee noted that a new abundance estimate for Northwest Atlantic harps seals of 4.8 million was available, based on a pup production estimate for 1994 of 702,900. The Management Committee also noted the conclusion that the Northwest Atlantic population of harp seals has been growing at a rate of 5% per year since 1990, and that the 1996 population was estimated to be 5.1 million, with a calculated replacement yield of 287,000.

The Management Committee concluded that catch levels of harp seals in Greenland and Canada from 1990 to 1995 were well below the calculated replacement yields in this period (*NAMMCO Annual Report 1996*: 81).

Hooded seals in the Northwest Atlantic

Noting the Scientific Committee=s review of available analyses of hooded seal pup production, which recognised that calculations are dependent on the particular rate of pup mortality used, as well as the harvest regimes, the Management Committee concluded that present catches of hooded seals in the Northwest Atlantic (1990-1995) were below the estimated replacement yields of 22,900 calculated for a harvest of pups only, and 11,800 calculated for a harvest of 1-year and older animals only (*NAMMCO Annual Report 1996*: 81-82).

Long-finned pilot whales

The Faroe Islands informed the Management Committee of their wish to continue to utilise pilot whales in an opportunistic manner as has been done for centuries. Catches of pilot whales may vary from year to year and total allowable catches are not considered appropriate for this form of hunt. In some years catches may exceed 2,000 whales, and in other years they may be much smaller, while the average annual catch since 1971 (1971-96) has been c. 1,400.

The Management Committee noted the findings and conclusions of the Scientific Committee, through its review of the ICES Study Group Report and the analysis of data from NASS-95 with respect to the status of long-finned pilot whales in the North Atlantic (Section 3.1, item 3.1), which also confirmed that the best available abundance estimate of pilot whales in the Central and Northeast Atlantic is 778,000. With respect to stock identity it was noted that there is more than one stock throughout the entire North Atlantic, while the two extreme hypotheses of i) a single stock across the entire North Atlantic stock, and ii) a discrete, localised stock restricted to Faroese waters, had been ruled out.

The Management Committee further noted the conclusions of the Scientific Committee that the effects of the drive hunt of pilot whales in the Faroe Islands have had a negligible effect on the population, and that an annual catch of 2,000 individuals in the eastern Atlantic corresponds to an exploitation rate of 0.26%.

Based on the comprehensive advice which had now been provided by the Scientific Committee to requests forwarded from the Council, the Management Committee concluded that the drive hunt of pilot whales in the Faroe Islands is sustainable (Section 2.1, item 5.2, this volume).

REFERENCES

NAMMCO Annual Report 1995. North Atlantic Marine Mammal Commission, Tromsø. 186pp.

NAMMCO Annual Report 1996. North Atlantic Marine Mammal Commission, Tromsø. 227pp.

NAMMCO/7/6. Scientific Committee. Report of the Fifth Meeting. Tromsø, 10-14 March 1997 (Section 3.1, this volume).

2.2
GUIDELINES TO THE INTERNATIONAL OBSERVATION SCHEME OF THE JOINT NAMMCO CONTROL SCHEME FOR THE HUNTING OF MARINE MAMMALS

(As adopted by the Management Committee in February 1997)

AD B.2.6 - DUTIES AND TASKS OF THE OBSERVER

1. According to article B.2.1 of the Joint NAMMCO Control Scheme, the observer is responsible for the observation of marine mammal hunting activities in NAMMCO member countries. The observer shall control whether these activities are carried out in accordance with decisions made by NAMMCO and relevant national regulations.

Control objects[1]

2. In connection with observation of whale hunting with harpoon guns in which the catch is taken to land and flensed/processed at a permanent installation, the observation shall, if it has not been carried out on board, take place at the flensing site. To the extent that such are required by regulation, the following shall, where possible, also be observed:

i) Hunting permit [2]

ii) Vessels= logbook

iii) Whaling logbook/report of catch (cf. Control Scheme, art. A.2.1 & art. A.3.1). The observer checks whether it has been kept correctly. In connection with controlling the number of whales on board in relation to the records of the logbook in off-coast whaling operations, where the products are stowed on ice or frozen on board, the observer shall only be concerned with those products which are kept separately according to the provisions set out in the Control Scheme, art. A.3.1, cf. art. A.2.5. The entire catch is controlled according to point 4 of these guidelines.[3]

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[1] Observation activities can be carried out in four areas: 1) observation of whaling carried out with the use of a harpoon gun or of flensing of whales taken with a harpoon gun; 2) observation of sealing or forms of whaling other than with harpoon guns, or the flensing of animals from such hunting; 3) observation of the landing/delivery of marine mammal catches; and 4) observation of national marine mammal inspection activities.

[2] The term Ahunting permit≅ refers to the permit which in some countries is issued as proof of the vessel=s authorization for hunting. The term also includes any licences and certificates of training required to hunt marine mammals.

[3] According to article A.2.5 of the Control Scheme, meat from individual whales shall be kept separate for at least six hours after the catch has been reported. When individual animals are no longer stored separately, observation is not relevant, as the number of whales caught can no longer be accurately determined. Control of catches chilled and stowed on

iv) Hunting equipment and its use [4]
v) Hunting procedures
vi) Killing methods

3. In connection with observation of hunting or flensing of whales and seals not covered by point 2 of these guidelines, the observer shall, to the extent that such are required by regulation, control the following [5] :

i) Hunting permit

ii) Whaling logbook/report of catch

iii) Hunting equipment and its use

iv) Hunting procedures

v) Killing methods

4. If the observation cannot be carried out during hunting or flensing, it may be done in connection with the delivery of catch, which is understood to be the physical and legal transfer to a third party. In this connection the items mentioned under 2 and 3 above, as well as documents necessary for the sale and production of the catch, can be controlled.[6]
5. In cases where a national inspector is also present during hunting activities, the observer shall report whether the national inspection is carried out in accordance with existing regulations.

Reports [7]

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board, will occur upon landing (as described in point 4 of these guidelines).

[4] The term Ahunting equipment≅ covers all equipment that is directly connected to the hunting or the flensing process.

[5] This point refers to all other forms of marine mammal hunting besides whaling with harpoon guns, such as the hunting of pilot whales and other small whale species, and all forms of sealing, whether opportunistic near-coast hunting or Norwegian sealing in the West and East Ice.

[6] Observation should take place at one or more of the following stages: 1) On board the hunting vessel; 2) in connection with flensing, whether this takes place at a permanent flensing place or elsewhere; 3) in connection with delivery of the catch (both in physical and legal terms). Once the catch is delivered, the observer will be precluded from further control. By both physical and legal delivery of the catch is meant that observation can take place as long as it is practically possible, and even if, for example, the catch has been sold while still on a vessel. Once the catch is sold and delivered to the buyer, observation shall no longer take place.

[7] It is at all times the responsibility of the authorities in the observed country to assess and act on any reports of infringements. In cases where regulations are broken by

6. No later than one month after the end of the employment period the observer must submit a report on activities (cf. the Control Scheme art B.2.4). The report shall be sent to the NAMMCO Secretariat (hereafter called Athe Secretariat≅) on a NAMMCO observer report form. The language of the report shall be either English or a Scandinavian language.

7. In case of infringements of regulations, the observer shall send a written report on the specified form as soon as possible to the Secretariat, with a copy to relevant authorities in the flag state and to the owner of the vessel (cf. the Control Scheme art. B.2.3). The report shall contain all relevant information regarding the nature of the infringement, including date, position at the time of violation, which regulations have been violated, and how the infringement occurred. The captain, the licence holder and the national inspector shall have the opportunity of making their own remarks to the report.

8. In cases where a national inspector is not present, and where an infringement involves the catch of a protected species/stock, the exceeding of a quota, hunting in restricted areas, hunting without a license where such is a requirement for hunting, or the use of unauthorized equipment, the observer shall at once inform the control authorities of the flag state through the Secretariat.

General conduct of observers

9. During the exercise of their duties, observers shall conduct themselves with appropriate tact and respect. Upon arrival at a vessel, a landing/receiving station or other place where observation duties are carried out, the observer shall always display his/her authorization and identification card to the person in charge.

Confidentiality

10. Observers shall ensure the confidentiality of their duties and shall not report on observations carried out under the NAMMCO Control Scheme to any other parties than the Secretariat or those institutions determined by the Secretariat (see also point 6-8 of these guidelines).

AD B.3.1 - APPOINTMENT OF OBSERVERS

11. Member countries develop a list of candidates for the following year and send it to the Secretariat by 15 November. The list shall include information on the qualifications of the candidates. The Secretariat circulates a combined list of suggested candidates to member countries for approval. In the event that a member country wishes to make a

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accident and where the infringement is reported correctly and at once, there will in general be no basis for the observer to prepare a specific report on the occurrence, although reference should be made to it in the general observation report.

reservation to any candidate, this must be done before 15 December.[8] The Secretariat then circulates the list of candidates approved by all member countries to the Management Committee for appointment.

AD B.4.1 - COMPETENCE, TRAINING ETC. OF OBSERVERS

12. The requirements for the professional and linguistic qualifications of the observers are set out in the Control Scheme, articles B.4.2 & B.4.3. If, due to special circumstances, a member country wishes to make use of the exemption clause under article B.4.2, priority shall nevertheless be given to the following qualifications: experience with similar inspection activities**,** hunting experience, administration of hunting and biological studies, with an emphasis on the killing of animals and/or management. [9]

13. In order to ensure that the persons appointed as observers are sufficiently informed about the relevant hunting regulations and the duties of national inspectors, observers shall participate in whatever annual training courses are compulsory for inspectors in the flag state. If such courses are not held, or if the observer is unable for other reasons to participate in such courses, the observer must receive other relevant training, developed in cooperation between the authorities of the flag state and the Secretariat.

AD B.5.2 - ADMINISTRATION OF INTERNATIONAL OBSERVATION SCHEME

Plans for observation and activities

14. By October each year the Secretariat develops a proposal for the Management Committee for the scope and range of observation activities during the following year in accordance with budgeted funds for these activities. The Management Committee shall approve this proposal and appoint the observers by 1 January. The Secretariat, in cooperation with control authorities in respective member countries, then develops a specific plan for observation activities. The plan shall, among other things, define the time frame for observation activities and shall specify the observation areas for each observer. The Secretariat may for practical reasons, and in cooperation with the authorities of the relevant member countries, make changes in the plan if necessary. The detailed plan of observation activities shall only be known to the control authorities in the relevant member countries and the Secretariat.

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[8] It is understood that a reservation to the appointment of a particular candidate is a reservation to his/her appointment as a NAMMCO observer in any area of activity.

[9] As the duties of national inspectors vary from member country to member country due to the differences in the activities which they control, it is expected that the exemption clause in Control Scheme art. B.4.2 will be applied to some extent. The notes to the Control Scheme outline which areas of competence are considered most important in relation to the application of art. B.4.2. To this has also been added biological studies, with an emphasis on the killing of animals and/or management.

Appointment of observers

15. Appointed observers will receive an employment contract from the Secretariat. When this is signed by both parties, the observer will receive a letter of appointment, and an authorization/identification card, as well as other relevant documentation necessary for his/her duties as observer, such as copies of the Provisions and Guidelines to the Control Scheme and the relevant reporting forms.

2.3
RULES OF PROCEDURE FOR THE MANAGEMENT COMMITTEE

(As revised by the Council at its Seventh Meeting,
Tórshavn, Faroe Islands, 28 May 1997)

I Representation

1. Each member of the Committee shall be represented by not more than three representatives who may be accompanied by experts and advisers.

II Taking of Decisions

2. Each member of the Committee shall have one vote.

3. Decisions of the Committee shall be taken by the unanimous vote of those members present and casting an affirmative vote.

4. Between meetings of the Committee and in case of special necessity to be determined by the Chairman, votes may be taken by mail or by other means of textual communication. The Secretary shall immediately notify the members of the Committee of the results of such votes.

III Chairman and Vice-Chairman

5. The Committee shall elect from among its members a Chairman and a Vice-Chairman, each of whom shall serve for a term of two years and shall be eligible for re-election provided that they do not serve for more than four years in succession in each office. The Chairman and Vice-Chairman shall not be representatives of the same Party.

6. The Chairman and Vice-Chairman shall take office at the conclusion of the meeting at which they have been elected.

7. The Chairman shall have the following powers and responsibilities:

a) to preside at each meeting of the Committee;
b) to sign, on behalf of the Committee, the reports of each meeting of the Committee; and
c) to exercise other powers and responsibilities as provided in these Rules and make such decisions and give such directions to the Secretary as will ensure that the business of the Committee is carried out effectively and in accordance with its decisions.

8. Whenever the Chairman is unable to act, the Vice-Chairman shall assume the powers and responsibilities of the Chairman.

IV Preparation for Meetings

9 a) The Secretary shall prepare, in consultation with the Chairman, a provisional agenda for each meeting of the Committee and transmit it to all members of the Committee no later than 45 days before the meeting.

b) Any member of the Committee may propose supplementary items by informing the Secretary thereof no later than 30 days before the meeting.
c) The Secretary shall prepare the draft agenda for the meeting, including the supplementary items, and transmit it to all members of the Committee no later than 15 days before the meeting along with related explanatory memoranda or reports.

10. The Secretary shall make all necessary arrangements for meetings of the Committee.

V Observers

11. The Committee may decide to invite observers to participate in its meetings and may establish the terms and conditions for that participation.

VI Reports

12. A report of each meeting of the Committee shall be prepared by the Secretary as required by the Committee and shall include any regulatory measures proposed by it, all decisions and recommendations adopted by it and references to all scientific information used or presented at the meeting. A draft report shall be considered by the Committee before the end of the meeting. The Secretary shall transmit the final report to all members of the Council as soon as possible after the meeting.

SECTION 3 – SCIENTIFIC COMMITTEE

3.1
REPORT OF THE SCIENTIFIC COMMITTEE

The Scientific Committee of NAMMCO met in the Grand Nordic Hotel, Tromsø, Norway from 10 to 15 March 1997. The meeting was attended by members of the Scientific Committee and scientific observers from Japan and Norway, as well as a number of invited experts to Scientific Committee Working Groups. A full list of participants is contained in Appendix 1.

1.-3. OPENING PROCEDURES

The Chairman, Tore Haug, welcomed members and observers to Tromsø and to the meeting. On behalf of the Committee, he welcomed in particular the two new members of the Committee, Pia Barner Neve for Greenland, and Lars Folkow, who replaced Arne Bjørge as member for Norway in 1996. For the benefit of new participants, the Chairman requested introductions all round.

The Chairman referred to both recent and outstanding requests for advice forwarded from the Council which formed the agenda for the present meeting. He noted that the Committee had most recently been assigned the important tasks of focusing on more specific items related to the role of marine mammals in the ecosystem. These included an examination of the food consumption of three major marine mammal predators in the North Atlantic, as well as a review of the current state of knowledge of sealworm infestation in fish. The Committee had agreed through correspondence prior to the meeting to establish *ad hoc* Working Groups under the chairmanship of Gísli Víkingsson (Iceland) for food consumption of minke whales, harp seals and hooded seals, and Geneviève Desportes (Faroes) for sealworm infestation, to deal with these questions (see under item 7 below). He further welcomed the participation of a broad range of external expertise represented by scientists from Canada, Denmark, Iceland, Norway and the UK who would be contributing to the work of the Working Groups.

The Chairman further noted that the Committee would also be dealing with the report of the Working Group on Abundance Estimates, which had only recently completed the task assigned to it to review the results of NASS-95 and provide updated abundance estimates for whale stocks in the North Atlantic. A further request for an assessment of the status of the Central Atlantic minke whale stock had been added to the agenda just prior to the meeting, and the Committee would also use this meeting to discuss how best to deal with this matter.

The Agenda, as contained in Appendix 2, was adopted and the Secretary, Kate Sanderson, was appointed as rapporteur.

The Secretary informed the Committee of the practical and social arrangements for the meeting, which included a Chairman=s dinner on the Tuesday evening, which was sponsored by the following Norwegian institutions and organisations: the University of

Tromsø, the Norwegian Institute for Fisheries and Aquaculture, the Norwegian Ministry of Fisheries, Råfisklaget, the Shipowners= Association of Northern Norway and Tromsø City Council.

4. REVIEW OF AVAILABLE DOCUMENTS

4.1 National Progress Reports

National Progress Reports for 1996 from the Faroes, Iceland and Norway, and for 1995 from Greenland (SC/5/NPR - F,G,I & N) were submitted to the Committee. These are contained in Section 4 of this volume.

Dorete Bloch, member of the Committee for the Faroes, had pointed in correspondence to the usefulness of including strandings and sightings data in National Progress Reports (SC/5/14). The Committee noted that while such data was not required according to the adopted Guidelines for the Content and Format of National Progress Reports (see *NAMMCO Annual Report 1996*, p.134), the extent of systematic recording of such data varied from country to country. It was further noted that in the Faroes and Iceland, incidental strandings and opportunistic sightings data were collected to a greater extent than was possible in Greenland and Norway, and that such data had already been included in National Progress Reports submitted to the Scientific Committee in previous years. It was decided that the inclusion of such data should be left up to the discretion of those responsible for compiling the respective National Progress Reports to NAMMCO.

4.2 Working Group reports & other documents

Working Group and other reports available to (and during) the meeting are listed in Appendix 3.

5. COOPERATION WITH OTHER ORGANISATIONS

5.1 ICES

The Chairman noted that ICES had now provided its final advice to NAMMCO on the request for an assessment of the long-finned pilot whale, forwarded to ICES from the Council in 1992 (see *NAMMCO Annual Report 1996*: 132). This was based on the work of the ICES Study Group on Pilot Whales, which had met for the third and final time to complete its work in Cambridge, UK in April 1996 (see under item 8.1).

The Secretary informed the Committee that negotiations were under way with ICES to develop a memorandum of understanding between NAMMCO and ICES. It had been suggested by NAMMCO that this should be a general agreement on cooperation and exchange of information, and further discussions on the issue were expected in the near future.

5.4 ASCOBANS

The Council of NAMMCO has an agreement with ASCOBANS to exchange observers at a Council level, and reports are regularly exchanged between Secretariats.The Secretariat had recently received the report of the last meeting of the ASCOBANS

Advisory Committee, at which Arne Bjørge (former Committee member for Norway) had reported on the 1996 meeting of the NAMMCO Scientific Committee. It was noted in this connection that the Scientific Committee has no arrangement with ASCOBANS for an exchange of observers on a scientific level (see also 5.8).

5.5 Canada/Greenland Joint Commission on the Conservation and Management of Narwhal & Beluga

The Secretary informed the Committee that reports were now being exchanged on a regular basis with the Canada/Greenland Joint Commission on the Conservation and Management of Narwhal and Beluga. The report of the December 1995 meeting of the Commission and the June 1995 meeting of the Scientific Working Group were now available. The next meeting of the Scientific Working Group was expected to take place in the summer of 1997, once data from a recent beluga survey were complete, and the Commission was likely to meet again in late 1997.

5.6 Arctic Monitoring & Assessment Programme (AMAP)

With reference to last year=s recommendation from the Committee for NAMMCO to exchange information with organisations which are assessing the status of the Arctic environment, the Secretary informed the Committee that information was exchanged regularly with the Secretariat of the Arctic Monitoring and Assessment Programme (AMAP) in Oslo. The final AMAP assessment report on contaminants in the Arctic would be the focal point of the AMAP International Symposium on Environmental Pollution of the Arctic & Third International Conference on Environmental Radioactivity in the Arctic, to be held in Tromsø, 1-5 June 1997. Copies of a preliminary programme for the Conference were available at the Committee meeting. The Secretariat planned to follow proceedings in Tromsø in June, and would endeavour to obtain copies of the final AMAP assessment report for distribution to Committee members.

5.7 International Union for the Conservation of Nature (IUCN)

Referring to information provided to the Committee at last year=s meeting concerning the establishment of working relations with the IUCN through its Species Survival Commission (SSC) Cetacean and Seal Specialist groups, the Secretary informed the Committee of her discussions with members of the SSC Secretariat during the IUCN World Conservation Congress in Montreal in October 1996. These contacts would be pursued in the near future, and further information exchanged with IUCN.

The Committee discussed briefly the new IUCN Red List of Threatened Animals, which is a global status of species defined under three main categories of Critically Endangered, Endangered and Threatened, based on a set of revised criteria which were adopted at the 1994 General Assembly of IUCN (Baillie and Groomsbridge, 1995). The Committee noted with concern the inappropriateness of producing status assessments on a global/species basis rather than on a stock basis.

5.8 Other matters - Observers

The Committee discussed the question of admission of observers to its meeting, noting that the Rules of Procedure for the Committee state that observers shall not be permitted at meetings of the Scientific Committee unless otherwise decided by the majority of the Committee and approved by the Council. It was, however, noted that despite this restrictive rule, observers had attended Committee meetings previously and two observers were present at this meeting, whose attendance had been cleared by the Committee prior to the meeting.

The Committee agreed that prospective observers at its meetings should submit a request in writing to the Secretariat stating their affiliations and reasons for wishing to attend, in order to provide Committee members with a proper basis on which to decide on their admission.

A question was also raised concerning the role of observers at Scientific Committee meetings, as this was not made explicit in the Rules of Procedure. It was agreed that observers could be invited to make comments and contribute to the discussions.

6. UPDATE OF LIST OF PRIORITY SPECIES

As agreed at the last meeting of the Scientific Committee, a draft update of the List of Priority Species had been prepared for the meeting, which incorporated new data on species and stocks provided by various members of the Committee and compiled by the Secretariat.

Further development of the List was discussed by the Committee under Agenda item 10 in relation to the Council=s request to the Scientific Committee to monitor stock levels and trends in stocks of all marine mammals in the North Atlantic.

The Scientific Committee **agreed** that the List of Priority Species should be replaced by a new document - Status of Marine Mammals in the North Atlantic - covering all marine mammal species, and that agenda items 6 and 10 should in future be merged (see further under item 10).

7. ROLE OF MARINE MAMMALS IN THE MARINE ECOSYSTEM

7.1 Food consumption of minke whales, harp seals and hooded seals in the North Atlantic and interactions with fish stocks

The Chairman referred to the request from the Council to the Scientific Committee

A to focus its attention on the food consumption of three predators in the North Atlantic: the minke whale, the harp seal and the hooded seal, with a particular emphasis on the study of the potential implications for commercially important fish stocks≅ (*NAMMCO Annual Report 1996*:28)

A Working Group on the Role of Minke Whales, Harp Seals and Hooded Seals in North Atlantic Ecosystems (SC/5/ME) was established under the chairmanship of Gísli Víkingsson (Iceland). The Working Group convened from 10-14 March, with the

participation of, and contributions by members of the Committee and a number of invited experts from Canada, Iceland, Norway and Russia. Víkingsson presented the report of the Working Group to the Committee, which was circulated as SC/5/9. The final report of the Working Group is contained in Section 3.2 of this publication.

7.1.1. Feeding ecology

Minke whales

The Committee noted that, except for the Northeast Atlantic, the diet composition of minke whales has been rather poorly documented in recent years.

Studies on the diet composition of minke whales off northern Norway, in the Barents Sea, and around Spitsbergen have shown large year-to-year variations. Recent studies, based on years with low capelin abundance (1992-1995), have identified herring and krill as the most important food items, followed by cod and various other fish species. In this area minke whales are estimated to consume 1.8 million tons of prey during the period April-October. Of this estimate 633,000 tons were herring, corresponding to about 70% of the total 1995 fishery for that species.

From the little available information, minke whales in Icelandic waters appear to feed on fish and krill in roughly equal amounts. The identified fish species were capelin, sand eel and cod. The total consumption of the species in this area, (based on abundance estimates from the 1987-1989 surveys) was estimated as 391,000 tons, of which 198,000 tons were fish.

In Greenland waters capelin is the most important food species for minke whales. Among other identified prey species were Atlantic cod, polar cod, Greenland cod, herring, sand eel and crustaceans.

In the Northwest Atlantic off Canada, capelin appears to be the dominant prey species of minke whales, while other identified food items include squid, salmon, herring, cod and crustaceans. A preliminary estimate indicates that the consumption of minke whales in Canadian waters is relatively low compared to that of harp seals, although it may be larger than the consumption of hooded, grey or harbour seals in the area.

Harp seals

Diet composition of harp seals in the Barents Sea varies substantially between areas and time periods. In general the most important prey groups are crustaceans, capelin, polar cod and herring. The total consumption of the Barents Sea harp seal stock was estimated as 1.1-1.7 million tons depending on the choice of input parameters in the model. Assuming a variable basal metabolic rate (BMR) throughout the year and a field metabolic rate of 2*BMR the estimated annual consumption by harp seals is 428,200 tons of crustaceans, 258,200 tons capelin (in years of high capelin abundance), 212,500 tons polar cod, 69,600 tons herring and 32,200 tons cod. In years of low capelin abundance capelin consumption seemed to be replaced by other fish species, notably polar cod.

Most of the examined harp seals from the Greenland Sea pack ice during spring and early summer had empty stomachs but analysis of the intestines revealed *Themisto sp*. as the major food item. The main prey species identified in harp seals collected during February-May in coastal North Icelandic waters were sand eels, cod fishes and capelin.

The food composition of harp seals in West Greenland waters is variable, with pelagic crustaceans, capelin and polar cod as the most important prey types. Although commercially important fish species are a small part of the diet, the total consumption of these may be of the same order of magnitude as the commercial fishery in the region.

Harp seals are considered the most important pinniped predators in Atlantic Canadian waters. In the northern Gulf of Maine and NAFO areas 2J3KL they were estimated to have consumed over 150,000 tons of Atlantic cod, 1.1 million tons of capelin, 600,000 tons of polar cod, 130,000 tons of Greenland halibut, 107,000 tons of redfish and 104,000 tons of herring in 1996. The greatest source of uncertainty in the estimates of consumption by harp seals in the Northwest Atlantic is related to limited information on seasonal distribution of the species and potential spatial and temporal variations in the diet.

Hooded seals

The diet composition of hooded seals is not generally as well known as that of harp seals.

The majority of hooded seals sampled in the Greenland Sea pack ice during spring and early summer had empty stomachs, but the major food item found in the intestines was the squid *Gonatus fabricii*. Redfish, cod and other fish species were the main prey species identified in a small number of hooded seals investigated off northern Iceland.

In Greenland waters, larger demersal fish species like Greenland halibut, redfish, cod and wolffish are apparently important prey items for hooded seals, in addition to the species also taken by harp seals in the area.

In Atlantic Canada hooded seals were estimated to consume 129,000 tons of Greenland halibut, 36,000 tons of Atlantic cod and 19,000 tons of redfish in 1996.

……

The Scientific Committee noted that a number of uncertainties were identified in relation to the estimates of consumption in the different species/areas and it was stressed that these estimates should therefore be used with caution.

7.1.2. Interactions between marine mammals (minke whales, harp and hooded seals) and commercially important fish stocks - multispecies modelling

A multispecies model for the Barents Sea (MULTSPEC) describes the interactions between minke whales, harp seals, herring, capelin and cod in the Barents Sea. The main effects identified were:

- The herring stock increased as predation from marine mammals decreased;
- The development of the capelin stock was mainly determined by changes in the herring and cod stocks;
- Generally, the cod stock increased or decreased when marine mammal stocks decreased or increased;
- Decreasing the preference for herring by cod had much larger effects than changing some of the marine mammal preferences.

It was noted that the model might be improved by including polar cod and taking account of seasonal variation in prey preferences.

Another model investigated the effect on fish stocks of tuning the Revised Management Procedure (RMP) for minke whales in the Barents and Norwegian Seas from the current level of 72% of k (carrying capacity) to 60% k. Assuming an abundance of 100,000 minke whales and a Maximum Sustainable Yield Rate (MSYR) of between 1% and 2%, the main effect of changing the RMP target from 72% to 60% was an increase of some 14% in the cod catches.

Investigations on interactions between three whale species, two seal species and two fish species in Icelandic waters indicate that natural morality of cod from marine mammal predation is twice that which is due to cannibalism and thus may be a major portion of natural mortality in the younger age classes.

The Scientific Committee noted the conclusions of the Report of the Workshop on Harp Seal-Fishery Interactions in the Northwest Atlantic: Toward Research & Management Actions (St. John=s, Newfoundland, 24-27 February 1997), which became available during the meeting and was reviewed by the Working Group (SC/5/13; Section 3.2 item 5.4).

The Scientific Committee noted that the effects of marine mammals are at present not included in models routinely used in multispecies management. A number of potential uses of multispecies models were identified, as well as the most important gaps in knowledge and data requirements for the modelling work (see Section 3.2, item 5.5).

7.1.3 Recommendations for future work

Based on results of studies reviewed by the Working Group, the Scientific Committee concluded that minke whales, harp and hooded seals may have substantial direct and/or indirect effects on commercial fish stocks. To better understand these effects, the Scientific Committee **recommended** the following:

1) For each species, knowledge should be improved of seasonal, annual and spatial variations in: abundance; distribution; diet; energy requirements; and prey abundance. Knowledge of each of these factors varies between areas and species. The extent of existing knowledge in these areas was noted by the Working Group in its report (Section 3.2), and should be considered when developing specific research plans.

2) Understanding of prey selectivity and responses to changes in prey abundance by these predators should be improved. Little is known about these processes at the present time.

3) Estimates of consumption by other important predators should be obtained and the degree of potential competition assessed.

4) Multispecies models should be improved by:

- incorporating uncertainty in the parameters (e.g. stock estimates, food preferences, migration) to provide a realistic estimate of the total uncertainty;
- incorporating variations in migration and prey selection. An understanding of these processes is important, but they are not understood at present;
- constructing models on the appropriate spatial and temporal scale for the various components.

5) Efforts to construct multispecies models in the Northwest Atlantic should be encouraged.

In conclusion, the Scientific Committee **recommended** that relevant scientific papers reflecting the present state of knowledge of the role of marine mammal predators in North Atlantic ecosystems, as reviewed by the Scientific Committee, should be published as a volume in the NAMMCO scientific publication series. The Chairman of the Working Group, Gísli Víkingsson, agreed to take on the task of editing such a volume, and would seek the assistance of an appropriate co-editor.

7.2 Sealworm infection

The Chairman referred to the Council=s request to the Scientific Committee -

A to review the current state of knowledge with respect to sealworm infestation and to consider the need for comparative studies in the western, central and eastern North Atlantic coastal areas, taking into account the priority topics recommended by the Scientific Committee and its *ad hoc* Working Group on grey seals (*NAMMCO Annual Report 1996*: 28; 111-116).

To address this request, a Working Group on Sealworm Infection (SC/5/SI) was established under the chairmanship of Geneviève Desportes (Faroes). The Working Group convened from 10-14 March, and was attended by a number of scientific experts from Canada, Iceland, Norway and the UK who had been invited to contribute working papers to the Working Group=s review of sealworm infection in the North Atlantic. Desportes presented the report of the Working Group to the Committee, which was circulated as SC/5/10. The final report of the Working Group is contained in Section 3.3 of this volume.

7.2.1 Review of the current state of knowledge

It was noted that as basis for its review, the Working Group took as its starting point the proceedings of an earlier sealworm workshop (Bowen 1990) and agreed to emphasise those areas where further progress had been made since this workshop.

i) Life cycle

As the number of species investigated increases, so too does the number of possible intermediate sealworm hosts, both invertebrate and fish.

New information on naturally infected small benthophagous fish species shows that the density of infection in these can be very high. This indicates the magnitude of the long-lived sealworm reservoir in the environment.

In seals, individual worm fecundity increases with worm length, and there was so far no evidence of a reduction in worm fecundity with total or individual species worm burden. Experimental egg hatching rates are greater than 90%.

ii) Environmental factors influencing the life cycle

Sealworm eggs do not hatch in water temperatures below 0EC. This may explain a decline in sealworm infection observed in grey seals, cod and plaice, following a period of cold waters in the Gulf of St Lawrence after 1990, and on the Breton and Scotians shelves and in the Gulf of Maine. However it was noted that temperature could only affect the level of sealworm infection at the northern edge of the distribution range.

Sealworm infections are prevalent on the continental shelf but are not found in deeper water systems, such as beyond the shelf edge and in some Norwegian fjords.

The species composition of invertebrate and small fish communities varies substantially with substrate type, and causes extensive local variability in infection levels.

iii) Behavioural factors influencing the life cycle

Both in invertebrates and fish, infected hosts have been shown in some systems to be more susceptible to predation than non-infected ones. This will influence the transmission rate between hosts. Persistent differences in individual foraging behaviour in seals have been shown to influence greatly the level of infection in individual seals and may explain some of the variability of sealworm abundance in seals.

iv) Influence of seal abundance on the level of infection in fish

Based on the findings of the Working Group, the Scientific Committee concluded that:

1) The presence of either grey seals or harbour seals can lead to sealworm infections in fish over the entire North Atlantic region. Reduction of either species may not therefore result in a significant reduction in sealworm infections in fish;

2) Although harbour seals are less abundant than grey seals in many areas, they could be responsible for high local infections in fish because of their limited foraging range;

3) At least in the short and medium term, sealworm infection levels in intermediate hosts are not necessarily directly correlated with seal abundance. They may be mitigated by other factors such as environmental temperature and intermediate host abundance and distribution;

4) Individual worm levels in seals vary to such an extent that a few seals could still maintain high infection levels in fish.

7.2.2 Need for comparative studies

In order to test the universality of sealworm models, there is a need not so much for purely comparative studies, but for comparable datasets in the western, central and eastern North Atlantic coastal areas. This can only be achieved through the development of long-term databases on sealworm infections for systems in the Northeast and Central Atlantic, and the development of comparable datasets for inshore systems from the Northwest Atlantic.

There is also a need to categorize habitat types (substrate, vegetation, invertebrate and fish communities) in order to compare infection rates between seal and fish populations.

7.2.3 Future work

i) Considering the incompleteness of information in some specific areas of the sealworm life cycle and dynamics, the Scientific Committee **recommended** that research efforts on sealworm biology and dynamics be intensified both in the Northeast and Northwest Atlantic, in particular with regard to sealworm development and lifetime fecundity in the seal host, possible changes of behaviour in infected host which may increase the transmission rate between hosts, and the processing of existing samples for sealworm abundances in different fish and seal species.

ii) Considering that -

a) very strong relationships between sealworm abundance in fish and seal population size have been observed in the Northwest Atlantic but that they may be modified by environmental changes and modifications in seal fishery interactions;

b) historical data is available in Iceland on levels of sealworm infection in seals and cod;

c) the grey seal population in Iceland has been reduced from 14,000 to 8,000 between 1986 and 1995; and

d) a major survey of sealworm in Atlantic cod is under way in Iceland,

- the Scientific Committee **recommended** that an intensive survey of anisakid nematodes in grey seal stomachs in Iceland be undertaken at the same time as the Icelandic survey on sealworm in Atlantic cod.This represents a unique opportunity to examine the relationship between sealworm levels in fish and seals and a dramatic reduction in a grey seal population.

iii) Appreciating the considerable amount of new information collected both on the life cycle of the sealworm and the dynamics of sealworm infection, as well as on the population structure of the seal colonies, the Scientific Committee **recommended** that

a workshop be convened, in cooperation with other relevant organisations and institutions, to undertake modelling of sealworm infection, involving both modellers and those familiar with the various biological systems in the North Atlantic.

iv) The Scientific Committee **recommended** that the material presented to the Working Group on Sealworm Infection should form the basis of a publication on sealworm infection in the North Atlantic as a part of the NAMMCO series of scientific publications. Desportes agreed to function as main editor of the volume, in collaboration with an appropriate co-editor from the field.

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

8.1 Long-finned pilot whales

The Chairman referred to the request from the Council for an assessment of the state of the pilot whale stock in the Northeast Atlantic, based on information sampled from the Faroese drive fishery and the NASS sightings surveys (see *NAMMCO Annual Report 1996*: 132). This request had been forwarded to ICES, in response to which ICES had established a Study Group on Long-finned Pilot Whales. The report of final meeting of the Study Group in April 1996 in Cambridge, UK, under the chairmanship of D. Butterworth (South Africa) (SC/5/4 - ICES CM1996/A:6) was used by the Scientific Committee as the basis for its discussions under 8.1.1. below.

At its second meeting in 1993, the Council further requested the Scientific Committee to analyse the effects of the pilot whale drive hunt in the Faroe Islands on North Atlantic pilot whales, especially whether the numbers taken are consistent with sustainable utilization (*NAMMCO Annual Report 1996*: 132). This matter was addressed by the Committee under item 8.1.2 below, based on the findings of the ICES Study Group (SC/5/4) and the review of results of NASS-95 (see also under item 9).

8.1.1 Assessment of status of pilot whale stock in the Northeast Atlantic

With its basis in the Report of the ICES Study Group on Long-finned Pilot Whales, the Scientific Committee reviewed the major findings and research requirements related to the assessment of the status of long finned pilot whales in the North Atlantic.

i) Population identity and seasonal movements

Distributional evidence

It was noted that new information available on abundance of the species still does not fill the gap in effort in offshore waters south of Greenland, from the shelf break east to 42EW. It was further noted that it was unfortunate that the longitudinal coverage could not have been extended in the NASS-95 survey to provide comprehensive coverage of the range of the species. It was concluded that the distributional evidence had not allowed delineation of any stock boundaries and that the area south of Greenland should be surveyed to determine if the gap in sightings data represents an actual gap in distribution.

Genetic evidence

No new genetic information was available for the last meeting of the Study Group. However, it was noted that the Study Group had discussed current available information, and in particular the low reported variability on mtDNA. It was noted that the explanation forwarded to the Study Group by B. Amos (Cambridge University) that if pilot whales live in strong matrilineal schools, as is suspected, then the genetically effective population size is the number of genetically related groups of animals, and not the total population. The number of such related groups is not known, but may be relatively small, in the order of several thousand. This small effective population might thus be expected to have low mtDNA variability, as is observed.

Morphometric evidence

Further analyses of the morphometric information available at the 1993 meeting of the Study Group and new morphometric information available on pilot whales stranded at Cape Cod allowed for a confirmation of the earlier presumption that there are significant differences in morphology between pilot whales taken in the Faroe Islands and those from Cape Cod and Newfoundland. The Scientific Committee agreed that the simplest interpretation of this conclusion is that there is more than one population of long-finned pilot whales in the North Atlantic.

General conclusions

Based on all available information, the Scientific Committee **agreed** that of the three hypothesis formulated and examined at the 1993 meeting of the Study Group:

1) There is only one North Atlantic population of long-finned pilot whales;
2) There is more than one such population;
3) There is only one stock in the near vicinity of the Faroe Islands, which is restricted to these waters.

the first hypothesis could be ruled out by the morphological differences seen between the eastern and western North Atlantic animals. The third hypothesis could also be ruled out; i.e. that pilot whales around the Faroes do not form a discrete localized population. This conclusion was based on the high inter-annual variability in distribution patterns in the area around the Faroe Islands, confirmed by the data from the NASS-95 survey, and the variation in pollutant loads and parasite burdens between schools of pilot whales taken in the Faroese drive fishery.

ii) Social structure and behavioural factors

Difference in average group size between sightings surveys and the Faroese drive fishery

A preliminary attempt to determine spatial structure of pilot whale schools during the Faroese NASS-95 sightings survey indicated that estimates of the size of the schools tended to increase with closer inspection, and that schools were spread out over several kilometres. The Scientific Committee noted, however, that the total number of animals in the aggregations investigated were still less than the average size of schools landed in the Faroe Islands, and that further investigation of this matter was necessary.

Effect of harvesting whole groups of whales

The effects of harvesting whole groups of animals which were genetically related had been explored to a certain extent. The Scientific Committee noted, however, that there does not appear to be sufficient information available about the specifics of the social processes involved in pod formation and creation, and their ecological implications, to enable concerns about the influence of the processes on the ability of pilot whales to support harvesting mortality to be completely addressed.

iii) Estimates of abundance

Eastern North Atlantic

In the light of results from NASS-95, it was concluded that the coverage of the three surveys (NASS-87, -89 and -95) was not identical and thus yielded substantially different estimates of total population abundance. However, when abundance estimates for comparable areas in 1987 and 1989 were compared, no significant differences were evident. Some of the blocks showed a significantly lower density in 1995 compared with 1989, while other blocks showed a similar density in 1989 and 1995. Comparable blocks in the 1987 and 1995 surveys also showed similar estimates of abundance. It was therefore concluded that given the mobility of the species, the apparent between-year shifts in distribution and the relatively thorough and extensive coverage of NASS-89, the estimate of 778,000 derived from this joint survey was the most appropriate (see also under 9.4).

Western North Atlantic

Although some new information was available on a local basis, no synoptic view of distribution and abundance of pilot whales based on systematic sightings surveys is available for the western North Atlantic.

iv) Historical catch estimates, population dynamics parameters and population models

Population dynamics parameters

In the light of the Study Group discussion, the Scientific Committee agreed that since the difference between the age at first ovulation and the age at first parturition (even the lowest estimate) is greater than the estimated length of gestation, a range of values of age at first parturition (from 10 to 14 years) should be used in population model analyses, instead of the age at first ovulation plus gestation length.

New analyses indicated that the highest fertility rates occurred in 10 year-old animals and that fertility declined with age. Animals over 32 years old were classified as reproductively senile, even though there was evidence that they continued ovulation and were still lactating. The Scientific Committee accepted these results as the best available estimates of age-specific fertility rates.

Population modelling

A simple population model was used to investigate the implication of three sources of information on the pilot whale population in the eastern North Atlantic. These are

possible range of maximum growth rate for the species, recent estimates of abundance and historical series of catches.

A plausible upper bound for the annual growth rate was chosen as 5.7%. Since it may not be achieved in practice, computations were also carried out with maximum growth rates of 0%, 1.4%, 2.8% and 4.3%, corresponding to 25, 50 and 75% of this upper bound.

The NASS-89 surveys provided an estimate of 778,000 pilot whales in the eastern North Atlantic. Since it is not known whether the population which is effectively harvested corresponds to the surveyed population, three smaller areas from which the harvested population may be taken were also used in the computations.

The estimates of historical catches were used, assuming that the catches recorded from Greenland eastwards came from one population. Alternative assumptions would not however substantially affect the results because the non-Faroese catches are small by comparison.

The summary statistics from the ICES Study Group Report (SC/5/4) which indicate the important features of the population trajectories are shown in Appendix 6. Section 8.1.2 summarises the conclusions of the Scientific Committee.

v) Further research recommendations

The Scientific Committee noted with appreciation that many of the 22 research needs listed at the 1993 meeting of the ICES Study Group had since been addressed. The major uncertainties in population status are the potential and actual population rates of increase and the geographical areas over which pilot whales range.

The Scientific Committee **agreed** to endorse the list of future research requirements listed by the ICES Study Group in its report (SC/5/4: 12-14). Further, the Scientific Committee agreed that two among these should be given the highest priority:

a) A long-term research and population monitoring strategy should be developed related to the Faroe Island fishery, based on an in-depth review of previous and current fishery monitoring procedures and the extensive research conducted in the Faroe Islands since the mid 1980s. The aims of such a programme should include both longer-term monitoring which would help improve understanding of the status of the harvested population, and short-term monitoring to detect more rapid changes as might occur.

b) In order to gain more information on the size of the population subjected to the Faroese fishery, the movements of individual pods of pilot whales that approach the Faroe Islands should be monitored by use of satellite tags. Several animals within a pod should be tagged, ideally with tags designed to be active over varying time periods.

8.1.2 Sustainability of the Faroese catch

In discussing the sustainability of the Faroese catch of pilot whales, the Scientific Committee focused on the population trajectories provided in SC/5/4, which are

contained in Appendix 3. Based on the catch history, the population trajectories predict the changes in the population size since 1840 under various assumptions of maximum population growth rates and for various stock areas, based on the population estimate resulting from NASS-89. A maximum growth rate of 0% was included in the table (upper row) to illustrate the effect of accumulated catches, but the Scientific Committee did not believe that this was a probable scenario. Similarly, the possibility that the catches were recruited solely from a local population around the Faroe Islands was considered extremely unlikely. The reason for this is that the variation in pollutants and parasite burdens between schools of pilot whales from the Faroe Islands suggest that they are not recruited from a local area, and this is further supported by the variation in abundance between surveys in this area (see under (8.1.1 - *i*). A more plausible range of maximum population growth rates of 1.4 to 5.7% per annum was applied to the three probable stock areas; Rockall-Iceland, Mid-Atlantic Ridge-Faroes, NASS-89 Survey Area.

Having excluded the two most extreme scenarios (0% growth/yr and local Faroese population), 12 population trajectories were examined (see Appendix 6). The trajectories were fitted to the population estimates from 1989 which are in agreement with the results from 1995 for comparable areas. The historical population sizes were derived from catch statistics and the range of maximum population growth rates. The present population sizes are compared to historic population sizes derived from the trajectories and the present size is given as a fraction of historical sizes. Only for the smallest area (Rockall-Iceland) and the lowest maximum population growth rate (1.4 % per annum) considered could a decline in population size be detected. The corresponding population trajectories for this area show declines after 1940 due to higher catches around that time, but also a stabilisation during the 1950s.

The Scientific Committee **concluded** that the effects of historic and present catches in the Faroe Islands have had a negligible effect on the long-term trends in the pilot whale stock. The Scientific Committee also noted that an annual catch of 2,000 individuals in the eastern Atlantic corresponds to an exploitation rate of 0.26% of the present best estimate of the abundance of pilot whales in the Northeast Atlantic (778,000 pilot whales from NASS-89).
While noting the recommendations for further research outlined under 8.1.1 above, the Scientific Committee considered that it had now completed its work in addressing the Council=s requests for advice on this species, based on all available information which had been thoroughly reviewed by the ICES Study Group on Long-finned Pilot Whales and the Scientific Committee with respect to the status of the pilot whale population in the North Atlantic and the sustainability of the Faroese catch.

8.2 Killer whales

8.2.1 Update on progress

The Chairman noted that it had not yet been possible to complete a full assessment of the killer whale as requested by the Council. Few new data were available, other than recent sightings data from NASS-95 which had not been analysed.

The Chairman drew the Committee=s attention to a recent publication by Similä et. al. (1996) on the relationship between killer whales in northern Norway and the distribution and abundance of Norwegian spring-spawning herring. It was shown that killer whales occurred in different areas during the summer and the autumn-winter, and these areas coincided with the distribution areas of herring. The present pattern of seasonal occurrence in the coastal waters of northern Norway is expected to change as a result of growth in the Norwegian spring-spawning herring stock.

8.2.2 Future work

The Committee agreed that further consideration of the Council=s request for an assessment of the killer whale should wait until further data became available.

8.3 Harp seals

The Committee had little new information to add to last year=s comprehensive review of available data on the harp seal, in particular in the Northwest Atlantic (see *NAMMCO Annual Report 1996*: 104-107).

It was noted, however, that the ICES/NAFO Joint Working Group on Harp and Hooded Seals would be meeting again later this year to look in particular at outstanding aspects of NAMMCO=s request with respect to harp and hooded seals in the West Ice and harp seals in the East Ice. It was therefore expected that the Committee would be in a position to return to these items at its next meeting in 1998.

It was noted that an aerial survey of harp seals in the White Sea was currently under way by Russian scientists, and it was hoped that this would provide information on pup production levels with which to develop an abundance estimate for the White Sea stock.

Folkow (Norway) also reported that some tagging of harp seals in the White Sea had been done in May 1996 in cooperation with Russian scientists with the aim of investigating migrational patterns between moulting and breeding seasons and distribution throughout the season.

8.4 Hooded seals

The Committee noted, as above under 8.3, that the ICES/NAFO Joint Working Group would be meeting again later this year, and that there was as yet nothing new to add to information reviewed at last year=s meeting.

Øien (Norway) reported on a forthcoming survey of hooded seal pups in the West Ice, using aircraft, helicopters and a coastguard vessel. It was expected that results from this survey would provide the data necessary for estimating abundance of the stock.

8.5 Harbour porpoises

The Chairman referred to the Committee=s recommendation at its last meeting for a comprehensive review of the harbour porpoise, and the Council=s endorsement of the inclusion of this species on the agenda of the Scientific Committee in the future. No specific request had, however, been forwarded from the Council.

The Committee noted that this species was common to all NAMMCO member countries, and that the extent of current research activities and expertise in member countries and elsewhere across the North Atlantic would provide an excellent basis for undertaking a comprehensive assessment of the harbour porpoise throughout its range, should the Council decide that this is an appropriate task for the Scientific Committee.

8.6 Central North Atlantic minke whales

The Chairman referred to the following request recently forwarded to the Scientific Committee:

AIn the light of the new survey abundance results the Scientific Committee is requested to undertake an assessment of the status of the Central North Atlantic minke whale stock, including to evaluate the long term effects of past and present removal levels on the stock.≅

As the request had only recently been received, the Committee began by discussing how best to deal with the task.

i) Estimate of abundance

With respect to abundance of the stock, the Committee noted the revised estimate of 72,000, based on the recent review of NASS-95 data (see under 9), and considered this as the best available estimate for the Central North Atlantic stock.

ii) Assessment of the status of the stock

It was noted that an earlier attempt to assess this stock had been carried out by the IWC Scientific Committee in 1990, which had agreed that A if the results of the runs of the HITTER model for the Central stock as at present defined are used as a basis for assessment, the Central stock of minke whales in the North Atlantic should be classified as an Initial Management Stock.≅ (*Rep.Int.Whal.Commn 41*,1991:68). The Committee noted that this assessment had been based on a considerably lower abundance estimate (28,000) than what was now available, and that new information on stock discreteness and catch levels was also available for use in assessing the status of the stock.

The Scientific Committee agreed to assign the task of assessing the status of the stock to the Working Group on Management Procedures, under the chairmanship of Nils Øien (Norway). Preliminary discussions were held during the meeting by members of the Working Group (Barner Neve, Gunnlaugsson, Heide-Jørgensen, Øien). The resulting proposal for how to proceed with the work was endorsed by the Scientific Committee:

To provide the requested assessment of the status of the Central North Atlantic minke whale stock, the Working Group on Management Procedures would:

1) provide a summary of completed work and ongoing studies of the stock discreteness of central North Atlantic minke whales;

2) examine past history of exploitation under varying assumptions of recent population size, maximum population growth rate and stock areas to be decided under i);
3) examine a range of management scenarios of present removals under most likely stock areas and with results from NASS-87, -89 and -95.

It was further noted that in order to carry out this work, the Working Group would need to contract the relevant expertise to summarize genetic results and to run population trajectories.

With regard to the time frame for undertaking this work, it was pointed out that the Council had requested the Scientific Committee to provide its advice on this matter prior to the next meeting of the Council. Although it was the general view of the Committee that it was unlikely that this work could be completed in time for the Council meeting, it was nevertheless agreed that effort should be made to complete the assessment as soon as possible.

9. REVIEW OF RESULTS OF NASS-95

The Chairman noted that at its 5th meeting in Nuuk (February, 1995), the Council had agreed to the following:

> AThe 1995 North Atlantic Sightings Survey (NASS-95) would provide updated abundance estimates for a number of whale species in the North Atlantic, and the Scientific Committee was requested to review results in the light of recent assessments of North Atlantic whale stocks.≅

To address this request, a Working Group on Abundance Estimates had been established with the task of reviewing the analyses, and where relevant, also to analyse data from NASS-95 to provide a basis for calculating abundance estimates for the relevant cetacean stocks in the North Atlantic. The Working Group began its work in 1996 by correspondence under the Chairmanship of Jóhann Sigurjónsson (Iceland), and was subsequently chaired by Nils Øien. A meeting was held in Reykjavik 20-23 February 1997, which was attended by members of the Working Group from Greenland, Iceland and Norway and invited experts from the UK. Øien presented the Working Group report to the Committee, which was circulated as SC/5/11 and is contained in Section 3.4 of this volume.

The Committee noted that the Working Group had focused on describing synoptic distributions of the cetacean species encountered during NASS-95, and abundance estimates for minke, fin, sei and pilot whales, which were the target species of the survey. The NASS-95 survey took place from late June to early August 1995 (see also *NAMMCO Annual Report 1996*: 116-119).

Survey methodology and data analysis for the respective survey areas and target species are described in Section 3.4 (item 3). The on-effort track lines for all survey areas are

shown in Section 3.4, Figure 3 and compiled by survey blocks and country in Section 3.4, Table 1.

9.1 Minke whales

i) Distribution

The Committee noted that although a considerable survey effort was allocated to southern areas southwards to 52EN, the southern limit of the minke whale distribution follows approximately the 1,000 m depth contours from Greenland to the British Isles. The distribution within the area is primarily over continental shelves, but nevertheless the abundance over the deep waters of the Norwegian Sea is considerable. The NASS surveys therefore seem to give a complete picture of the summer distribution of minke whales in the northeast Atlantic.

Compared to earlier surveys, a shift in minke whale distribution was observed in the Barents Sea as few minke whales were seen in the southeastern part off the Kola peninsula in 1995, while this was an area of high density in 1989. Around Iceland the highest densities of minke whales were found over the shelf areas and thus covered by the aerial surveys.

ii) Abundance

The overall estimate for the Norwegian survey blocks were 118,000 (CV 0.10); for the Icelandic shipboard surveys 17,900 and the Icelandic aerial survey 55,900 (CV 0.31). This gives a total estimate (corrected by excluding from the shipboard estimates the part that overlaps the aerial survey area) of 184,000 minke whales for the total NASS-95 area (Section 3.4, Table 2).

It was noted that minke whale estimates from Icelandic aerial surveys show a great increase from 1987 to 1995, although the total number of sightings is about the same in both years. Although more of the effort in 1995 is in low density areas, so given the same number of sightings, a larger estimate would be expected, the difference is to a large degree a function of different methodology as well as different observers. Thus, reanalysis of the 1987 aerial survey data gives more than twice the estimate obtained by the earlier methods (SC/5/AE/2). Although great fluctuations in estimates are to be expected due to the high variance, the problems involved should be addressed in future aerial surveys.

9.2 Fin whales

i) Distribution

The highest densities of fin whales during NASS-95 were found in the area between Iceland and East Greenland and large numbers were also found on the Jan Mayen Ridge and near Spitsbergen. Within the Icelandic survey area, the distribution pattern is similar to previous surveys, although the relative 1995 density is even higher in the Denmark Strait - Irminger Basin than in the 1987 and 1989 surveys.

ii) Abundance

The total abundance of fin whales for the areas covered by NASS-95 was 22,800 (CV 0.15). The total estimate for the Norwegian survey area is 3,100 fin whales (CV = 0.25)

and for the Icelandic/Faroese survey area 19,700 fin whales (CV=0.17). The estimate for the East Greenland-Iceland stock, 18,900, is the largest to date. In particular, the abundance is considerably higher in the area between E-Greenland and Iceland than in the 1987 and 1989 surveys. In fact the abundance in block 9 alone in 1995 is higher than the total abundance in all blocks from either of the previous surveys. This may reflect a true increase in the stock, while discontinuity in distribution towards the south of the survey area may indicate that the 1995 survey captured the peak of the fin whale migration to these waters better than earlier surveys

9.3 Sei whales

i) Distribution

The distribution of sei whales corresponds well with that of the 1987 and 1989 surveys, with consistent low abundances in both Norwegian and Faroese survey areas. However, the 1989 Icelandic survey was conducted somewhat later in the season when the species typically migrates into the area west off Iceland and covered areas further south with large densities of sei whales.

ii) Abundance

The total estimate of sei whales from NASS-95 was 9,249 animals (95% confidence interval: 3,700 - 23,116. Although the majority (about 70%) of the 1989 estimate (10,600, CV=0.27) was derived from survey blocks south of the 1995 survey, the two surveys are not inconsistent in the light of the wide confidence limits and difference in timing.

It is unlikely that any of the NASS surveys covered the total distribution of the sei whale stock and the species is known for relatively large between-year variations in abundance in northern waters (Christensen et.al. 1991).

9.4 Long-finned pilot whales

i) Distribution

The distribution of ***long-finned pilot whale*** sightings in 1995 is comparable to the distribution observed in the two previous NASS surveys, i.e., the sightings were made south of the ridge Greenland-Iceland-Faroe Islands, with a few stragglers off the Norwegian coast. This indicates that the NASS surveys cover the northernmost areas of pilot whale distribution in the northeast Atlantic.

ii) Abundance

The total abundance of pilot whales over all blocks in 1995 is 215,000 animals (CV 0.26).

Previous surveys of long-finned pilot whales had been conducted in 1987 and 1989, and a total estimate of 778,000 (CV 0.29) has been calculated based on 1989 data when the survey had its largest extension. The area surveyed in 1995 covered a similar area to that surveyed in 1987. The total abundance estimate in 1987 was 123,000 (CV 0.29).

Excluding blocks in the 1989 survey so that the estimate was comparable to the total estimate from the 1987 data, the 1989 estimate was 191,000 animals (CV 0.33). If the Faroese block B is excluded from the analysis, so that the 1995 estimate is broadly comparable to the 1987 and 1989 estimates, the total abundance estimate in 1995 is 181,440 (CV 0.26). The 1995 estimate is therefore consistent and not significantly different from previous estimates for the area covered.

9.5 Non-target species

The Scientific Committee noted that from a distributional point of view, several other species were also considered by the Working Group on Abundance Estimates, including the NASS-95 distribution of humpback (*Megaptera novaeangliae*), blue (*B. musculus*), sperm (*Physeter macrocephalus*), northern bottlenose (*Hyperoodon ampullatus*) and killer (*Orcinus orca*) whales, harbour porpoises (*Phocoena phocoena*) and small *Delphinidae* (*Lagenorhynchus sp.* and similar species).

9.6 Conclusions & recommendations

The Scientific Committee **concluded** that the updated abundance estimates for the target species as reviewed by the Working Group on Abundance Estimates represented the best available estimates for the stocks concerned.

The Scientific Committee agreed that there would be great value in compiling the results of NASS-95 and the analyses of the sightings data in a single volume for future reference. It was therefore **recommended** that this be done in the context of the NAMMCO scientific publication series and that the original chairman of the Working Group on Abundance Estimates, Jóhann Sigurjónnson should be assigned the task of coordinating the editing process.

10. MONITORING OF STOCK LEVELS AND TRENDS IN STOCK LEVELS OF MARINE MAMMALS IN THE NORTH ATLANTIC

The Chairman noted that at its 5th meeting in Nuuk (February 1995), the Council agreed to the following:

> AIn relation to the importance of the further development of multi-species approaches to the management of marine resources, the Scientific Committee was requested to monitor stock levels and trends in stocks of all marine mammals in the North Atlantic.≅

It was clarified that the purpose of this request was to ensure that data on marine mammals was available for input into multi-species models for management. The Management Committee had suggested that the Scientific Committee present this information annually in the form of a table (*NAMMCO Annual Report 1995:* 47).

At its last meeting, the Scientific Committee had agreed that the Working Group on Abundance Estimates should also be given the task of addressing this request. Øien reported that the Working Group had not had time to discuss the development of a table during its recent meeting in Reykjavik. However, the Secretariat began work compiling the data necessary to include in an overview compilation in table form prior to and during the Scientific Committee meeting, a working draft of which was circulated as SC/5/16.

The Committee discussed the manner in which information on stock levels and trends in stocks would be best presented for the reference of the Council and Management Committee. It was agreed that there would be little value in compiling all information in a single table form, given the differences in survey methodologies and areas on which estimates of abundance levels are based.

In addition, variations in abundance estimates from different periods and areas are not necessarily an indication of trends in stock levels. For example, very little could be concluded at this stage about trends in relation to the target species of the NASS surveys.

Instead, the Committee agreed that updated information on abundance and indications of trends in abundance of stocks of marine mammals in the North Atlantic should be clearly described in a new document for the internal reference of the Council, to replace the List of Priority Species. This document would be entitled Status of Marine Mammals in the North Atlantic and should include those cetacean and pinniped species already contained in the List of Priority Species, as well as other common cetacean species in the NAMMCO area for which distribution and abundance data is also available (fin, sei, humpback, blue, and sperm whales). It was also suggested that it would be useful to include an indication of research needs for each species/stock, as well as references to relevant general review literature and working group reports.

The Scientific Committee **agreed** that the Status of Marine Mammals in the North Atlantic should be further developed by the Secretariat, with the current update of the List of Priority Species as a basis, and in consultation with those members of the Committee who had been assigned the task of updating information on particular species/stocks for the List of Priority Species prior to this meeting. It was also noted that, in the absence of a thorough review of available information on trends in abundance by the Working Group on Abundance Estimates, it was important that the Status document also contain available information on trends, and that it be completed as far as possible in time for the next meeting of the Council.

11. DATA AND ADMINISTRATION

11.1 Database and data requirements

The Secretary referred the Committee to document SC/5/6, a report on the status of the databases in the Secretariat, which had been distributed by correspondence to Committee members in July 1996. There were a number of outstanding questions concerning the further development of the catch database in the Secretariat, which had

been raised in correspondence with members of the Data Liaison Group established by the Committee at its last meeting, including the question of whether incidental strandings and sightings data, as well as data from sightings surveys should also be compiled at the Secretariat.

As a follow up to the report on the status of databases, the Secretariat had also prepared a draft set of guidelines for the submission of catch data to the Secretariat (SC/5/8 - see Appendix 4), the purpose of which was to establish permanent routines for the format and regular submission of catch data from member countries.

It was agreed that these matters should be further reviewed and discussed through the Data Group, whose role was to advise the Secretariat on data-related matters.

11.2 Other matters

In relation to last year=s recommendation that member countries establish a system for reporting data on by-catches of marine mammals for use in population assessments, and the Council=s request for the Secretariat to investigate the requirements for a standard system in liaison with the Scientific Committee=s Data Group, the Secretariat presented a brief overview of the present status of marine mammal by-catch reporting in NAMMCO member countries, initiatives taken by other international organisations, as well as scientific data requirements for such reporting (SC/5/7 - see Appendix 5).

The Scientific Committee noted that there was at present no systematic reporting of marine mammal by-catches in any NAMMCO member country, although by-catches in Greenland were recorded in the context of the standard catch reporting scheme. The Scientific Committtee agreed that, other than the points noted in item 3 of SC/5/7 (Appendix 5), no further advice could be given on the specific requirements for by-catch data collection until steps were taken by national authorities to establish a system for recording such data.

12. PUBLICATIONS

The Chairman referred to the Council=s decision at its last meeting to begin a NAMMCO series of scientific publications. It was subsequently decided that the first edition of the series would be a collection of papers on ringed seals, based on the Scientific Committee=s assessment of this species throughout its range at its 1996 meeting.

Heide-Jørgensen (Greenland) who is co-editing this edition together with Christian Lydersen of the Norwegian Polar Institute in Tromsø, informed the Committee of progress with the editing. Six final papers had been received and were currently being reviewed, while a remaining six contributions would be completed in the near future. It was expected that the publication would be completed by the autumn of 1997.

The Scientific Committee noted in connection with the ringed seal edition that papers dealing with aspects outside the immediate scope of the Working Group=s assessment of ringed seals were also to be included in the edition. It was agreed that the NAMMCO scientific series should not necessarily confine itself to the material reviewed in the

context of Working Groups, but should provide a forum for the publication of other papers relevant to an overall review of the subject matter in question, given that appropriate standards for submission and peer review were maintained.

The Secretariat informed the Committee of plans to produce a set of editorial guidelines for authors for use in the editing process for the NAMMCO series. In discussion of copyright matters in relation to distribution of material on the Internet, it was noted that appropriate authorization should be obtained from contributors if NAMMCO publications were in the future to be made available in this context.

The Chairman noted that contributions to the two Working Groups at the present meeting (on food consumption of minke whales, harp and hooded seals in the North Atlantic and sealworm infection), had also provided material which would be useful to publish in the NAMMCO scientific series, as did the results and analyses deriving from the 1995 North Atlantic Sightings Survey (NASS-95) (see also under 7.1.3; 7.2.3 iv) and 9.6 above).

Finally, the Chairman encouraged Scientific Committee members to give some thought to an appropriate title for the NAMMCO scientific publication series.

13. BUDGET

The Secretary informed the Committee that although the final budget for 1997 had not yet been formally adopted by the Council, the same level of funding for invited expertise and projects could be expected for 1997 and 1998. Furthermore, it had been proposed that sufficient funding to cover costs earmarked for contract work and editing in connection with the ringed seal publication should be included in the 1997 budget in addition to the sum usually earmarked for the Scientific Committee.
It was noted that there would only be limited funding remaining for further work by the Scientific Committee in 1997 once the costs of invited expertise to the present meeting had been deducted.

14. FUTURE WORK PLANS

14.1 Scientific Committee

Noting the fact that the Scientific Committee had now established a tradition of rotating its meetings between member countries, it was agreed that the next meeting of the Scientific Committee should be held in Iceland in 1998. It was also agreed that late February/early March was the most suitable time for most members, but that the precise timing of the next meeting would also depend on the timing of the 1998 Council meeting.

In this connection it was noted that more effort should be made to avoid overlap with meetings of other international organisations normally attended by Scientific Committee members.

14.2 Working Groups

It was noted that the outstanding request to this year=s meeting for an assessment of the status of the Central North Atlantic stock of minke whales would be dealt with through the Working Group on Management Procedures, under the chairmanship of Nils Øien, and that this work would be completed as soon as possible (see 8.6, ii)).

It was further noted that the Working Groups established for the present meeting to deal with the request for advice on food consumption of minke whales, harp seals and hooded seals (SC/5/ME) and sealworm infection (SC/5/SI) had completed their work and it was therefore agreed to dissolve them.

It was agreed that the Working Group on Abundance Estimates should remain in place for the time being to deal with the editing of a review edition on NASS-95 for the NAMMCO publication series (see under 9.6).

The Data Liaison Group would continue to advise the Secretariat on the matters raised under 11.1 above.

15. ELECTION OF OFFICERS

Mads Peter Heide-Jørgensen (Greenland) was elected Chairman of the Scientific Committee for the next two years (1997-98). Dorete Bloch (Faroes) was elected Vice-Chairman of the Scientific Committee for the next two years (1997-98).

16. ANY OTHER BUSINESS

On behalf of the other members of the Committee, Heide-Jørgensen thanked the retiring Chairman, Tore Haug, for his relaxed and effective handling of the work of the Committee during his term as Chairman, and presented him with a gift as a token of the Committee=s appreciation.

Haug thanked Committee members for their cooperation and hard work during his term as Chairman, and expressed his appreciation to the Secretariat on behalf of the Committee for the organisation of the meeting.

17. ADOPTION OF REPORT

A draft report covering a number of the substantive items dealt with by the Committee was reviewed during the meeting. The final report was adopted by correspondence on 10 April 1997.

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Appendix 1

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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
6. Update of List of Priority Species
7. Role of marine mammals in the marine ecosystem
   - 7.1 Feeding ecology of minke whales, harp seals and hooded seals in the North Atlantic and interactions with fish stocks
   - 7.2 Sealworm infestation
   - 7.3 Other matters
8. Marine mammal stocks - status and advice to the Council
   - 8.1 Long-finned pilot whales
   - 8.2 Killer whales
     - 8.2.1 Update on progress
     - 8.2.2 Future work
   - 8.3 Harp seals
     - 8.3.1 Update on progress
     - 8.3.2 Future work
   - 8.4 Hooded seals
     - 8.4.1 Update on progress
     - 8.4.2 Future work
   - 8.5 Harbour porpoises
   - 8.6 Central North Atlantic minke whales
9. Review of results of NASS-95
10. Monitoring of stock levels and trends in stock levels of marine mammals in the North Atlantic
11. Data and administration
    - 11.1 Database & data requirements
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12. Publications
13. Budget
    - 13.1 Review of funds 1996
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14. Future work plans
    - 14.1 Scientific Committee
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15. Election of Officers

15.1 Election of Chairman for 1997/98
15.2 Election of Vice-Chairman for 1997/98
16. Any other business

Appendix 3

LIST OF DOCUMENTS

Committee documents

SC/5/1	List of Participants
SC/5/2	Agenda
SC/5/3	List of Documents
SC/5/4	Report of the Study Group on Long-finned Pilot Whales - ICES C.M.1996/A:6
SC/5/5	Draft Update of List of Priority Species
SC/5/6	Overview of the current status of databases in the NAMMCO Secretariat (Atli Konráðsson, July 1996)
SC/5/7	Marine mammal by-catch data reporting in NAMMCO member countries (A note by the Secretariat)
SC/5/8	Draft guidelines for the submission of data to the Secretariat
SC/5/9	Report of the Working Group on the role of minke whales, harp seals and hooded seals in North Atlantic ecosystems (SC/5/ME)
SC/5/10	Report of the Working Group on Sealworm Infestation (SC/5/SI)
SC/5/11	Report of the Working Group on Abundance Estimates (SC/5/AE)
SC/5/12	Extract from Report of ASCOBANS Advisory Committee Meeting, 13-15 Nov.1996
SC/5/13	Report of the Workshop on Harp Seal-Fishery Interactions in the Northwest Atlantic: Toward Research & Management Actions, St. John=s, Newfoundland, Canada, 24-27 February 1997. Canadian Centre for Fisheries Innovation and Memorial University of Newfoundland: I-vi + 41pp.
SC/5/14	Letter from Dorete Bloch regarding National Progress Reports
SC/5/15	T. Gunnlaugsson, Observations on humpback whale distribution and trend in abundance
SC/5/16- rev 1	Table of Abundance Estimates for Marine Mammals in the North Atlantic (working draft)
SC/5/NPR - F	Faroe Islands - Progress Report on Marine Mammal Research in 1996
SC/5/NPR - G	Greenland - Progress Report on Marine Mammal Research in 1995
SC/5/NPR - I	Iceland - Progress Report on Marine Mammal Research in 1996
SC/5/NPR - N	Norway - Progress Report on Marine Mammal Research in 1996

Council documents

NAMMCO/7/8	Report of the ICES Advisory Committee on Fishery Management (ACFM) and Advisory Committee on Marine Environment (ACME) on Long-finned Pilot Whales (final advice from ICES to NAMMCO).

Appendix 4

DRAFT GUIDELINES FOR THE SUBMISSION OF DATA TO THE SECRETARIAT

The current structure of data files in the Secretariat containing catch data and biological information is given in SC/5/6 Table 1. The following are draft guidelines regarding file structure and formats and deadlines for future submission of data to the Secretariat.

1. FIELD STRUCTURE IN DATA FILES

a) Cetacean catch statistics
Year - month - {day} - species - location - no.

b) Cetacean individual biological data
Year - month - day - location - sex - length - {other}

c) Pinniped catch statistics
Year - {month - {day}} - species - location - no. - {pups - 1_ year+}

Key to field names:

Year - month - day:	fields refer to date of catch.
location:	field refers to location of catch in terms of coordinates or other definitions.
no.:	total number of animals caught.
other:	any additional information (e.g. age, reproductive status).
pups:	no. of animals younger than 1 year at catch.
1_year+:	no. of animals older than 1 year at catch.
{..}:	optional field

2. FILE FORMATS

Data files should be submitted in either *Paradox*, *Quatro Pro* or ASCII (in order of preference). As a standard procedure, files should be mailed to the Secretariat on IBM formatted diskettes together with printouts.

3. DEADLINES

Data should be submitted to the Secretariat at least once each year and as soon as possible after the end of the hunting season. National institutes identified by the Secretariat as responsible for submission of data are:

Norway -	Marine Research Institute, Bergen (Nils Øien)
Iceland -	Marine Research Institute, Reykjavík (Gísli Víkingsson)
Greenland -	Nature Research Institute , Nuuk (Aqqalu Rosing-Asvid)
Faroes -	Museum of Natural History, Tórshavn (Dorete Bloch)

Appendix 5

MARINE MAMMAL BY-CATCH DATA REPORTING IN NAMMCO MEMBER COUNTRIES

A Note by the Secretariat, March 1997

1. INTRODUCTION

At its last meeting in 1996, the Scientific Committee noted the importance of obtaining data on the level of by-catches for population assessment. The Council agreed at its Sixth meeting in 1996 to the recommendation from the Scientific Committee that member countries establish a system for reporting data on by-catches, and that the Secretariat be entrusted to investigate the requirements for a standard system of reporting such data, in liaison with the Scientific Committee=s Data Group. As a first step, the following note has been prepared on the current status of by-catch reporting in NAMMCO member countries and discussions in other organsiations, as well some comments on specific data requirements on by-catches.

2. CURRENT STATUS OF MARINE MAMMAL BY-CATCH REPORTING

a) NAMMCO member countries have no specific regulations for systematic reporting of marine mammal by-catch in fisheries apart from Greenland, where fishermen are obliged to report all catches of marine mammals. No distinction is made, however, between directed catches and by-catches , other than by-catches of those species subject to IWC aboriginal subsistence quotas.

b) ICES member countries have been urged through an ICES Council resolution from 1994 (Cnl.Res. 1994/4:8) to record all by-catches in the ICES area. A detailed description of data requirements/reporting form has been prepared by the ICES Secretariat (Anon. 1994).

c) It has been formally recommended by the IWC that incidental kills of small cetaceans should be included in National Progress Reports (IWC 1977, p.26). More recently, an IWC Workshop on Mortality of Cetaceans in Passive Nets and Traps recommended that ICES and EC should improve collection coordination of data regarding incidental catches of small cetaceans and should play important roles in facilitating these activities (Perrin et.al.1994).

d) ASCOBANS has expressed interest in cooperating with ICES in the establishment of a by-catch database and in obtaining access to data on fishing effort in the ASCOBANS area.

3. DATA REQUIREMENTS

If the database is to be used in the assessment of total by-catch for any population in a given fishery, some points should be considered:

a) *Numbers caught* (e.g. by a sample of vessels) must be registered and at least information on *species, date of catch, location, gear type* and *sample effort* should be collected. The reliability of data from such reports must be given a special attention. Lien et. al. (1994), for example, compare five different reporting methods and conclude that the numerical estimates of by-catch are at least partly dependent on the methodology used. Furthermore, identification of species is an obvious source of potential error.

b) In the planning stage of any system for registering by-catch, an overview of information regarding *total effort* in the fishery must be available in order to coordinate the registration of total effort and the sample effort in question.

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Appendix 7

PRESS RELEASE

Tromsø, 17 March 1997

The Scientific Committee of NAMMCO - the North Atlantic Marine Mammal Commission - met in Tromsø, Norway, 10-14 March 1997. The meeting was attended by scientific experts appointed to the Committee from NAMMCO member countries (Norway, Iceland, Greenland and the Faroe Islands). As well, a number of invited experts from across the North Atlantic, including Canada, Iceland, Norway, the UK and Russia, contributed to the Committee=s special focus this year on questions related to the role of whales and seals in the marine ecosystem. Some of the major conclusions and recommendations of the Scientific Committee can be summarised as follows:

* ***Estimates of whale abundance in the North Atlantic***

New information on the abundance of several whale stocks in the North Atlantic was reviewed. Data from the 1995 North Atlantic Sightings Survey for cetaceans (NASS-95), which was coordinated through NAMMCO, was used as the basis for revised estimates for the surveyed areas.

- The current best estimate of the central North Atlantic stock of **minke whales** is 72,000. Combined with the estimate of 112,000 from the Norwegian part of the survey in the Northeast Atlantic, which was reviewed by the Scientific Committee of the International Whaling Commission in 1996, this gives a total estimate of 184,000 minke whales in the central and northeast Atlantic.
- The Scientific Committee concluded that the abundance of **fin** and **sei whales** in North Atlantic waters east of Greenland was 22,800 and 9,250 respectively.

* ***Long-finned pilot whales***

Pilot whales are of particular interest for the Faroe Islands. Data from the NASS-95 survey did not result in significantly different estimates of abundance, and the earlier number of 778,000 pilot whales in the northeast Atlantic was still considered to be the best estimate. The Scientific Committee concluded that the effects of historic and present catches in the Faroe Islands have had a negligible effect on the long-term trends in the stock.

* ***Role of marine mammals in the ecosystem***

- <u>Fish consumption of minke whales, harp seals and hooded seals in the North Atlantic</u>

Based on a review of recent results from ecological studies, the Scientific Committee concluded that minke whales, harp seals and hooded seals may have substantial direct and/or indirect effects on commercial fish stocks. As an example it was shown that stocks of minke whales and harps seals in the Barents Sea and off northern Norway may consume 2.5-3.5 million tons of prey per year, more than half of which is commercially important fish.

- To better understand the possible effects of this consumption, the Scientific Committee recommended that knowledge be improved in a number of areas, such as variations in abundance, distribution, diet, energy requirements and prey abundance of these marine mammals, the way in which marine mammals select their prey, and the extent of consumption of fish species by other predators in the system.

- Sealworm infection in fish

Transmission of parasites (sealworm) from seal to fish has a significant economic impact on the fisheries sector in many parts of the North Atlantic. The Scientific Committee reviewed the current state of knowledge concerning the life cycle of sealworms. In relation to the influence of seal abundance on the level of sealworm infection in fish, the Scientific Committee concluded that:

- The presence of grey seals or harbour seals may lead to sealworm infection over the entire North Atlantic region; - because of their more limited foraging range, harbour seals could be particularly responsible for high local infection in fish; - sealworm infection in fish is not necessarily directly correlated with seal abundance, as even a few seals can maintain high infection levels in fish in an area.

3.2
REPORT OF THE SCIENTIFIC COMMITTEE WORKING GROUP ON THE ROLE OF MINKE WHALES, HARP SEALS AND HOODED SEALS IN NORTH ATLANTIC ECOSYSTEMS

1.-3. OPENING PROCEDURES

At its Sixth Meeting in Tromsø, March 1996, the Council requested that the Scientific Committee:

A...focus its attention on the food consumption of three predators in the North Atlantic: the minke whale, the harp seal and the hooded seals, with a particular emphasis on the study of the potential implications for commercially important fish stocks≅

As a result, the Scientific Committee decided to convene a special Working Group on the Role of Minke Whales, Harp Seals and Hooded Seals in the North Atlantic (SC/5/ME), during the 1997 Scientific Committee meeting. The Working Group was chaired by Gísli Víkingsson (Iceland) and included scientists from Canada, Denmark, Greenland, Iceland, and Norway. A list of participants is given in Appendix 1.

The Agenda for the Working Group as given in Appendix 2 was adopted. Pia Barner Neve (Greenland) and Garry Stenson (Canada) agreed to act as rapporteurs. A list of documents presented and references is given in Appendix 3.

4. FEEDING ECOLOGY IN THE NORTH ATLANTIC

4.1 North East Atlantic

4.1.1 Minke whale

SC/5/ME/4 presented current information on the energy requirements, diet composition, and stock size of minke whales *(Balaenoptera acutorostrata)* in northeast Atlantic waters. These were combined to estimate the consumption of various prey species by this stock.

The distribution pattern and abundance estimate were based on a survey conducted in 1995. A total of 85,000 minke whales that feed in coastal waters off northern Norway, in the Barents Sea and around Spitsbergen, were estimated to consume more than 1.8 million tons of prey biomass during the six months from mid-April to mid-October.

This biomass consumed by minke whales was composed of 602,000 tons of krill *(Thysanoessa* spp.), 633,000 tons of herring *(Clupea harengus)*, 142,000 tons of capelin *(Mallotus villosus)*, 256,000 tons of cod *(Gadus morhua)*, 128,000 tons of haddock *(Melanogrammus aeglefinus)*, and 55,000 tons of other fish species, including sand eel (*Ammodytes* sp.) and saithe *(Pollachius virens)*. It was also noted that minke whale diets are subject to year-to-year variations due to changes in the resource base in different feeding areas. Thus, relative distribution of consumption of different prey items is highly dynamic.

Consumption by minke whales may therefore represent an important cause of mortality for some of the prey species. This is indicated, for example, by the fact that the estimated minke whale consumption of herring corresponds to about 70% of the total fishery, or 16% of the estimated spawning stock biomass, of Norwegian spring-spawning herring in the northeast Atlantic in 1995. However, it should be noted that the diet assumed is based upon samples taken during a period (1992-1995) of high herring and low capelin abundance.

The estimate of minke whale consumption was based on an energy model including energy requirements for reproduction, feeding, growth and storage of energy in tissue. Also the energy density of prey species varied seasonally.

Major uncertainties in the model are related to assumptions of minke whale distribution throughout the feeding season. The main strength of the approach was a good abundance estimate and a reasonable assessment of the energy requirements.

4.1.2 Harp seals

Paper SC/5/ME/7 combined data collected in 1990-1996 on harp seal *(Phoca groenlandica)* diet compositions from various areas and seasons in the Barents Sea, with information on the energy density of various prey species. It was possible, under certain assumptions, to estimate the total consumption of various prey items required by harp seals to cover their energy demands. All diet composition data were based on reconstructed prey biomass, and adjustments were made for differences in digestibility of crustaceans and fish. The number of seals belonging to different age and sex groups was calculated, and then their monthly food requirements were modelled.

Under the assumptions of a variable basal metabolic rate (BMR) throughout the year, and a field metabolic rate (FMR) of 2 x BMR, the estimated consumption by harp seals of crustaceans was 428,200 tons, capelin 258,200 tons (in 1992 when capelin stocks were high), polar cod *(Boreogadus saida),* 212 500 tons, herring *(Clupea harengus)* 69,600 tons, cod *(Gadus morhua),* 32,200 tons and Avarious fish≅ 142,300 tons.

The total food consumption of the Barents Sea harp seal stock (assumed to comprise 700,000 seals, including 100,000 pups) was estimated to be in the range of 1.14 - 1.61 million tons (depending on choice of input parameters) when capelin *(Mallotus villosus)* is abundant in the Barents Sea ecosystem. When capelin stocks in the Barents Sea are low, the estimated total food consumption increased slightly, to values ranging between 1.25 - 1.74 million tons. According to the model the largest quantities of food were consumed in the period June-September.

When the capelin stock was at a very low level (as in the period 1993-1996), consumption of capelin seemed to be replaced by an increased consumption of other species, particularly polar cod (from 16.9-18.6 % to 25.5-26.1%), followed by other gadoids, Avarious fish≅, herring and crustaceans. Using the same assumptions as above, the harp seal consumption of polar cod increased by 113,900 tons, other gadoids (cod, saithe and

haddock) by 80,200 tons, various fish by 76,500 tons, herring by 61,300 tons, and crustaceans by 29,100 tons.

The food consumption estimates are sensitive to the model assumptions. The most critical parameter for the total consumption estimates examined in the model was the choice of the multiplier ("a") for predictions of field metabolic rate from basal metabolic rate FMR = a x BMR. When ≅a≅ was increased from 2 to 3, the estimated food consumption increased approximately 40%. Stenson et al. (1995) estimated an increased food consumption of 25% when they increased Aa≅ from 2 to 2.5. The consumption estimates based on the lowest FMR (Aa≅ = 2) in SC/5/ME/7 are similar to estimates based on the monitored energy expenditures of immature harp seals in captivity throughout the year (Nordøy et al. 1995). The consumption estimates showed little variation by changing procedure for calculating basal metabolic rate (BMR) in the model (annual average BMR or monthly changes in BMR).

4.1.3 Cod

SC/5/ME/11 describes the diet of cod in the Barents Sea in the period 1984-1995, based on consumption calculations made by Bogstad and Mehl (1996). The total annual consumption by cod in the Barents Sea varied between 5 and 7 million tons in the period 1992-1995, i.e. the consumption by cod is about twice that of harp seals and minke whales combined. The diet is dominated by fish, with capelin as the most important prey. The consumption estimates are based on stomach content data and a model of the gastric evacuation rate. Consumption is calculated separately for three areas, each half-year and cod age group. The composition of the diet varies considerably between years, corresponding to the fluctuations in the prey (particularly capelin) stock size. For some years and prey species, the calculated consumption is considerably higher than the prey stock estimate. The consumption per cod is also quite variable.

4.2 Central North Atlantic

4.2.1 Minke whales

Paper SC/5/ME/5 summarises the available data on stomach contents of minke whales in Icelandic waters. 58 animals, mostly from June/July 1977-78 were examined, of which 44.8 % contained fish only, 24.1 % krill only and 29.3 % a mixture of the two. The identified fish species were capelin, sand eel and Atlantic cod. Calculations based on a population estimate from the NASS-87 and NASS-89 surveys, migration patterns and estimated energy requirements indicate that minke whales consume around 391,000 tons in Icelandic and adjacent waters (approximately ICES 5a division), of which 198,000 tons are fish (Sigurjónsson and Víkingsson 1995) . The Working Group noted that the diet assumptions are based upon low sample sizes and a simple classifications system of the prey items found in the stomachs.

4.2.2 Harp seals

SC/5/ME/8 presented information on diet of harp seals from 1987-1992. The material was collected in the Greenland Sea pack ice (the West Ice) during spring and early summer. The majority of the harp seal stomachs were empty in all sampling periods, but intestinal contents were found in most of the seals. The harp seal diet was totally dominated by

pelagic amphipods *(Themisto* sp.), but krill *(Thysanoessa* sp.) and polar cod *(Boreogadus saida)* were also eaten quite frequently.

Gray (1889) reported that stomachs of adult harp seals in the Greenland Sea contained *Themisto libellula* and krill, while Surkov (1960) reported *Themisto* sp. in harp seal stomachs and crustacean remains in faecal masses on the ice in the Jan Mayen area during spring and July. *Themisto* sp. was the dominant prey of young (< 1 year) harp seals in the Greenland Sea in April 1995 (Haug et al. 1996). Polar cod also occurred frequently in the harp seal intestines in some of the sampling periods in this study, which is consistent with previous observations made during spring and summer in coastal areas of eastern Greenland (Pedersen 1930; Rasmussen 1957).

Harp seals collected in the period February-May in coastal areas of northern Iceland had a diet comprised mainly of sandeels *Ammodytes* sp., codfishes (*Gadidae*), capelin *(Mallotus villosus)* and other fish species. Crustaceans (including amphipods and krill) and other invertebrates were also present (Hauksson and Bogason 1995a).

4.2.3 Hooded Seals

Paper SC/5/ME/8 presented information on the diet of hooded seals *(Cystophora cristata)* collected in May and June 1992 and 1994 during Soviet/Russian commercial sealing in Greenland Sea pack ice. The majority of the hooded seal stomachs were empty in all sampling periods, but intestinal contents were found in most of the seals. The hooded seals had mainly been feeding on squid *(Gonatus fabricii),* which occurred most frequently in the intestines. It also dominated the biomass in the few stomachs with contents. Polar cod also occurred frequently in most of the periods, while crustaceans, such as amphipods and krill, occurred sporadically.

Little additional information is available concerning hooded seal diets in the Greenland Sea. Arsenjev et al. (1973) reported that the hooded seal diet in the Greenland Sea consisted mainly of squid and to a lesser extent fish, such as redfish, codfishes and others.

Pelagic amphipods *(Themisto libellula)* dominated the hooded seal pup diet after weaning (April) in the Greenland Sea (Haug et al. 1996). As in the present analyses (SC/5/ME/8), most hooded seal stomachs examined by local hunters in Southeast Greenland were empty in July and August (Kapel 1982;1995). In those with contents redfish *(Sebastes* sp.) dominated. The dominance of the squid *(G. fabricii)* and the frequent occurrence of polar cod in the hooded seal diet (SC/5/ME/8) resembles stomach content analysis of young hooded seals made in Southeast Greenland in September when squid dominated the diet, followed by shrimp *(Pandalus* sp.), polar cod and redfish (Kapel 1995*).*

In the coastal waters of northern Iceland from April to October, hooded seals were reported to feed mainly on redfish, cod and various other fishes. Shrimp and squid *(Todarodes sagittatus)* were also eaten (Hauksson and Bogason 1995b).

Recent satellite tracking data have shown that hooded seal migrate between breeding and moult from the pack ice areas off eastern Greenland to the continental shelf edges off the Faroe Islands and northern Ireland, and to areas in the Norwegian Sea (Folkow and Blix

1995; Folkow et al. 1996). After moult hooded seals perform excursions which last for approximately 3-7 weeks to the waters off the Faroe Islands, the Irminger Sea, north/northeast of Iceland, areas in the Norwegian Sea and along the continental shelf edge from Norway to Bear Island.

Evidence of hooded seal feeding habits in these areas are lacking. In order to improve current knowledge on the feeding habits of hooded seals, stomach and intestines should be sampled in the areas where the seals are observed to occur for longer periods.

4.3 Northwest Atlantic

4.3.1 Minke whales

SC/5/ME/15 presented a review of earlier published results on the diet of minke whales in Greenland together with information reported by local hunters in Greenland through the Greenland Home Rule reporting system. Previous information on the feeding of minke whales highlights the importance of capelin as the most important prey species, making up about 70 % of the items found in the stomachs. Other identified food items recorded are Atlantic cod (*Gadus morhua*), polar cod (*Boreogadaus saida*), Greenland cod (*Gadus ogac*), and Atlantic catfish (*Anarhichas lupus*), herring , sand eel (*Ammodytes* sp.). Amphipoda (*Themisto* sp.), euphausiacea (*Thysanoessa* sp.), decapoda (*Pandalus* sp.) and pteropods have also been reported. Minke whales in Greenland appear to have a flexible feeding pattern.

A review of the available information on the diet, distribution and abundance of minke whales in Atlantic Canada was presented in SC/5/ME/6. The most comprehensive information on diet was collected prior to 1972 and indicated that capelin was the primary prey. Other species such as squid (*Illex illecebrosus*), salmon (*Salmo salar*), herring, cod, euphausiids and copepods were also eaten. Examination of a small number (n=10) of stomachs from minkes caught in fishing nets indicate that the whales had been feeding exclusively on capelin. There is no information on the diet of minke whales in the Gulf of St. Lawrence.
A study of whales in one Newfoundland bay during the early 1980s (Piatt et al. 1989) estimated that humpback, fin and minke whales took less than 1% of the total capelin biomass in the area. Of this, minke whales accounted for approximately 10%.

There are no current estimates of minke whale abundance in Canadian waters and the seasonal distribution is unknown. However, a preliminary estimate of prey consumption assuming a population of 6,000 and seasonal movements between Newfoundland and the Gulf of St. Lawrence suggests that minke whale consumption is relatively low in comparison to harp seal consumption. The amount of capelin consumed may be greater than that taken by hooded, grey or harbour seals in the area, but this estimate was considered to be illustrative and not appropriate for detailed comparisons.

4.3.2 Harp Seals

Paper SC/5/ME/9 presented information on results of stomach contents analysis of material collected in West Greenland waters in the period 1986-93 compared with published data and information from local hunters. The diet of harp seals feeding in this

region is available but consists mainly of pelagic crustaceans (*Thysanoessa* spp. and *Themisto libellula*) and small fish species like capelin (*Mallotus villosus*), sand eel (*Ammodytes* spp.), polar cod (*Boreogadus saida*) and Arctic cod (*Aectogadus glacialis*). Species of importance for commercial fisheries in Greenland, such as northern shrimp (*Pandalus borealis*), Atlantic cod (*Gadus morhua*), and Greenland halibut (*Reinhardtius hippoglossoides*) play a minor role in the diet of harp seals in this area.

Using information on distribution of catches and recoveries of tagged seals, an attempt to calculate the relative importance of various prey items of harp seals during their stay in coastal West Greenland was presented. It was concluded that about 1/3 of the food was capelin, 1/4 polar cod and 1/4 euphasiids or amphipods. Cod, shrimp and Greenland halibut each constituted 1-2 % of the food eaten. However, even at this low level, consumption by harp and hooded seals of these three prey species may well be of the same order as the commercial fishery in this region.

The estimates of consumption are sensitive to the assumed number of harp seals in West Greenland throughout the year.

Estimates of the consumption of Atlantic cod, capelin, and *Boreogadus* by harp seals off the coast of Newfoundland and in the Gulf of St. Lawrence were presented in Stenson et al. (1995). SC/5/ME/10 provides an update of the model used previously to estimate consumption of all prey species in Atlantic Canada from 1990-96. It also provides estimates of consumption by grey, harbour and hooded seals for comparison.

Harp seals were the most important pinniped predator in the northern Gulf and NAFO areas 2J3KL. They were estimated to have consumed over 150,000 tons of Atlantic cod, 1.1 million tons of capelin, 600,000 tons of *Boreogadus*, 130,000 tons of Greenland halibut, 107,000 tons of redfish and 104.000 tons of herring in 1996.The amount of cod consumed was not sensitive to the assumption concerning the proportion of time spent in near shore or offshore areas of Newfoundland, but changes in this assumption will affect estimates of the other species, particularly capelin, herring and *Boreogadus*. Although the total amount of prey consumed by harp seals in Atlantic Canada is large, most are not commercial species or taken prior to recruitment to the fishery.

There were several differences in the model presented in SC/5/ME/10 when compared with that found in Stenson et al. (1995). The major differences were related to the use of a population model which assumes that pup mortality is greater than that of older seals and incorporating seasonal and geographic variation in the diet of seals off Newfoundland. The proportion of time spent in the Gulf of St. Lawrence and off Newfoundland was also corrected from the earlier model. The resulting estimates were similar to those presented in Stenson et al. (1995) for the same time period, although the proportion taken off Newfoundland is greater while that taken in the Gulf is less.
There is a considerable amount of information available on harp seals in the Northwest Atlantic, particularly on population size, and energy requirements. There is also extensive data on geographical and seasonal variations in the diet of harp seals off Newfoundland although there is less information for offshore areas and in the Gulf. The greatest source of uncertainty in the estimates of consumption are related to the limited information

available on the seasonal distribution of harp seals and potential spacial and temporal variations in the diet. Current studies on the movements of seals using satellite telemetry will increase our understanding of the distribution of harp seals and improve the estimates of consumption.

4.3.2 Hooded Seals

Paper SC/5/ME/9 also presented information on the results of stomach contents analysis of material from hooded seals collected in Greenland waters in the period 1986-93 and information from hunters from 1970-83. Variation in the diet of hooded seals is less well documented than the harp seal, but in addition to the species also taken by harp seals, larger demersal fishes such as Greenland halibut, redfish (*Sebastes* spp.), cod and wolffish (*Anarhichas minor*) are apparently important prey items.

SC/5/ME/10 presents estimates of prey consumption of hooded seals in Atlantic Canada. Total abundance was estimated using a Leslie matrix model and recent data on reproductive rates. Based on estimates of pup production off Newfoundland and in the Gulf of St. Lawrence, the population was assumed to be increasing at 5% per year in this area. Greenland halibut was the major prey of hooded seals in offshore areas, followed by witch flounder, squid (*Gonatus*), and Atlantic cod. Greenland halibut and redfish were the main prey in inshore areas. No information was available on the diet in the Gulf and it was assumed that it was the same as that observed in near shore areas of Newfoundland. Considering the small population present in the Gulf, changes in this assumption will affect the estimates of consumption in the northern Gulf but will have little influence on the estimates of total consumption.

Hooded seals were estimated to have consumed approximately 129,000 tons of Greenland halibut, 36,000 tons of Atlantic cod and 19,000 tons of redfish in 1996. Almost all of the prey consumed were from NAFO division 2J3KL. However, these estimates are based upon a limited number of samples of hooded seal diet.

The greatest sources of uncertainty in the consumption estimates are associated with the estimates of abundance and seasonal distribution. The model assumes that the change in pup production between 1984 and 1990 represents an actual increase in the area and not a temporary influx of females from Davis Strait. It is also assumed that Davis Strait hooded seals do not enter the area. There is also uncertainty associated with the seasonal distribution of hooded seals. While satellite telemetry has provided information on the movements of seals during the spring, little is known about their distribution during the fall and winter.

5. INTERACTIONS BETWEEN MARINE MAMMALS (MINKE WHALES, HARP AND HOODED SEALS) AND COMMERCIALLY IMPORTANT FISH STOCKS - MULTISPECIES MODELLING

5.1 Northeast Atlantic

Two papers describing multispecies models incorporating fish and marine mammal stocks in Northeast Atlantic were presented.

SC/5/ME/11 describes how multispecies interactions between minke whales, harp seals, herring, capelin and cod in the Barents Sea are modelled in the multispecies model MULTSPEC (Bogstad et al. in press). The model is divided into seven areas, and the species included are also structured by age, sex and length (fish only). A one-month time step is used. In the model, minke whales and harp seals are predators on cod, capelin and herring. Cod prey on capelin, herring and young cod (cannibalism), while herring is a predator on capelin larvae. The feeding, growth, fertility and natural mortality rates of minke whales and harp seals all assumed to be constant. The feeding and growth rates of cod are affected by the abundance of prey, while the growth of herring and capelin depends on the abundance of these two species combined.

MULTSPEC was used to study the effects of varying:
i) the stock size of harp seals and minke whales;
ii) the food preferences of harp seals and minke whales; and
iii) the food preferences of cod.
This was done by running the model for a period of 20 years. A reference run, resulting in variations in the biomass of cod, herring and capelin within the range observed for the period where stock estimates are available, was decided upon. A fixed harvesting rate for fish and marine mammals was assumed throughout the period. In the reference run, the catches of marine mammals are set so that the marine mammal populations stay approximately constant.

The main effects can be summarized as follows:

The herring stock increased as predation from marine mammals decreased. With prey preference as in the reference run, the herring stock was much more sensitive to changes in the minke whale stock than to changes in the harp seal stock. The quantity of herring consumed by whales and seals in the Barents Sea was moderate or negligible compared to the total herring stock biomass. The reason why the herring stock was so sensitive to changes in the whale stock is that predation reduced the number of recruits to the mature stock by an amount which is not negligible, and this had both an immediate effect on the total stock and a long-term effect through the spawning stock-recruitment relationship.

The development of the capelin stock was mainly determined by changes in the herring and cod stocks. The effect of changes in these stocks on capelin generally went in the opposite direction to effects from changes in marine mammal predation on capelin. This resulted in an increase in the capelin stock when the minke whale stock increased, and *vice versa*. Since herring was less sensitive to changes in the seal stock than to changes in the minke whale stock, and since predation on capelin from seals was high, an increase in the seal stock lead to a decrease in the capelin stock, and *vice versa*.

Generally, the cod stock increased or decreased when marine mammal stocks decreased or increased, as expected. However, because of the strong cod-capelin interactions, resulting in a tendency to cyclic variations in the two stock trajectories, the changes in the cod stock in some years was in a direction opposite to the one expected when compared to the reference run.

Decreasing the preference herring by cod had much greater effects than changing some of the marine mammal preferences, and even more dramatic effects than removing both marine mammal stocks from the system. In these runs, the herring stock increased above historical levels, with resulting detrimental effects on the capelin stock. The cod stock also decreased due to low capelin stock. An increasing minke whale stock had the greatest affect on the herring stock, while an increased harp seal stock mainly affected the capelin and herring stocks.

Considering the importance of polar cod to harp seals and possibly cod, including polar cod into the model may affect the interactions observed. It was also noted that the prey preferences in the model remained constant throughout the year. Given the reported changes in the prey selection by harp seals in the Barents Sea, it is important to consider the potential effect seasonal differences in prey selection may have on the model.

The MULTSPEC model was designed to describe fish/fish interactions. Although marine mammals have been included, their impact is through removal of fish. The model allows for the inclusion of an impact of fish stock size on the reproductive rates and growth of marine mammals, but such runs have not been made. Inclusion of such effects may provide a more realistic view of interactions among the species.

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SC/5/ME/12 investigated the effect of tuning the Revised Management Procedure (RMP) for minke whales from the current level (with a stock target of 72% of carrying capacity - k) to one with a lower abundance (60% of k) on fish stocks in the Barents and Norwegian Seas. A number of scenarios were simulated and the results analysed by regression methods. Four species were included in the model: cod, capelin, herring and minke whales. The fish populations were age and length distributed, while the minke whale was age and sex distributed. The time step was one month, and two areas (Barents and Norwegian Sea) were included.

The model assumes a food-web with minke whales as the apex predator, consuming herring, capelin and cod. Cod consume cod, herring and capelin, while herring prey on capelin. A non-linear function for minke whale prey preference is used. Minke whales may forage on plankton and fish other than cod, capelin or herring, and are thus modelled as having carrying capacity and demographic parameters independent of the status of the fish stocks in the model.

A constant fishery model was assumed for cod and herring, while capelin was managed using a fixed target spawning stock. Minke whales were managed according to the RMP. Fish recruitment and survey indices of minke whales were modelled stochastically. The model, run over a 100 year period, simulated 27 scenarios spanning 9 experimental factors, at three levels each. The primary study variable was the tuning level of the RMP, and the response variables are cod and herring catches and mortality caused by whale predation. The response variables were average over the last 90 years of the period.

Assuming 100,000 minke whales and MSYR between 1% and 2%, the main effect of changing the RMP target from 72 % to 60 % was an increase of some 14% in the cod

catches. Mean mortality rate for cod caused by minke whales decreased from 0.2 to 0.1 and the mean yearly catch of whales was increased from approximately 270 animals to around 490 animals. For herring, no clear main effect was found on catch or mortality rate.

It was difficult for the Working Group to interpret the results of the model because of questions concerning the validity of the parameters used. The carrying capacity for the minke whale appears to have been set too high and the reproductive capacity (MSYR) too low. More relevant results might have been obtained with a lower carrying capacity and higher reproductive capacity.

Although indirect effects on the stock size of capelin and herring due to changes in marine mammal abundance were observed in the MULTSPEC model of the Barents Sea (SC/5/ME/11) and the model presented for Iceland (SC/5/ME/13), they were not observed in the model presented in SC/5/ME/12. This may be due to the different methods used or a result of the parameters chosen. The model should be run using a different set of parameters to determine if indirect effects are present.

In this model, the population dynamics of minke whales were assumed to be independent of prey availability. If prey availability is a limiting factor, the consumption might not be independent of stock level, as modelled.

The fish-fish interactions are not well estimated, particularly predation of herring on capelin and cannibalism in cod. The net effect of increased whaling on cod catches may be less clear-cut, particularly when the whale stock is at lower levels, if predation of capelin by herring in the Barents Sea or the amount of cannibalism by cod is greater than assumed in the current model.

In the general discussion that followed on the two models presented for the Northeast Atlantic it was noted that neither model included size selectivity in terms of the amount of fish taken by marine mammals. Both models assumed a constant size selection pattern. Data exists to estimate the age selectivity from the diet samples and it was felt that these data should be incorporated into the models. It was also noted that different models of the cod/capelin/herring dynamics are used and it is therefore difficult to determine whether the differences in estimates with varying marine mammal abundance are due to the way in which the fish species are modelled rather than how the marine mammals are included.

5.2 Central North Atlantic

A model which explores potential interactions between several marine mammal species off Iceland and commercially important stocks that constitute their principal prey was presented in SC/5/ME/13. The analysis included three whale species - fin whale (*Balaenoptera physalus)*, minke whale (*Balaenoptera acutorostrata)* and humpback whale (*Megaptera novaeangliae*), two seal species - harbour seal (*Phoca vitulina)* and grey seal (*Halichoerus grypus)*, two fish species - Atlantic cod and capelin, and shrimp (*Pandalus borealis*). The inclusion of seals in the computations is a new and important addition to earlier models (Stefánsson et al., 1994; Stefánsson et al., 1995; Baldursson et al., 1996) for the area. In this model, cod act as both prey for the marine mammals, and as predator on capelin, shrimp, and young cod (cannibalism).

A single-species model of different harvest regimes of the Icelandic cod stock has been combined with a crude multispecies model to study the potential impacts of various developments of the marine mammal stocks on capelin and cod stocks. The model was run using a variety of assumptions regarding stock sizes, food preference, potential rates of increase and harvesting strategies. Simple aggregate population models were used to describe the marine mammal stocks, and the population and fisheries dynamics for shrimp and capelin were modelled using simple biomass-production models. Thus, only aggregates such as total, recruiting or adult numbers or biomass were considered for these species, as opposed to the fully age-class based cod model.

The impact of the five species of marine mammals on the development of the cod stock is uncertain. However, in the base run natural mortality from predation was estimated to be about twice that due to cannibalism and thus may be a major portion of natural mortality on the younger ages. Given the limited data on which the estimates of marine mammal consumption are based, it is important to improve understanding of the feeding habits of whales and seals in the area.

The main advantage of the approach used is model simplicity and thus clarity in terms of which factors affect which results. The simplicity comes at the expense of a lack of internal consistency, since each species group is modelled according to its own simplified approach and there is no possibility of examining the importance of spacial and temporal effects.

In the discussions that followed it was noted that although the residual natural mortality is unknown, it would have to be extremely large to change the effect of reducing whales on cod yield. However, the decrease in predation mortality which may be expected by reducing the numbers of marine mammal predators was compensated, to some extent, by increased cannibalism.

Recent information obtained from satellite telemetry and observed catches indicate that harp and hooded seals are seasonal migrants to Icelandic waters. They may provide an additional source of mortality on cod. It will be possible to estimate the level of predation by harp and hooded seals when more information on their movements and diet are obtained.
Paper SC/5/ME/14 described a statistically-based multispecies model framework, based on defining many stock components corresponding to areas, maturity stages, length and age groups. This approach allows for the possibility of using many different data sources in order to obtain a consistent set of parameters describing e.g. growth, migration, consumption and fishing. The main drawback of the methodology lies in the complexity and inherent difficulty in obtaining the adequately disaggregated data. The main advantage lies in the possibility of evaluating the effects of including spatial information and overlap as well as comparing information in different data sources.

This approach is similar to that described SC/5/ME/11. Although they provide a better understanding of the interactions between the components of the ecosystem, they are difficult to parameterize. The Working Group encourages this approach.

5.3 Northwest Atlantic

No models designed to assess the impact of the estimated harp or hooded seal consumption on commercial fish stocks in the Northwest Atlantic were presented. However, the Working Group was informed that work is currently underway to incorporate harp seal consumption into a sequential population analysis for NAFO Division 2J3KL cod (>Northern Cod=). The approach will be similar to that described in Mohn and Bowen (in press), which presents a two-species model (grey seals and Atlantic cod) describing the potential impact of seals on Eastern Scotian Shelf cod.

The difficulty of constructing multispecies models for the Northwest Atlantic was addressed by the Workshop on Interactions between Harp Seals and Commercial Fish in the Northwest Atlantic (see 5.4 below)..

5.4 Report of the Workshop on Harp Seal-Fishery Interactions in the Northwest Atlantic

Paper SC/5/13 presented the report from the Workshop on Harp Seal- Fishery Interactions held at Memorial University, St. Johns, Canada from 24 to 27 February 1997. The following is a summary of the main conclusions of the Workshop.

Population Size and Trends

The Workshop concluded that harp seal numbers in the Northwest Atlantic have increased since 1978, and that the best estimate of the 1994 total population size is around 4.5 million animals (although the precise size depends on what is assumed about the mortality of young animals). Animals are now growing more slowly, and the pregnancy rate is lower, than in the 1980s. These effects are expected when food becomes more difficult to find.

Harp Seal Diet

The diet of harp seals in the near shore waters of the Labrador-Newfoundland shelf is dominated by Arctic cod (*Boreogadus saida),* with some capelin and herring. In offshore waters the most important species are capelin and flatfish (mostly Greenland halibut). In both areas, Atlantic cod is a small, but apparently consistent, part of the diet. The proportion of Atlantic cod in the diet of harp seals does not appear to have declined in recent years, but this needs to be examined more carefully.

Effects on Commercial Fisheries

The Workshop could not assess whether or not harp seals were affecting commercial fish stocks - and Atlantic cod, in particular - on the Labrador-Newfoundland shelf. This was because there is an urgent need for an estimate of the size of the cod stock in both inshore and offshore areas, and for an assessment of the amounts of cod which are being taken by the other important predators (such as Greenland halibut, whales, and seabirds). When this information is available, it will be possible to analyse the effect of predation on the Atlantic cod stock.

Recommendations

A number of specific recommendations were made by the Workshop. The more general recommendations, summarised in order of priority, were:

1. There is an urgent need for an accurate estimate of the distribution and absolute abundance of young cod, in age-classes 0,1 and 2, in the inshore and offshore waters of NAFO divisions 2J, 3K and 3L.

2. The consumption of fish by harp seals in NAFO divisions 2J, 3K and 3L needs to be placed in context. There is therefore an urgent need for better estimates of the diet and consumption of fish by other predators in this ecosystem.

3. If the impact of higher predators on cod stocks is to be assessed, there is a need to extend the single species models which have been used to assess the status of cod stocks to include the effects of other predators.

4. Monitoring of the diet and pregnancy rate of harp seals should continue. More studies of the distribution of adult and young harp seals in NAFO divisions 2J, 3K and 3L using satellite transmitters are needed to refine the existing estimates of how much time is spent in the inshore and offshore waters of these divisions. Results from these studies should then be used to direct the sampling of harp seals for diet studies.

5. Existing information on the proportion of cod in the diet of harp seals in NAFO divisions 2J, 3K and 3L should be reanalysed to determine the statistical power of these data to detect trends over time, and to estimate the probability that this proportion has fallen to lower levels in recent years.

6. The model used to estimate abundance, trends in abundance, and replacement yields for harp seals in the Northwest Atlantic should explicitly incorporate variance in all of the inputs (i.e., catch at age**,** age-specific pregnancy, and pup production), by maximizing the combined likelihood over all available data. The sensitivity of this model to assumptions regarding longevity should also be investigated. The Workshop also recognized the fundamental importance of capelin in the Newfoundland-Labrador shelf ecosystem.

5.5 Theoretical consideration of multispecies models

In a discussion of the theoretical aspects of multispecies models, the Working Group noted that when ICES takes into account the results of multispecies models they usually only incorporate interactions among fish species. Marine mammal consumption is usually considered part of natural mortality in the normal assessments. However, in Iceland marine mammals have recently been incorporated into models used to understand the impact of long-term management strategies.

Because marine mammal stocks vary slowly, they have little effect on short term management goals which are more likely to be affected by fish/fish interactions. For long-term strategies, however, models should attempt to include long-term effects such as marine mammals.

A number of specific questions were considered by the Working Group.

i) What are the potential uses of multispecies models?
Multispecies models provide insight into a number of aspects of the ecosystem and the way in which various components may interact. As such they can be used to:

- improve our understanding of how different factors influence the ecosystem;
- identify gaps in knowledge;
- identify which uncertainties are important to answer the questions we pose and which are not;
- provide an indication of where research efforts should be directed to improve management advice;
- assess the possible effects of a given management strategy.

ii) What is the current state of multispecies modelling in the North Atlantic?
There are efforts to model multispecies interactions in the Barents and Norwegian Seas and Icelandic areas. The output of these models incorporating fish/fish interactions are being used in management. However, models explicitly incorporating marine mammals are not routinely used. The available models provide a general impression of interactions and illustrate the range of effects which may occur. However, it should be realised that the models are designed to answer questions concerning the impact of various components of the ecosystem on fish, particularly cod. They do not include marine mammal/marine mammal interactions nor the potential effect of the prey on the apex predator. The models described in SC/5/ME/11 and SC/5/ME /14 will, in theory, allow this to be modelled but there is presently a lack of the appropriate data.

iii) What conclusions can be drawn from the results of the available models?
It must be remembered that models are designed to answer specific questions and extreme care should be taken before extending the interpretations to answer questions that were not specifically posed when constructing the model. For example, comparing the yield in two runs with different scenarios of whale abundance is not quite the same as estimating the impact of changing the abundance of whales with the associated uncertainties. This may be addressed if the model is constructed with the question in mind. One approach may be to include a wide range of scenarios similar to that outlined in SC/5/ME/12.

Including marine mammals in the current multispecies models provides a more realistic estimate of the uncertainty in predictions of fish abundance.

iv) What should be done to improve the models?
Uncertainty in the parameters (e.g. stock estimates, food preferences, migration) should be included in the models to provide a realistic estimate of total uncertainty.

The factors influencing migration or prey selection are poorly understood. A good understanding of these processes is important and should be incorporated into the models.

Models should be constructed on the appropriate spatial and temporal scale for the various components.

6. FUTURE WORK - RECOMMENDATIONS

The results of studies presented to the Working Group indicate that minke whales, harp and hooded seals may have substantial direct and/or indirect effects on commercial fish stocks. To better under-
stand these effects, the Working Group **recommended** the following:

1) For each species, knowledge should be improved on seasonal, annual and spatial variations in:
- abundance
- distribution
- diet
- energy requirements
- prey abundance

Knowledge on each of these factors varies for areas and species. The degree of knowledge for each has been noted within the report and should be considered when developing specific research plans.

2) The understanding of prey selectivity and responses to changes in prey abundance by these predators should be improved. Little is known about these processes at the present time.

3) Estimates of consumption by other important predators should be obtained and the degree of potential competition assessed.

4) Multispecies models should be improved by:
- incorporating uncertainty in the parameters (e.g. stock estimates, food preferences,
  migration) to provide a realistic estimate of the total uncertainty;
- incorporating variations in migration and prey selection. An understanding of these processes is important, but they are not understood at present;
- constructing them on the appropriate spacial and temporal scale for the various components.

5) Efforts to construct multispecies models in the Northwest Atlantic should be encouraged.

7. ADOPTION OF REPORT

The report was adopted on 13 March 1997.

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Appendix 2

AGENDA

1. Opening remarks

2. Adoption of Agenda

3. Appointment of rapporteur

4. Feeding ecology of minke whales, harp seals and hooded seals in the North Atlantic

    4.1 NE-Atlantic
        4.1.1 Minke whales
        4.1.2 Harp seals
        4.1.3 Cod

    4.2 Central N-Atlantic
        4.2.1 Minke whales
        4.2.2 Harp seals
        4.2.3 Hooded seals

    4.3 NW-Atlantic
        4.3.1 Minke whales
        4.3.2 Harp seals
        4.3.3 Hooded seals

5. Interactions between marine mammals (minke whales, harp and hooded seals) and commercially important fish stocks - Multispecies modelling

    5.1 NE-Atlantic
    5.2 Central N-Atlantic
    5.3 NW-Atlantic
    5.4 Report of the Workshop on Harp Seal/Fisheries Interactions, St. John=s, February 1997.
    5.5 Theoretical consideration of multispecies models

6. Future work - Recommendations

7. Any other business

8. Adoption of report

Appendix 3

LIST OF DOCUMENTS

Working Group documents

SC/5/ME/4 Lars P. Folkow, Tore Haug, Kjell.T. Nilssen, and Erling S. Nordøy**,** Estimated food consumption of minke whales in Northeast Atlantic waters in 1992-1995

SC/5/ME/5 Jóhann Sigurjónsson and Anton Galan, Some information on stomach contents of minke whales (*Balaenoptera acutorostrata*) in Icelandic waters.

SC/5/ME/6 J. Lien, B. Sjare, M.O. Hammill and G. Stenson, Diet and Prey Consumption by Minke Whales in the Northwest Atlantic: A Review

SC/5/ME/7 Kjell.T. Nilssen, Ole Petter Pedersen, Lars P. Folkow & Tore Haug. Food consumption of Barents Sea harp seals.

SC/5/ME/8 Vladimir Potelov, Kjell T.Nilssen, Vladislav Svetochev & Tore Haug, Feeding habits of harp (*Phoca groenlandica*) and hooded seals (*Cystophora cristata*) during moult (April-June) in the Greenland Sea

SC/5/ME/9 Finn O. Kapel, Feeding habits of harp and hooded seals in Greenland waters

SC/5/ME/10 M.O. Hammill and G.B. Stenson, Estimated prey consumption by Harp seals (*Phoca groenlandica*), Grey seals (*Halichoerus grypus*), Harbour seals (*Phoca vitulina*) and hooded seals (*Cystophora cristata*) in the Northwest Atlantic.

SC/5/ME/11 Bjarte Bogstad, Multispecies interactions between minke whales, harp seals, herring, capelin and cod in the Barents Sea

SC/5/ME/12 Tore Schweder, Einar Hatlebakk and Gro S. Hagen, On the effect of whaling on other fisheries: Scenario experiments of the Barents- and Norwegian Sea

SC/5/ME/13 Gunnar Stefánsson, Erlingur Hauksson, Valur Bógason, Jóhann Sigurjónsson, and Gísli Víkingsson, Multispecies interactions in the C Atlantic

SC/5/ME/14 Gunnar Stefánsson and Ólafur K. Pálsson, A framework for multispecies modelling of Boreal systems

SC/5/ME/15 Pia Barner Neve, The diet of minke whales in West Greenland - a short review

Scientific Committee documents

SC/5/13 Report of the Workshop on Harp Seal-Fishery Interactions in the Northwest Atlantic: Toward Research & Management Actions, St. John=s, Newfoundland, Canada, 24-27 February 1997. Canadian Centre for Fisheries Innovation and Memorial University of Newfoundland: I-vi + 41pp.

3.3
REPORT OF THE SCIENTIFIC COMMITTEE WORKING GROUP ON SEALWORM INFECTION

1.-3. OPENING PROCEDURES

The Chairman of the Working Group, Geneviève Desportes (Faroes), welcomed participants to the meeting (see Appendix 1). She noted that the Working Group had been established by the Scientific Committee to address the following request forwarded from the Council of NAMMCO at its last meeting in March, 1996:

AAware that the population dynamics of the sealworm (*Pseudoterranova decipiens*) may be influenced by sea temperature, bathymetry, invertebrate and fish fauna, the Scientific Committee was requested to review the current state of knowledge with respect to sealworm infection and to consider the need for comparative studies in the western, central and eastern North Atlantic coastal areas, taking into account the priority topics recommended by the Scientific Committee and its *ad hoc* Working Group on grey seals≅ (*NAMMCO Annual Report 1996*: 28 & 111-116).

The draft Agenda was revised and adopted as contained in Appendix 2. Invited experts Sophie des Clers (UK) and Wayne Stobo (Canada) acted as rapporteurs.

4. REVIEW OF DOCUMENTS

Documents available to the Working Group (Appendix 3) were reviewed.

5. SEALWORM LIFE HISTORY

Electrophoretic analyses have revealed that there exist three sibling species of *Pseudoterranova decipiens*, termed A, B and C (Paggi et al. 1991). In the northwest Atlantic, sibling B is found in grey and harbour seals, sibling C in bearded seals, and sibling A is lacking. In the northeastern Atlantic and the Norwegian Sea, siblings A and B occur in both grey and harbour seals, with A more abundant in grey seals and B more abundant in harbour seals. Sibling C is also found in bearded seals in European Arctic waters. Di Deco et al. (1994) described the morphometric differences between mature males of these sibling species, but at present no clear morphological differences can be seen in immature stages or mature females.

These sibling species might have different life histories. The status of the sibling species is not clear in many of the studies performed on the eastern side of the North Atlantic, and on the western side it is assumed that only sibling B is found on the Grand Banks, the Scotian Shelf and the Gulf of St. Lawrence.

5.1 Invertebrate host

A review of available information on infections in invertebrates has shown that, although natural sealworm infections have not been found in copepods, harpacticoid and cyclopoid species are susceptible to infection in the laboratory. Natural infections have been found, however, in various macro-invertebrates (Table 1) (McClelland 1990; SC/5/SI/12). Experimental evidence from McClelland (1995) questioned the necessity for a copepod host, although participation of a copepod in the life cycle enhances transmission to the macro-invertebrate. To date, mysids appear to be the most probable macro-invertebrate intermediate host in Canadian waters (Martell and McClelland 1995; Marcogliese 1992; 1993a; 1996; Marcogliese and Burt 1993). In a worldwide context, groups other than mysids could be as important, depending on changes in local invertebrate communities with substrate etc. No new information was available on the growth or longevity of worms in invertebrate hosts. Host life spans vary between a few weeks or months for small hosts to one or two years for the largest hosts.

5.2 Small benthophagous fish

It was noted that the pepsin digestion technique on fresh fish was far superior than the candling technique for detecting small worms. Worms 2 -10 mm in length, similar in size to those described from invertebrate hosts, have been found with this technique (SC/5/SI/11). It is likely that small worms in fish had been missed before. New information on naturally infected small fish species has been presented where density of infection could be very high (Table 2). Benthic feeders have the highest density of worms (McClelland 1995). It was noted that, density of infection (nos. of worms / unit host weight) was more relevant than sealworm abundance (mean nos of worms / host) in quantifying transmission at this level.

In the Northwest Atlantic, distinguishable modes were found in the length frequency distributions of worms in small fish. The modality in worm lengths also suggested a possible seasonal pulse of infections which may be linked to seasonal changes in availability of macro-invertebrate hosts such as mysids (Martell and McClelland 1995). Similar modes in the size distribution of worms were observed in Norwegian fish for three anisakid species (Andersen pers. comm.).

The high level of infection in these fish indicates the magnitude of the long-lived sealworm reservoir in the environment. The dynamics of bullrout as a reservoir host of sealworm have been described (Aspholm et al. 1995).

5.3 Piscivorous fish

As investigations continue, more piscivorous fish species have been found to be infected (Andersen et al. 1995; Marcogliese 1995). Young fish are infected when they feed on benthic crustaceans. In some cases an increase in infection has been observed as fish change diet to become piscivorous (cod - McClelland et al. 1990; sculpins - SC/5/SI/4). In some systems, there was a decline in infection observed in the largest and oldest fish (SC/5/SI/10). Within the oldest age-classes Andersen found a decrease in the levels of infection of the larger fish (SC/5/SI/4). These declines could be due to death of worms, death of the most heavily infested fish, or due to emigration and immigration of fish. Finally, as abundances of larval sealworm increase, an inverse relationship between infection levels and host size or age may develop in fish species which accumulate most

of their nematodes when they are young (McClelland et al 1990; Martell and McClelland 1995)

Larval sealworm may survive indefinitely in fish hosts. Hemmingsen et al. (1993 & pers. comm.) report no evidence of worm mortality in captive cod after four years, while in Canada, there was evidence neither of mortality, nor encapsulation of sealworm in plaice held in the laboratory for five to six years (SC/5/SI/10; Marcogliese pers. comm.). Evidently, the parasites continue to migrate in the flesh of plaice throughout the course of infection (McClelland pers. comm.).

5.4 Seals

There is no new information to resolve the magnitude of host response in grey seals or harbour seals to different levels of worm abundance. Worm survival in seal stomachs has not been quantified, but an on-going project at Dalhousie has indicated that egg production was still significant from worms in captive grey seals six months after exposure (McClelland, pers. comm.). Individual worm fecundity (number of eggs *in utero*) increases with worm length (McClelland 1980; Marcogliese, pers comm). In a study in progress, the lengths of >20,000 mature sealworm and *Contracaecum osculatum* from Nova Scotian grey and harbour seals have been determined in an effort to analyse variations in size and fecundity of the nematodes with host species, age (size) and geographical origin, time of year, and worm densities in host stomachs (McClelland, pers. comm.). Fecundities will be estimated from nematode fecundity/length regressions based on subsamples of worms from each host species.

So far, there has been no evidence of a reduction in worm fecundity with total or specific worm infection levels (sealworm and *Contracaecum*, Marcogliese, pers.comm.). Both McClelland (1982) and Brattey (1990) reported experimental egg hatching rates greater than 90%.

5.5 Recommendations / Research needs

The Working Group concluded and recommended the following:

- Pepsin digests should be used for large-scale invertebrate surveys;
- Experimental research is needed to study possible changes of behaviour for infected hosts;
- The pepsin digestion technique on fresh fish is far superior to candling procedures:
- Further analyses of the samples already collected from seal stomachs are needed to improve our knowledge of worm fecundity.
- In order to model the system, experimental work is required to estimate the worm=s total fecundity, including the duration of prepatency and of egg production period (patency);
- In the Northeast Atlantic processing of existing samples for sealworm abundances in different seal species should be completed;
- In the Northwest Atlantic, further parasite data should be collected in the Gulf of St. Lawrence from harp seals to determine the extent to which they are contributing to sealworm levels in groundfish.

6. ENVIRONMENTAL FACTORS INFLUENCING THE LIFE CYCLE

6.1 Temperature

Recent experimental work shows that sealworm eggs do not hatch in water temperatures below 0E C (Measures 1996). This may explain a decline in sealworm infection observed in grey seals (Marcogliese et al. 1996), cod and plaice (Boily and Marcogliese 1995) following a period of cold waters in the Gulf of St Lawrence after 1988 (see Figure 1). Similarly, McClelland presented results showing reduced infection levels in plaice on the Breton and Scotian shelves and the Gulf of Maine, and attributed them to lower water temperatures (SC/5/SI/10).This event may also explain a reduction in the proportion of mature worms from Sable Island grey seals in 1989 (SC/5/SI/15). Sealworm levels subsequently rebounded in certain locations in the southern Gulf of St. Lawrence and the Scotian-Fundy fisheries (Figs. 2 & 3). It was noted that there was limited sea temperature data other than from satellite for inshore areas along the Canadian coast; in the central and Northeast Atlantic, inshore data are more readily available.

6.2 Bathymetry

Sealworm infections are prevalent on the continental shelf and are not found in deep water systems beyond the shelf edge and some Norwegian fjords. Infected fish caught in deeper waters are assumed to be migrants from the shelf.

6.3 Other factors

The species composition of invertebrate and small fish communities may vary substantially with substrate type, and may cause extensive local variability in infection levels (SC/5/SI/4; SC/5/SI/5; SC/5/SI/14).

Marcogliese mentioned a forthcoming theoretical study of sealworm egg dispersion by marine currents (McConnell et al. in press).

6.4 Recommendations / Research needs

The Working Group agreed that further work was needed to:

- investigate the role of sea temperature on sealworm transmission and development;

- gather long term time series of sea temperature and sealworm infection in fish from cold water areas (near the 0EC threshold) on both sides of the North Atlantic in order to monitor possible effects of climate change;

- examine the relationship between distribution of sealworm infections in fish and seals with sea temperature for near shore waters around Iceland, Norway and the UK using a Geographical Information System (GIS);
- categorize habitat types (substrate, vegetation, invertebrate and fish communities) in order to compare infection rates between seal and fish populations.

7. BEHAVIOURAL FACTORS INFLUENCING HOST WORM LEVELS

7.1 Macro-invertebrates

Evidence from other parasitic worm systems (Buckner et al. 1978) show that invertebrates found in the stomachs of predators are more heavily infected with larval helminths than those sampled from invertebrate populations at large. This would suggest that infected invertebrate hosts could be more susceptible to predation than non-infected ones. McClelland observed behavioural aberrations in infected copepods (1982) and amphipods (1990).

7.2 Fish

Sealworm infections may reduce swimming speed in fish (Sprengel and Luchtenberg 1991). Sealworms have been found to secrete volatile ketones while in the musculature of the fish which could have an anaesthetic effect (McClelland 1995 and pers. comm.). Various members of the Working Group also speculated that, through their behaviour, activity patterns and habitat selection, individual fish, such as "red" inshore cod, may be exposed to infection more frequently. More information needs to be analysed on the extent of migration and movements of such fish.

7.3 Seals

In harbour seals in a patchy habitat, individual differences in foraging behaviour appear to be persistent (Bjørge et al. 1995). Thus differences in individual seal foraging may explain some of the high variability of sealworm abundances in seals, and only a few heavily infected seals may be needed to maintain high infections in fish in small, relatively confined areas. This has been illustrated in an isolated brackish pond on Sable Island (Canada) where a small number of harbour seals caused extremely high levels of infection (>4000 worms/kg) in sticklebacks (Marcogliese 1996).

7.4 Recommendations / research needs

The Working Group agreed that further research was needed in the following areas:

- Experimental work is needed to estimate the extent of increased susceptibility to predation of infected invertebrates and fish;

- The habitat use and foraging behaviour of individual seals needs to be studied and taken into account in assessments of the harbour seal as host for *Pseudoterranova decipiens* in a patchy environment

8. TEMPORAL AND SPATIAL VARIATIONS IN LEVELS OF SEALWORM INFECTION

8.1 Long-term trends

In Canada, surveys of Canadian plaice (*Hippoglossoides platessoides*) conducted since 1980 have revealed complicated long term trends in larval sealworm infection levels, with a general increase throughout the 1980s (McClelland et al. 1983a;1983b; 1985, 1987,

1990) followed by a decline in some areas after 1990 (Figures 2 & 3). The decline has been attributed to a cold water event, which may have had a direct negative effect on embryonation and hatching of sealworm eggs (Boily and Marcogliese 1995; Marcogliese 1995), but which may also have influenced transmission of the parasite indirectly, through changes in distributions and abundances, and hence, availability of important intermediate hosts (SC/5/SI/10). By 1995-96, infection levels in plaice from many sites in the southern Gulf of St. Lawrence, Breton and Scotian Shelves, and southwestern Nova Scotia had begun to increase again (SC/5/SI/10; Figures 2 & 3).

In grey seals from Sable Island, data collected in 1983 and 1989 have shown no evidence of changes in sealworm levels within seal age groups (SC/5/SI/15), although the grey seal population has been increasing by over 12% annually during that period (Stobo & Zwanenburg 1990). Two surveys (1985-87 and 1988-92) have shown that sealworm abundances have declined in both adult and juvenile grey seals from eastern Nova Scotia, and have also fallen in juvenile and adult harbour seals in the Bay of Fundy (McClelland pers. comm.; SC/5/SI/16). In the northern Gulf of St. Lawrence, Marcogliese et al. (1996) found a decline in sealworm levels in grey seals for several age groups, although the population size was increasing (Zwanenburg and Bowen 1990). These declines parallelled declines in cod (Boily and Marcogliese 1995).

In Iceland, there were no changes in infection levels in cod in three surveys conducted in 1980-1985, 1988 and 1990-91(SC/5/SI/14). Similarly, Icelandic surveys of sealworm levels in grey seals of 4 years and older, conducted in 1979-82 and 1989-93, also showed no changes (Ólafsdóttir and Hauksson, submitted), although there has been a progressive reduction in the grey seal population since 1986 (SC/5/SI/14).

8.2 Medium-term trends

Although Norway has no long-term time series of seal abundance or sealworm infection in cod, a five year study (1990-94) in the Oslofjord has followed the effect of the common seal epizootic of 1988. Although the epizootic killed two thirds of the harbour seals in the North Sea region, no changes were observed in sealworm infections in cod and sculpins (des Clers and Andersen 1995; Aspholm et al. 1995).

Surveys of nematode infections in various fish and seal species in Norwegian waters have been made in different localities, and are continuing (Aspholm pers. comm.). Sealworm levels in cod were documented in detail in the 1960s in the UK (des Clers 1991) and an annual survey of sealworm levels in cod from Scottish waters took place between 1990 and 1994 (SC/5/SI/9).

8.3 Seasonal trends

A complex set of seasonal changes in seal behaviour, fish migration and environmental factors are likely to create seasonal variations in sealworm transmission.

It has been suggested that sealworm infections in plaice and small benthic feeding fish in offshore areas (SC/5/SI/11) could be linked to the local availability of mysids and acquired mainly in the winter or early spring. In Norway and the UK, circumstantial evidence suggests that young cod born late in the spring may only become infected in their

second year, while early recruits may be infected in the first year of life, pointing to a limited window of transmission from invertebrate hosts (des Clers pers.comm.).
In a small sample of harbour seals, Pálsson (1977) observed that sealworm levels were lower in seals which consumed capelin than in those preying on demersal species. However, this was not confirmed in a more extensive sample from 1979-82 (SC/5/SI/14).

Along the west coast of Iceland, changes in the activity patterns of grey seals during breeding resulted in reduced mobility and local foraging on heavily infected fish species such as bullrout (SC/5/SI/14).

Surveys of nematode infections in various fish and seal species have been conducted in Norwegian waters (Aspholm, pers comm). Analyses of seasonal variations in infection levels are ongoing.

8.4 Spatial variability

A long term time series of larval sealworm infection levels in *Hippoglossoides platessoides*, surveyed throughout Atlantic Canada (SC/5/SI/10), has revealed complex patterns in the temporal and spatial distributions of the parasite. However, the highest infection levels were generally recorded in fish from areas of high grey seal density such as Sable Island Bank.

In Icelandic waters sealworm abundance was significantly lower in long rough dab and bullrout from north eastern Iceland compared to other areas (SC/5/SI/14).

On a more local scale, high infection levels in fish were observed close to seal haul-out sites in the Oslofjord, Norway (Andersen et al. 1995; Aspholm et al. 1995; SC/5/SI/4, SC/5/SI/5) and in Varangerfjord, northern Norway (SC/5/SI/6).

8.5 Recommendations / research needs

The Working Group concluded and recommended the following:

- There is a need for a standardized sampling protocol to be developed for long term sampling programmes;.

- There is a need to establish long-term time series in the Central and Northeast Atlantic. Associated biotic and abiotic information should be collected in order to allow comparison of data between years and sites;

- Caution is needed in the interpretation of infection levels in seals when sample sizes are small. No recommendation could be devised as to the most suitable age group of seals to be sampled;

- There is a need to define the abiotic and biotic systems involved in each study area since the variability of *P. decipiens* is related to very different spatial scales.

9. DYNAMICS OF SEALWORM INFECTIONS

9.1 Influence of seal abundance

In the long-term there appears to be a relationship between increasing worm infections in fish and seal abundance. However, various evidence presented to the Working Group indicated in the short term a lack of direct correspondence between changes in seal abundance and response in sealworm infection levels. In the Northwest Atlantic, grey seal populations have been increasing at rates of 6-12% annually while sealworm infection levels have shown increases, decline, or stability in various intermediate hosts. In Iceland, sealworm infections in fish have remained stable despite a reduction in the grey seal population. In the Northeast Atlantic, the 1988 epizootic reduced the harbour seal population by two thirds, yet the infection levels in various intermediate hosts have shown no declines, or only a temporary decline restricted to the year following the epizootic.

Evidence was presented which suggested that differences in behaviour between harbour seals and grey seals are consistent over the North Atlantic, and when both seal species are present, grey seals have heavier infections than harbour seals (McClelland 1980). The distributions of seals, and hence the magnitude and scope of their impact on worm levels in fish, however, is greatly influenced by the extent of the continental shelf. As a consequence of the narrow shelf found in some areas of the northeast Atlantic, movements of grey seals are restricted to coastal areas where their range often overlaps that of harbour seals. Although harbour seals are less abundant than grey seals in many areas, they may transmit high local infections to fish (Norway, Germany and UK) because of their limited foraging range.

Investigations reveal that when harp seals enter the coastal waters of northern Norway, their anisakid nematode communities come to resemble those of grey seals (SC/5/SI/6).

The Working Group concluded that:

i) sealworm infection levels in intermediate hosts are not necessarily correlated with seal abundance changes, at least in the short and medium terms. The impact of changes in seal abundances may be mitigated by other factors such as environmental temperature and intermediate host abundance and distribution;

ii) the presence of either grey seals or harbour seals can lead to sealworm infections in fish over the entire North Atlantic region. Reduction of either species may not therefore result in a significant reduction in sealworm infections in fish.

iii) individual worm levels in seals vary to such an extent that a few seals can still maintain high infection levels in fish;

iv) although harbour seals are less abundant than grey seals in many areas, they could be responsible for high local infections in fish because of their limited foraging range.

9.2 Miscellaneous: other parasite species

In seals, the examination of other parasite species is important as it provides corroborative information on the diets and migratory activities of the hosts, and on possible impacts of large scale environmental changes. This was noted for *Contracaecum* and *Pseudoterranova decipiens* in grey seals from Anticosti Island in Canada (Marcogliese et al. 1996) and in grey seals from the eastern shore of Nova Scotia (McClelland pers.comm.).

9.3 Recommendations / research needs

Given that in Iceland: i) the grey seal population has been reduced from 14,000 to 8,000 between 1986 and 1995; ii) a major survey of sealworm in Atlantic cod is underway; and iii) historical data on levels of sealworm infection in seals and cod exist, the Working Group **recommends** that an intensive survey of anisakid nematodes in grey seal stomach be undertaken in Iceland at the same time. This represents a unique opportunity to examine the relationship between sealworm levels in fish and seals, and a dramatic reduction in a grey seal population. Such a project should be initiated as soon as possible before the population grows to former levels. Other seal prey species known to be important hosts for sealworm (e.g. bullrout) should also be surveyed.

10. MODELLING OF SEALWORM INFECTION

The Working Group agreed that modelling was now a priority in order to bring together and analyse the considerable amount of new data collected since the last workshop (Bowen (ed.) 1990). Although some needs for further data collection were identified by the Working Group, it was agreed that enough new information was available to make a substantial advance over previous modelling efforts. It was also agreed that more than one modelling approach was desirable. Models should originally be developed for a specific system (e.g. main seal species, specific geographical location and fish and invertebrate communities). However, models should also be applied to other systems in order to test the universality of underlying assumptions.

The prime reason for modelling would be to provide insight to marine resource managers on the main factors influencing the dynamics of the host-parasite system. Predictive capability is required to assess the likelihood of effectively controlling infections in exploited fish species. In systems where control is likely, the models should provide a means to assess the results of proposed control measures.

Optimally, the models need to be kept as simple as possible, while taking into account the main features of the interactions between hosts and parasites and the dynamics at each host level. For example, the growth of fish could be described for both non-exploited and exploited key fish species. In many Central and Northeast Atlantic systems, the migration patterns of key fish species may also need to be modelled. Recent observations in the Gulf of St. Lawrence suggest that environmental changes may have had substantial threshold effects on the ability of sealworm eggs to hatch. This mechanism should be included in modelling that system. Models constructed should be able to account for situations where abundance of sealworm in groundfish is not correlated with abundance in seals.

Recommendation

The Working Group **recommends** that a workshop be convened to undertake the modelling exercise, involving both modellers and those familiar with the various biological systems in the North Atlantic. Any modelling exercise should include alternative approaches.

11. NEEDS FOR COMPARATIVE STUDIES IN THE NORTH ATLANTIC

In order to test the universality of sealworm models, there is a need for comparative studies. This can only be achieved through the development of long-term databases on sealworm infections for systems in the Northeast and Central Atlantic, and the development of comparable data sets for inshore systems from the Northwest Atlantic.

12. FUTURE WORK - RECOMMENDATIONS

In addition to the specific recommendations and research needs identified under the items above, the Working Group also **recommends** that:

- the question of sibling species in *P. decipiens* should be resolved, as well as the possibility of variations in the life history of these sibling species;

- Investigations of invertebrate infections using the pepsin digest methods should be increased;

- the relationship between fecundity and sealworm size should be established;

- due to the continuing concern regarding *P. decipiens* in the North Atlantic, research efforts to resolve the relationships between parasite and hosts should be enhanced.

13. ADOPTION OF REPORT

The report was adopted at 00:40, 13 March 1997.

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Appendix 1

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Appendix 2

AGENDA

1. Opening remarks
2. Adoption of Agenda
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4. Review of documents

5. Sealworm life history
   - 5.1 Invertebrate hosts
   - 5.2 Small benthophagous fish
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6. Environmental factors influencing life cycle
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7. Behavioural factors influencing host worm levels
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8. Temporal and spatial variation in sealworm burdens
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9. Dynamics of sealworm infections
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10. Modelling of sealworm infection
11. Needs for comparative studies in the North Atlantic
12. Future work - Recommendations
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Appendix 3

LIST OF DOCUMENTS

SC/5/SI/4	K. Anderson, Population structure of *Pseudoterranova decipiens* in the common sculpin (*Myxocephalus scorpius*) from two areas in Norway.
SC/5/SI/5	S-G.Lunneryd, P. E. Aspholm & K.I. Ugland, Sealworm (*Pseudoterranova decipiens*) Infection Dynamics in Colonies of Harbour Seals (*Phoca vitulina*).
SC/5/SI/6	K.I. Ugland & P. E. Aspholm, Communities of gastric nematodes in grey seals and harp seals off the northeastern coast of Norway.
SC/5/SI/7	A. Bjørge, The Significance of Behavioral Traits in Seals Exposure to Cod Worm.
SC/5/SI/9	S. des Clers, et.al. Monitoring sealworm infections in Scottish cod (*Gadus morhua*) landings.
SC/5/SI/10	G. McClelland, R.K. Misra, and D.J. Martell. Spatial and temporal variations in prevalance and abundance of larval sealworm, *Pseudoterranova decipiens* (Nematoda: Anisakinæ), in Amercian plaice, *Hippoglossoides plantessoides*, in eastern Canada.
SC/5/SI/11	G.McClelland, and D.J. Martell, Juvenile Canadian plaice (*Hippoglossoides platessoides*), and other small benthic consumers as primary fish hosts of larval sealworm (*Pseudoterranova decipiens*) in eastern Canada.
SC/5/SI/12	D.J. Marcogliese, Distribution and abundance of sealworm (*Pseudoterranova decipiens*) in macroinvertebrate hosts in eastern Canada.
SC/5/SI/13	D.J. Marcogliese, Distribution and abundance of sealworm (*Pseudoterranova decipiens*) and other anisakid nematodes in fish and seals in the Gulf of St.Lawrence: potential importance of climatic conditions.
SC/5/SI/14	D. Ólafsdóttir, Sealworm (*Pseudoterranova decipiens* sensu lato) infections in Icelandic common and grey seals and their fish prey.
SC/5/SI/15	W. Stobo and G.M. Fowler, Sealworm (*Pseudoterranova decipiens)* dynamics in Sable Island grey seals (*Halichoerus grypus*): seasonal fluctuations and changes in total burdens during the 1980s.
SC/5/SI/16	G. Mc Clelland, Anisakine nematodes in grey (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) from the Gulf of St.Lawrence, eastern Nova Scotia and the lower Bay of Fundy. (Summary)

Table 1. List of invertebrates naturally infected with sealworm (*Pseudoterranova decipiens*). Abundance values, expressed as number per 1000 are provided when available.

Species	Location	Year	Abundance	Reference
Crustacea				
Amphipoda (Gammaridea)				
Marinogammarus obtusatus[1]	White Sea	1984	7.5	Val'ter (1987)
Gammarus lawrencianus	Northwest Arm, N.S.	-	1.5	McClelland (1990)
Unciola irrorata[2]	Northwest Arm, N.S.	-	2.0	McClelland (1990)
Americochestia megalophthalma	North beach, Sable Island	1990 1991	4.6 1.3	Marcogliese (1993a) Marcogliese (1993a)
Amphiporeia virginiana	South beach, Sable Island	1991	2.5	Marcogliese (1993b)
Gammarus spp.[3]	Wallace Lake, Sable Island	1992 1994	0.5 0.3	Marcogliese (1996) Marcogliese (1996)
Amphipoda (Caprellidea)				
Caprella septentrionalis[4]	White Sea	-	-	Val'ter (1978)
Isopoda				
Idothea neglecta[5]	Norway	-	-	Bjørge (1979)
Decapoda				
Sclerocrangon boreas	Barents Sea	-	-	Uspenskaya (1963)

[1] 1047 specimens of *m. obtusatus* were collected from Passamaguoddy Bay, N.B. in 1991. No sealworm were found (Marcogliese and Burt, 1993).

[2] 3874 specimens of *U. irrorata*, and a total of 17, 800 amphipods belonging to 35 species were collected from Sable Island Bank in 1989-90. No sealworm were found (Marcogliese pers.comm.; SC/5/SI/12).

[3] Amphipods were reported as *Gammarus oceanicus* in Marcogliese (1992) and *G. oceanicus* and *Gammarus setosus* in Marcogliese (1993a). However, there since has been some disagreement among experts who have examined specimens of *G. setosus*, one claiming it is *G.setosus* and another, *G. lawrencianus*. For that reason they were reported as *Gammarus spp.* in Marcogliese (1996).

[4] 1664 specimens of *Caprella linearis* were collected in Passamoguoddy Bay, N.B. in 1991. None were infected with sealworm (Marcogliese and Burt, 1993).

[5] These infected specimens were collected from the stomach contents of fish.

Table 1 continued

Species	Location	Year	Abundance	Reference
Mysidacea				
Mysis spp.	Bras d'Or Lakes, N.S.	1960	0.6	Scott and Black (1960)
Mysis mixta	Bras d'Or Lakes, N.S.	-	-	Scott and Black (1960)
	Sable Island, N.S.	-	-	Martell and McClelland (1995)[5]
Neomysis integer	Elbe estuary	-	-	Lick (1991)
Neomysis americana	Wallace Lake, Sable Island	1990	1.1	Marcogliese (1992)
		1991	0.9	Marcogliese (1993a)
		1994	4.0	Marcogliese (1996)
	Middle Wallace Lake, Sable Island	1990	1.5	Marcogliese (1992)
	Sable Island Bank	1995	2.3	Marcogliese (1996)
Mysis stenolepis and/or *Neomysis americana*	Bras d'Or Lakes, N.S.	1993	0.2	Jackson et al. (in press)
	St. Ann's Bay, Cape Breton Island, N.S.	1993	0.5	Jackson et al. (in press)
Annelida (Polychaeta)				
Lepidonotus squamatus	White Sea	1962-64	1.0	Val'ter and Popova (1974)

Table 2. Levels of larval sealworm (*Pseudoterranova decipiens*) infection in small benthic consumers in Norway, Iceland and Canada.

Host				*P.decipiens* levels		
Species	Length (cm)	Location	n	Prev (%)	Abd.	Dens. (no.kg^{-1})
Lophius americanus (Juvenile)	≤30	Canada - Sable Is.	15	60	5.07	21
		SW Nova Scotia	27	7	0.07	1
Ciliata mustela	?	Norway - Hvaler	10	80	2.50	26
Enchelyopus cimbrius (mature)	?	Norway - Hvaler	195	14	0.16	1
	15-30	Canada - E Nova Scotia	23	52	2.82	29
		Sable Is.	56	89	3.91	117
		SW Nova Scotia	9	33	0.67	14
	4-24	Atlanticosti Is.	35	0	0	0
Gadus morhua	19-56	Iceland - Breidfj.	31	52	1.74	5.7
	12-14	Lodmundarfj.	16	25	1.38	2
	18-45	Norway - Vega	414	41	4.8	4
		Hvaler	128	63	10.0	26
	21-30	Canada - E Nova Scotia	50	52	1.18	8
		Sable Is.	42	67	1.81	11
		SW Nova Scotia	36	50	1.36	9
Melanogrammus aeglefinus (juv.)	21-30	Canada - Sable Is.	81	36	0.72	4
		SW Nova Scotia	38	3	0.03	<1
Pollachius virens (juv.)	17-42	Iceland - N-Faxaflói	73	43	2-11	6.8
	<40	Canada - SW Nova Scotia	70	3	0.03	<<1
Urophycis tenuis (juv.)	21-30	Canada - Sable Is.	129	13	0.39	3
		SW Nova Scotia	57	2	0.02	<<1
	≤30	Anticosti Is.	18	0	0	0
		St. George's Bay	31	10	0.10	<1
Apeltes quadracus (mature)	3	Canada - Sable Is. (pond)	24	62	2.50	4233
Gasterosteus aculeatus (mature)	3	Canada - Sable Is. (pond)	74	44	1.30	927
Labrus bimaculatus	≤20	Norway - Hvaler	5	40	1.80	-
Lycodes reticulatus	←30	Canada - E Nova Scotia	30	38	0.56	7
Lycodes vahlia	≤30	Canada - E Nova Scotia	100	32	0.49	3
		Sable Is.	13	62	2.62	27
Macrozoarces americanus (juv.)	≤30	Canada - SW Nova Scotia	58	47	1.28	22
	≤50	St. George's Bay	21	48	1.00	3
Zoarces viviparus	?	Norway - Hvaler	3	33	0.33	30

Table 2 continued

Host			*P.decipiens* levels			
Species	Length (cm)	Location	n	Prev (%)	Abd.	Dens. (no.kg^{-1})
Eumesogrammus praecisus (mature)	9-20	Canada - E Nova Scotia	46	20	0.20	7
	14-39	SW Newfoundland	19	0	0	0
Lumpenus lumpretaeformis (mature)	13-42	Canada - E Nova Scotia	11	9	0.09	3
Pholis gunnellus (mature)	?	Norway - Vega	1	100	1.00	110
Cryptacanthodes maculatus (juv.)	≤40	Canada - Sable Is.	11	36	0.64	12
Callionymus lyra	7-15	Norway - Vega	3	-	-	39
Agonus olophractus	8-12	Norway - Hvaler	2	-	-	80
Artediellus atlanticus (mature)	4-9	Canada - E Nova Scotia	59	5	0.05	11
		Sable Is.	41	51	1.76	375
		SW Nova Scotia	30	0	0	0
		Bradelle Bank	10	0	0	0
Hemitripteris americanus (juv.)	≤20	Canada - Sable Is.	22	81	13.41	157
		SW Nova Scotia	19	42	0.95	11
Myoxocephalus octodecemspinosus	≤20	Canada - Sable Is.	44	84	5.57	187
		SW Nova Scotia	20	10	0.20	5
	≤30	SW Newfoundland	17	6	0.12	<1
		St. George's Bay	55	31	3.36	19
Myoxocephalus scorpius	8-31	Norway - Vega	248	76	23.2	176
	10-36	Hvaler	172	19	26.1	209
	17-31	Iceland - Breidafj.	60	92	30.50	150
	17-30	N-Faxaflói	71	100	95.20	340
	15-30	Lodmundarfj.	21	76	3.70	10
	≤30	Canada - Anticosti Is.	121	23	1.33	5
		St. George's Bay	13	43	1.43	3
Taurulis bubalis	8-10	Norway - Vega	2	50	1.50	50
		Hvaler	8	62	-	46
Triglops murrayi (juv. mature)	4-16	Canada - E Nova Scotia	63	33	0.52	41
		Sable Is.	152	68	3.31	405
		SW Nova Scotia	156	8	0.12	17
		SW Newfoundland	19	0	0	0
		Anticosti Is.	36	0	0	0
		Bradelle Bank	77	0	0	0

Table 2 continued

Host				*P.decipiens* levels		
Species	Length (cm)	Location	n	Prev (%)	Abd.	Dens. (no.kg $^{-1}$)
Aspidophoroides monopterygius (mature)	8-18	Canada - E Nova Scotia	17	6	0.06	14
		Sable Is.	51	49	1.04	285
		SW Nova Scotia	38	0	0	0
Eumicrotremus spinosus (mature)	3-9	Canada - Sable Is.	72	46	0.82	65
	3-12	Anticosti Is.	33	0	0	0
Scophthalmus aquosus (juv.)	≤20	Canada - Sable Is.	55	85	3.22	62
Glyptocephalus cynoglossus (juv.)	25-49	Iceland - Selvogsgrunn	56	18	0.21	<1
	21-30	Canada - E Nova Scotia	22	18	0.27	3
		Sable Is.	60	15	0.32	4
		SW Nova Scotia	17	24	0.41	4
	≥30	SW Newfoundland	10	0	0	0
		Gulf North Shore	32	0	0	0
		Gospé	78	0	0	0
		Bradelle Bank	20	5	0-10	<<1
Hippoglossoides platessoides (juv.)	?	Norway - Vega	10	50	1.40	14
	20-29	Iceland - Látrabjarg	40	35	0.75	6
	10-19	Selvogsgrunn	5	40	2.00	39
	20-29	Selvogsgrunn	51	82	4.61	39
	20-29	Hornafj.	42	88	2.52	14
	10-19	Langanes	4	50	1.00	19
	20-29	Langanes	57	60	1.28	10
	10-19	Húnaflói	46	50	0.89	29
	20-29	Húnaflói	75	70	1.96	16
	11-20	Canada - E Nova Scotia	83	33	0.46	14
		Sable Is.	165	72	5.44	186
		SW Nova Scotia	67	55	1.60	42
Limanda limanda	?	Norway - Hvaler	33	10	0.10	<<1
	13-29	Iceland - Breidafj.	16	0	0	0
Pleuronectus ferrugineus	≤20	Canada - E Nova Scotia	20	0	0	0
		Sable Is.	121	22	0.32	10
		SW Newfoundland	22	0	0	0
Pleuronectes platessa	?	Norway - Hvaler	71	1	0.01	<<1
	14-34	Iceland - Breidafj.	7	0	0	0
		N-Flaxaflói	18	11	0.11	<1
Reinhardtius hippoglossoides	14-30	Canada - E Nova Scotia	11	0	0	0
		Sable Is.	18	11	0.22	2
	≤30	Anticosti Is.	99	0	0	0

Figure 1. Bottom surface area where temperatures are <0°C in the southern Gulf of St. Lawrence (from D. Swain, DFO, Canada, see SC/5/SI/13).

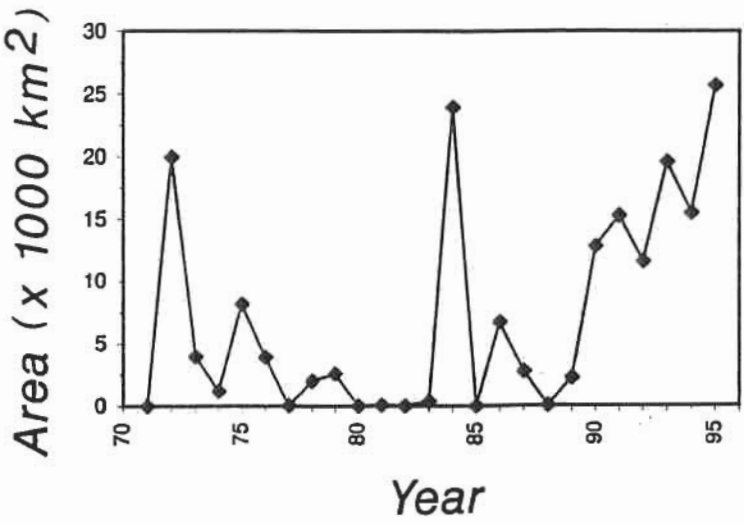


Figure 2. Plot of eastern Canada indicating locations where samples of Canadian plaice (*Hippoglossoides platessoides*) in the 31-40 cm length range were collected for surveys of the spatial and temporal distributions of larval sealworm (*Pseudoterranova decipiens*) between 1980 and 1996.

Key to locations: 1. Chéticamp; 2. St. George's Bay; 3. Magdelen Islands; 4. Smokey Channel; 5. St. Ann's Bank; 6. Louisbourg Hole; 7. East Banquereau; 8. Central Banquereau; 9. West Banquereau; 10. North Sable Island; 11. East Sable Island; 12. S.W. Sable Island; 13. Western Bank.

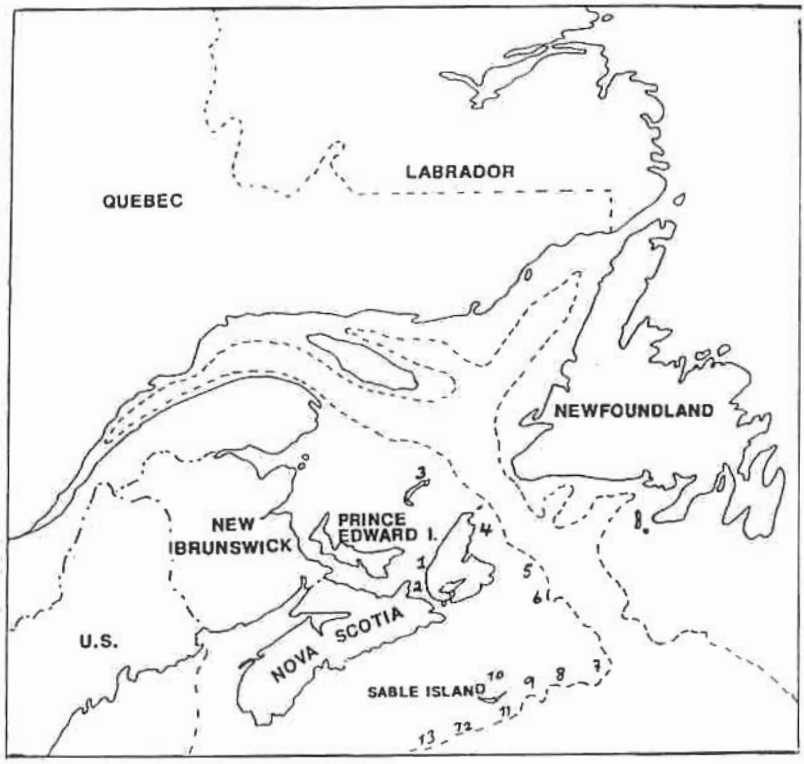
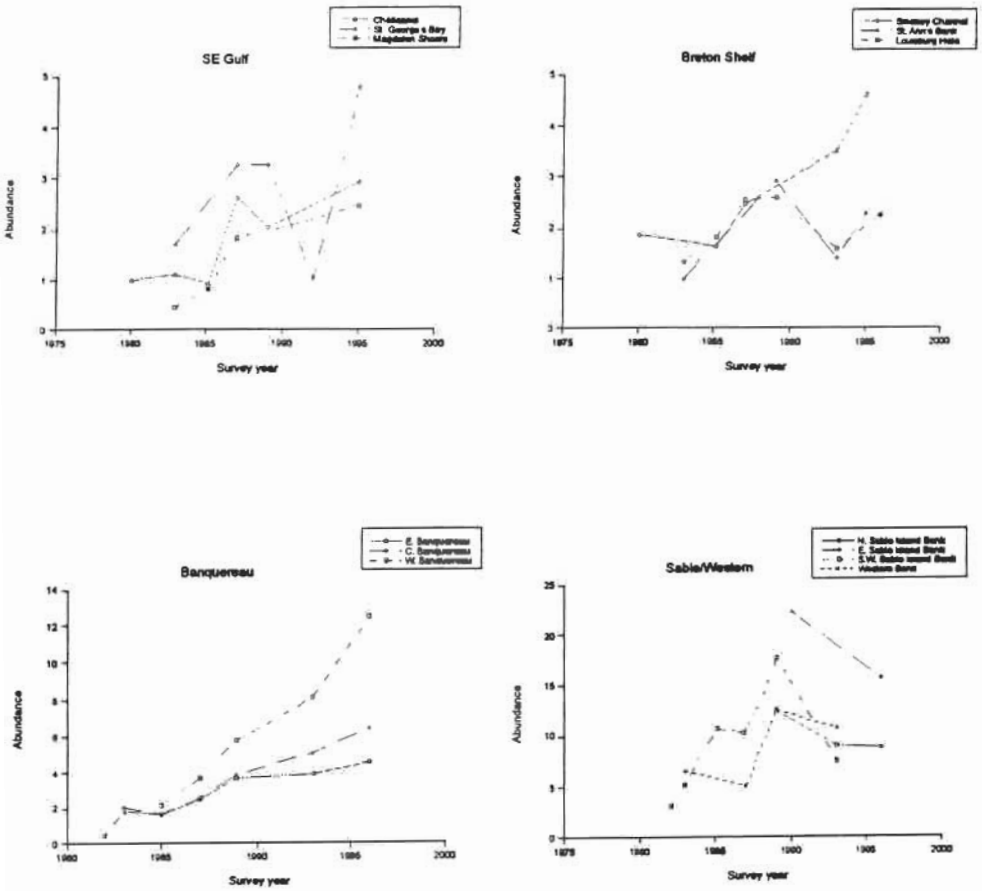


Figure 3. Temporal variation in abundance of larval sealworm (*Pseudoterranova decipiens*) in Canadian plaice (*Hippoglossoides platessoides*) in the 31–40 cm length range from the Gulf of St. Lawrence. Breton Shelf and the central and eastern Scotian Shelf between 1980 and 1996.



3.4
REPORT OF THE SCIENTIFIC COMMITTEE WORKING GROUP ON ABUNDANCE ESTIMATES

The Working Group met at the Marine Research Institute, Reykjavík during 21-23 February 1997, under the chairmanship of Nils Øien (Norway). The meeting was attended by members of the Working Group: Þorvaldur Gunnlaugsson (Iceland), Pia Barner Neve (Greenland), Nils Øien (Norway), Jóhann Sigurjónsson (Iceland), Gísli Víkingsson (Iceland), as well as invited participants David Borchers and Louise Burt from the Mathematical Institute, University of St Andrews, UK.

1. TERMS OF REFERENCE

The Working Group was established by the Scientific Committee at its fourth meeting in Tórshavn, Faroe Islands in February 1996 and was given the task:

(i) Ato review the analyses and where relevant also to analyse data from NASS-95 to ensure its compatibility, both between NASS-95 survey areas, as well as with data from other sightings surveys, in order to provide a basis for calculating abundance estimates for the relevant cetacean stocks in the North Atlantic≅, and

(ii) Ato monitor stock levels and trends in stocks of all marine mammals in the North Atlantic≅.

The Working Group coordinated its work by correspondence (led by J. Sigurjónsson, Iceland until replaced by N. Øien). The meeting in Reykjavik was the first and only meeting of the Working Group, and focused on describing synoptic distributions of the cetacean species encountered during NASS-95, and abundance estimates for minke, fin, sei and pilot whales.

2. PLANNING THE NASS-95 SURVEY

In 1987 and 1989 synchronized large scale cetacean sightings surveys were conducted on board vessels and aircraft allocated by the Faroe Islands, Greenland, Iceland, Norway and Spain known as the NASS-87 and NASS-89 (North Atlantic Sightings Survey) surveys, respectively (see e.g. *Rep.int.Whal.Commn* 39 (1989):395-455*; Rep.int.Whal.Commn* 41 (1991):134-138). In addition to scientists from the sponsoring laboratories, scientists from Japan, New Zealand, UK and USA were also involved in the planning and conduct of the surveys. As a result of these joint research efforts, the first synoptic view of distribution and abundance of cetaceans was obtained that covered deep and shallow areas of the northern North Atlantic Ocean from the coast of Spain in the south to the Barents Sea in the north, and as far west as to the coasts of Iceland and West Greenland south to 50EN. The surveys were planned and the results were analysed in cooperation with members of the International Whaling Commission (IWC) Scientific Committee.

In 1993 the North Atlantic Marine Mammal Commission (NAMMCO) Council decided that a North Atlantic sightings survey should be conducted under the auspices of the NAMMCO Scientific Committee. The Council requested the Scientific Committee to plan joint cetacean sightings surveys in the North Atlantic by coordinating national research programmes with the aim to obtain new abundance estimates of the principle whale species in the northern North Atlantic. The Committee decided that the survey was to take place during July-August 1995 and established a Working Group to plan the NASS-95 under the chairmanship of F. Larsen (Greenland).

The Working Group had three meetings in 1994 and 1995 (NASS-95 Working Group Report 1994a; 1994b; *NAMMCO Annual Report* 1995:121-124) to plan and coordinate activities in the NAMMCO member countries and to establish cooperation with scientists and laboratories in other relevant countries and organisations, particularly the IWC Scientific Committee and the International Council for the Exploration of the Sea (ICES). A joint meeting with experts from both organisations was held in December 1994, where theoretical and practical aspects of the survey were discussed in detail. The Norwegian part of the NASS-95 survey, NILS-95 (Norwegian Independent Line-Transect Survey), was subject to special consultations within the IWC Scientific Committee (*Rep.int.Whal.Commn* 46 (1996):61-62).

At the outset it was decided that the design and planning of NASS-95 was to be compatible with the earlier surveys in order to allow for comparison of abundance and distribution in time. During the planning phase, an increase in the area coverage to the western North Atlantic compared to earlier surveys (see Figures 1 and 2) was considered an important goal. However, efforts failed to obtain simultaneous participation by the relevant countries in the western North Atlantic. In contrast to the surveys in 1987 and 1989, no surveys were conducted off West Greenland in 1995. However, an aerial survey was conducted in that area in 1993, and reported by Larsen (1995). Observations from that survey have been used for distributional maps to indicate the extent of known distributions.

2.1 Target Species of the Survey

As in earlier surveys, the participating countries had different species priorities. Norway still had minke whale (*Balaenoptera acutorostrata*) as the main target species. The Faroe Islands had greatest interest in long-finned pilot whales (*Globicephala melas*), but secondary interest in bottlenose dolphins (*Tursiops truncatus*) and northern bottlenose whale (*Hyperoodon ampullatus*). Iceland attached greatest emphasis to minke, fin (*B. physalus*) and sei whales (*B. borealis*), the last mentioned species having however less importance than the first two. It was recognized that while abundance estimation might be possible for other cetacean species observed during these surveys, the design and conduct of the survey might to a varying degree facilitate such estimation, depending on both the species and areas in question.

2.2 Area Coverage and Timing

Figure 2 shows the areas covered by the NASS-95 surveys by participating countries as well as the survey blocks, where the nations had synchronised their efforts according to available resources and the over all goal. One Faroese vessel participated during the

period 3 July-6 August, covering a similar area as the single vessel conducting the survey in 1989 with an additional extension to the southwest. Eleven Norwegian vessels participated during the period 5 July-8 August, covering the same areas as in 1989 as well as an extension westwards to the drift ice off East Greenland, including the Jan Mayen area. The Icelandic survey, carried out with two vessels during the period 22 June-4 August, had the main sightings effort and area coverage somewhat similar to the 1987 Icelandic survey, but earlier and more to the north than the Icelandic survey in 1989.

The Icelandic aerial survey component (7-25 July, see SC/4/17), aimed at minke whales in the coastal (depth less than 600-1,000 m) waters of Iceland, was similar both in coverage and timing as the 1987 survey (Donovan and Gunnlaugsson 1989). The track lines and survey blocks are shown in Figure 4.

3. METHODOLOGY

3.1 Shipboard Surveys

The basic methodology used was the line-transect survey method (Buckland et al. 1993a). The Icelandic shipboard survey was conducted in a delayed-closure mode with one barrel and the upper bridge as the search platforms (Sigurjónsson et al. 1996b).

The Faroese surveys were carried out in passing mode with a random sample collected in delayed-closure mode to estimate school sizes of pilot whales (for further details, see Desportes et al. 1996). Two independent observation platforms were used, a primary platform (searched with naked eye within 1,000 m from vessel) and a tracker platform (searched with binoculars ahead and beyond 1,000 m from vessel), that operated according to a specific protocol (Buckland and Turnock 1992).

The details of the Norwegian survey design and sighting protocols are given in Øien (1995, 1996). The survey was operated in passing mode with basically two independent observer teams on watch during acceptable conditions, although minor parts of the survey were run in a one-platform configuration. Vessel speed on effort was intentionally 10 knots.

3.2 Aerial Survey

The tracks were originally (1987) set out according to a procedure by Cooke and Hiby (1987), where an objective function is used to specify the drawing of the tracks such that the probability of any given point being covered can be calculated as a function of its position. The estimated population size is then calculated as the sum of reciprocals of the coverage probabilities for all the sightings. The survey was conducted (Sigurjónsson et al. 1996a) from a twin-engine high wind *Partenavia Observer P-68*, with a plexiglass bubble window on each side. The plane operated generally at an altitude of 750 feet when conditions permitted and at a speed of around 90 knots (167 km/hr).

3.3 Analyses

3.3.1 Shipboard Surveys

The Icelandic and Faroese data as well as the Norwegian fin whale data have basically been analysed using the Distance software package (Laake et al. 1994). The analysis of the Norwegian minke whale data are described in Schweder et al. (1996).

3.3.2 Aerial Surveys

Only minke whale abundance estimation was attempted based on the data obtained by the aerial survey around Iceland. The analysis carried out (SC/5/AE/2) is based on the cue-counting method (Hiby and Hammond 1989) as described in Buckland et al. (1993a), using the computer programme DISTANCE (see Buckland et al. 1993a).

4. SURVEY RESULTS

4.1 Distribution of effort

The on-effort track lines for all survey areas are shown in Figure 3 and compiled by survey blocks and country in Table 1.

The on-effort track line of the two Icelandic vessels was 6,125 n miles compared to a planned track line of 8,400 n miles. Of these 3,336 n miles were sailed in 0-3 Beaufort and the remaining 2,849 n miles in Beaufort 4-7. The total Icelandic survey area was 443,813 sq. n miles.

The Faroese on-effort vessel track line amounted to 1,662 n miles of which 1,153 and 509 n miles were under wind speed Beaufort 0-3 and 4-5, respectively. The total Faroese survey area was 341,183 sq. n miles.

Table 1. *NASS-95 shipboard surveys: Distribution of effort by nations and survey area (see also Figs 3 and 4). Data are also given for Greenland 1993 aerial survey and Iceland aerial survey in 1995.*

Nationality	Block size (sq. n miles)	On-effort (n miles)
Faroe Islands	341,183	1,662
Iceland	443,813	6,125
Norway	824,336	13,522
Iceland-aerial 1995	76,080	5,500 (approx.)
Greenland-aerial 1993	110,140	3,600 (approx.)

The total Norwegian vessel survey area was 824,336 sq. n miles. The eleven participating vessels traveled on primary effort 13,522 n miles, i.e. under Aacceptable≅ weather

conditions for conducting minke whale sightings (Beaufort 4 or less; visibility greater than 1 n mile).

In total the Icelandic aerial survey comprised 5,500 n miles on-track effort.

4.2 Minke Whale Sightings

4.2.1 Distribution

The distribution of minke whales based on NASS-95 is shown in Figure 5. Although a considerable survey effort was allocated to southern areas southwards to 52EN, the southern limit of the minke whale distribution approximately follows the 1,000 m depth contours from Greenland to the British Isles. The distribution within the area is primarily over continental shelves, but nevertheless the abundance over the deep waters of the Norwegian Sea is considerable. The NASS surveys therefore seem to give a complete picture of the summer distribution of minke whales in the northeast Atlantic.

Compared to earlier surveys, a shift in distribution was observed in the Barents Sea, as few minke whales were seen in the southeastern part off the Kola peninsula in 1995, while this was an area of high density in 1989. Around Iceland the highest densities of minke whales were found over the shelf areas and were thus covered by the aerial surveys. In the 1993 Greenland aerial survey most of the minke whale sightings were made in central and southern coastal areas, which confirms the general patterns from surveys made in earlier years.

4.2.2 Abundance

Abundances of minke whales are summarised in Table 2.

The coastal areas around Iceland were surveyed by aircraft and are tabulated as AX (AIR)≅. The Icelandic shipboard blocks 5 and 6 were restratified correspondingly for this analysis to avoid overlap in estimates. Thus the numbers tabulated for blocks A5 and 6≅ exclude the aerial survey block, and a shipboard estimate was calculated for the remaining parts of these blocks and tabulated as AX (SHIP)≅. AX (AIR)≅ includes coastal areas not part of AX (SHIP)≅. Since the Icelandic shipboard survey was conducted with one platform only on each of the two ships, no information is available to evaluate the bias introduced in the analyses by assuming g(0)= 1. The Icelandic shipboard survey estimates were calculated at the meeting. The overall estimate for the Icelandic ship survey blocks were 17,871 (CV = 0.225; 95% CI 11,555-27,639).

The minke whale estimates based on the Norwegian shipboard survey (Schweder et al. 1996) have been the subject of a major review by the IWC Scientific Committee (*Rep.int.Whal.Commn 48*, in press). The Working Group did not feel that they could add much to those discussions, and the estimates agreed by the IWC/SC were tabulated at face values. The over all estimate for the Norwegian survey blocks was 118,299 (CV= 0.103; 95% CI 93,746-138,720).

There were only two minke whale sightings contained in the Faroese survey data set, and thus no estimate was calculated for those blocks.

4.3 Fin Whale Sightings

4.3.1 Distribution

The distribution of fin whale sightings made during NASS-95 are shown in Figure 6. As in previous surveys, highest densities are found in the area between Iceland and East Greenland and significant numbers were also found on the Jan Mayen Ridge and near Spitsbergen. Within the Icelandic survey area, the distribution pattern is similar to those from previous surveys, although the relative 1995 density is even higher in block 9 (Denmark Strait - Irminger Basin) than in the 1987 and 1989 surveys.

4.3.2 Abundance

Abundance estimates for fin whales are given in papers SC/5/AE/4 (Norwegian survey area) and SC/5/AE/1 (Icelandic and Faroese areas), and summarised in Table 3. The total estimate for the Norwegian survey area is 3,080 fin whales (CV= 0.248) based on a standard line transect analysis approach. The total abundance estimate for the Icelandic/Faroese survey area is 19,708 fin whales (CV =0.166). Adding the estimated abundance from Norwegian blocks JMC (76, CV= 0.445) and NVN (332, CV= 0.652) and subtracting 2/3 of the abundance from the Faroese blocks (as the Faroese block A is not a part of the East Greenland-Iceland (EGI) area), gives a total estimate of 18,932 (CV= 0.160) fin whales within the part of the EGI schedule stock area surveyed in 1995. This is the largest estimate for the EGI stock of fin whales to date. In particular, the abundance is considerably higher in the area between East Greenland and Iceland than in the 1987 and 1989 surveys, respectively. In fact the abundance in block 9 alone in 1995 is higher than the total abundance in all blocks from either of the previous surveys.

4.4 Sei Whale Sightings

4.4.1 Distribution

The distribution of sei whale sightings made during NASS-95 is shown in Figure 7. Only two sightings (one primary sighting) were made by the Norwegian survey vessels, three sightings were made onboard the Faroese vessel and 103 sightings onboard the two Icelandic vessels. The distribution corresponds well with that of the 1987 and 1989 surveys, with consistent low abundance in both Norwegian and Faroese survey areas. However, the 1989 Icelandic survey was conducted somewhat later in the season when the species typically migrates into the area west off Iceland and covered areas further south with significant densities of sei whales.

4.4.2. Abundance

Paper SC/5/AE/1 gives the abundance estimates for sei whales by survey blocks, resulting in a total estimate of 9,249 animals (95% CI: 3,700 - 23,116), see Table 4. Of these, 722 animals (CV=0.80) were estimated in the Faroese survey area, while the rest is derived from the Icelandic survey area. Although the majority (about 70%) of the 1989 estimate (10,600, CV=0.27) were derived from survey blocks south of the 1995 survey, the two surveys are not inconsistent in light of wide confidence limits and difference in timing.

4.5 Pilot Whale Sightings

4.5.1 Distribution

The NASS-95 distribution of pilot whales is shown in Figure 8. This distribution is complementary to the minke whale distribution; i.e. the sightings were made south of the

ridge Greenland-Iceland-Faroe Islands, with a few stragglers off the Norwegian coast. This indicates that the NASS surveys cover the northernmost areas of pilot whale distribution in the northeast Atlantic.

4.5.2 Abundance

The abundance of pilot whales by block is given in Table 5.

The estimate (SC/5/AE/3) is based on application of a conventional line transect method. Data from all blocks were pooled for estimating the effective search width, while encounter rate and school size were estimated by block. The total abundance over all blocks is 215,000 animals (CV= 0.26).

In the areas covered by Norwegian vessels, only two primary sightings of pilot whale groups were made, of which one comprised a group of an estimated 150 individuals.

4.6 Other species

Several other species were considered from a distributional point of view. The NASS-95 distribution of humpback (*Megaptera novaeangliae*), blue (*B. musculus*), sperm (*Physeter macrocephalus*), northern bottlenose (*Hyperoodon ampullatus*), killer (*Orcinus orca*), harbour porpoises (*Phocoena phocoena*) and small *Delphinidae* (*Lagenorhynchus* sp. and similar species) are shown in Figures 9-15.

5. TRENDS IN DISTRIBUTION AND ABUNDANCE

5.1 Minke whale

Although the point estimates for the aerial surveys for coastal Iceland differ by a factor of nearly 3, that is roughly 20,000 whales from NASS-87 vs. roughly 56,000 whales from NASS-95, a large part of the difference is due to the fact that the NASS-87 aerial survey covered a substantially smaller area. There is a continuity in distribution of minke whales from Icelandic coastal areas towards the ice edge at Greenland and Jan Mayen, which may give cause for substantial movement in and out of the aerial survey area, and taking the high variances associated with the point estimates into consideration, no conclusion about trends can be made.

For the Norwegian survey blocks, large differences occured between the 1989 and 1995 estimates, most notably the block off the Kola coast in the southeastern Barents Sea, which, from being the largest contributor to the total abundance estimate in 1989, was the least important in 1995. However, aggregated on a small management area level, the abundance estimates are consistent between the two years, the 1995 estimates being roughly twice the 1989 estimates; 118,000 as compared to 68,000 animals. Although the number of minke whales within the area may have increased from increased immigration or natural rate of increase, most of the difference is probably related to the fact that the 1995 estimate was derived from a designed survey with independent teams of observers and there was no need to extrapolate from ancillary survey data as was necessary for the 1989 estimate.

5.2 Fin whale

The 1995 point estimate of 19,642 (CV=0.20) in the Icelandic and Faroese survey areas appears to be higher than the estimates derived from earlier surveys. The increase in abundance is particularly noticable in the southwestern part of the survey area, between East Greenland and Iceland (Block 9). Sightings made in high Beauforts contribute significantly to the large abundance estimate in Block 9 in 1995, but the implications of this are unclear.

The abundance estimate of fin whales from the Norwegian survey area (3,080, CV= 0.25) is not significantly different from the earlier NASS surveys. In 1991 the Scientific Committee of the IWC tabulated an estimate of 15,614 fin whales in the EGI stock area, based on combined data from the 1987 and 1989 surveys (*Rep.int.Whal.Commn* 42 (1992): 600). The estimate from the NASS-95 of 18,932 fin whales is considerably higher even though the 1995 survey did not cover a large area where a significant number of fin whale sightings were made in 1989. This may reflect a true increase in the stock, while discontinuity in distribution towards the south of the survey area may indicate that the 1995 survey captured the peak of the fin whale migration to these waters better than earlier surveys.

5.3 Sei whale

The estimates from the Icelandic/Faroese parts of the NASS-89 and NASS-95 surveys of 10,600 and 9,249 sei whales, respectively, appear to be in good agreement. However, the 1995 survey did not cover the south-westernmost parts of the 1989 survey area from which around 70% of the 1989 abundance estimate was derived. Although comparisons of abundance in identical subareas in the three sightings surveys may indicate an increase and/or northward shift in abundance, interpretations should be made with caution due to the relatively wide confidence limits and difference in timing of surveys. It is unlikely that any of the surveys covered the total distribution of the stock, and the species is known for relatively large between-year variations in abundance in Icelandic waters.

5.4 Pilot whales

Previous surveys of long-finned pilot whales were conducted in 1987 and 1989 (Buckland et al. 1993). The area surveyed in 1995 covered a similar area to that surveyed in 1987 and extended as far south, in the eastern part of the survey area, as the 1989 survey. The total abundance estimate in 1987 was 123,000 (CV= 0.29). Excluding blocks in the 1989 survey so that the estimate was comparable to the total estimate from the 1987 data, the 1989 estimate was 191,000 animals (CV= 0.33). If the Faroese block B is excluded from the analysis, so that the 1995 estimate is broadly comparable to the 1987 and 1989 estimates, the total abundance estimate in 1995 is 181,440 (CV=0.26). The 1995 estimate is therefore consistent and not significantly different from previous estimates for the area covered.

6. ACKNOWLEDGMENTS

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Table 5. Abundance of pilot whales by survey block and for the total survey area.

NATION	BLOCK	ABUNDANCE	CV	TOTAL ABUNDANCE	CV
ICELAND	4	7,585	0.803		
	7	19,490	0.443		
	3	na			
	9	45,057	0.460		
	8	42,940	0.855		
	2	na		**214,840**	0.26
	6	na			
	5	na			
NORWAY	LOC	2 primary sightings, one group 150 animals			
FAROE ISLANDS	A & B	99,768	0.630		

FIGURE LEGENDS

Fig 1. Area coverage for NASS-87, NASS-89 and NASS-95.

Fig 2. Stratification of survey blocks for NASS-95.

Fig 3. Realised effort for shipboard part of NASS-95.

Fig 4. Aerial survey transects off West Greenland in 1993, and survey blocks and transect for the Icelandic aerial survey part of NASS-95.

Fig 5. Distribution of minke whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 6. Distribution of fin whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 7. Distribution of sei whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 8. Distribution of pilot whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 9. Distribution of humpback whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 10. Distribution of blue whale sightings during NASS-95.

Fig 11 Distribution of sperm whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 12 Distribution of Northern bottlenose whale sightings during NASS-95.

Fig 13 Distribution of killer whale sightings during NASS-95. For West Greenland observations made during the 1993 aerial survey are plotted.

Fig 14. Distribution of harbour porpoises sightings during NASS-95.

Fig 15. Distribution of small Delphinidae sightings during NASS-95.

SECTION 4 – NATIONAL PROGRESS REPORTS

4.1
FAROE ISLANDS – PROGRESS REPORT ON MARINE MAMMAL RESEARCH 1996

Dorete Bloch and Jústines Olsen

1. INTRODUCTION

This report summarises Faroese research on cetaceans and pinnipeds conducted in 1996. Since 1984, the main bulk of research on marine mammals in the Faroes has been conducted by the Zoological Department of the Faroese Museum of Natural History, with some assistance from the Faroese Fisheries Laboratory and the Department of Natural Science at the University of the Faroes.

2. RESEARCH

2.1 Species and stocks studied

Pinnipeds

* Grey seals (*Halichoerus grypus*) - coastal waters of the Faroes

Cetaceans

* Sperm whale (*Physeter macrocephalus*) - stranded animals
* Pilot whales (*Globicephala melas*) - landed animals
* White-sided dolphins (*Lagenorhyncus acutus*) - landed animals

2.2 Field Work

Pinnipeds

In the summer periods 1993-1995, a total of 68 grey seal were collected in Faroese coastal waters for scientific purposes, and comprehensive samples were taken from each. No further field activities have been conducted in 1996.

Cetaceans

Opportunistic sightings of whales were reported to the Museum of Natural History by the Faroese Fisheries Inspection Services (T, OH), the Danish Fisheries Inspection Services (Thetis), the Faroese fisheries research vessel (MH, Hvítiklettur), local ferries between the islands in the Faroes (Ritan, Sam, Sildberin, Teistin, Ternan, Ternan I, Tróndur), the weekly ferries between the Faroes and Aberdeen, Scotland (Smyril) and the Faroes and Stavanger, Norway (Magn), as well as numerous local sources. Summaries of offshore and inshore cetacean observations in Faroese waters are contained in Tables 4 and 5.

Samples have been collected from stranded whales, in 1996 for instance from one sperm whale (*Physeter macrocephalus*). In total, nine different sperm whales have stranded dead in the Faroes since 1987, as shown in Table 1.

One killer whale (*Orcinus orca*) was seen floating dead on the surface, first observed

close to Rituvík 29 April, 200-300 m from shore and possibly the same was seen again 1 May off Tórshavn in Nólsoyarfjørður. The whale was too far to observe the size or sex or take samples.

An immature male harbour porpoise (*Phocoena phocoena*) 121 cm in body length was found dead 20 April at Argir and samples were taken.

In 1996, a beluga (*Delphinapterus leucas*) was observed three times in Faroese coastal waters for the first time since 1920 (See Table 5).

Sex, *skinn* values and total body length in cm have been recorded from all pilot whales caught in 1996 with kind the assistance of local sheriffs and whalers.

Data on times-to-death in the pilot whale hunt were recorded at one whale drive in 1994, two in 1995 and one more in 1996. Data is now available from a total of 16 whales using the ball-pointed hook, and 180 whales where the traditional hook was used to secure the animals during the kill.

2.3 Laboratory work

Pinnipeds

The material from stomachs and intestines from the 68 grey seals sampled in 1993-1995 has been examined and is being prepared for presentation.

Teeth slides from the 1993 and 1995 material, a total of 41 grey seals, have been age-determined by the Institute of Marine Research in Bergen, Norway.

Cetaceans

Teeth slides of pilot whales from 1995 have been prepared for age determination by the NINA Laboratory in Trondheim. One tooth has been prepared from one of the stranded sperm whales for age determination.

2.4 Other studies

Pinnipeds

No other studies have been conducted on pinnipeds, but the ovaries/testes and tissue and blood samples from the sampled grey seals have been stored for later examination.

Cetaceans

A project has been started to examine thoroughly the historical data from the National Archives in Tórshavn with the purpose of investigating the distribution of the whale catch over the last 200 years compared with the size and distribution of the population.

2.5 Research results

Pinnipeds

The summer diet of grey seals in the Faroes is exclusively fish, mainly cod fish, catfish, and sand eel. Squids are not found in the diet. Despite the short distance in the Faroes, differences are shown in the diet between three localities, possibly indicating that grey seals feed quite locally in the summer months.

Sealworms were present in varying number in all stomachs examined.

A tagged grey seal from North Rona, Shetland, was collected in the 1994 season.

Cetaceans

The ICES Study Group on Long-Finned Pilot Whales had its third and final meeting in April 1996 in Cambridge, UK. After new comparative studies between landed pilot whales in Newfoundland, stranded pilot whales in Cape Cod, MS, USA and landed pilot whales in the Faroes, it was accepted that long-finned pilot whales occur in an eastern and a western North Atlantic population, different from each other in external morphology.

The data from NASS-95 indicated that the areas from NASS-1987 and NASS-1989 containing many pilot whales were not exactly the same in NASS-95. A Hitter model showed that only a very small area around the Faroes contained an amount of pilot whales presumably too small to sustain the annual Faroese annual catch. The results from the Faroese pilot whale study 1986-1988 found large differences between schools in the levels of heavy metals, organochlorines, food items and parasites, indicating that the base population of the long-finned pilot whale for the Faroese harvest is extremely unlikely to be restricted to a year-round distribution only in the Faroe Island area.

Research on the efficiency of killing methods in the pilot whale hunt indicates that a simultaneous severing of the spinal cord and blood supply to the brain using the traditional Faroese pilot whale knife is the quickest, safest and most practical method for dispatching smaller whales (mean time-to-death: 34.7 ∀ 1.96 s; range 3.5-172 s; 50% dispatched in 26.0 s; N=180). A ball-pointed hook has been constructed to insert in either of the vestibular air sacs lateral to the blowhole. This hook has been tested and the total killing time was 23.9 ∀ 3.33s; range 6-46 s; 50% dispatched in 20.5 s (N=16).

3. CATCH DATA

3.1 Pinnipeds

A number of grey seals are shot every year in connection with salmon farming, but there is still no systematic reporting of these removals.

3.2 Cetaceans

Tables 2 and 3 provide an overview of catches of pilot whales and other cetacean species in the Faroe Islands in 1996.

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Weihe, P., Grandjean, P., Debes, F. and White, R. 1996. Health implications for Faroe Islanders of heavy metals and PCBs from pilot whales. *The Science of the Total Environment* 186: 141-148.

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Table 1. Sperm whales (*Physeter marcocephalus*) stranded dead in the Faroes from 1987-1996

Year	Date	Locality	Length, m	Age, dl
1987	13/3	Rituvík	15.75	32
1988	31/3-25/4		15	
1988	24/7	Tórshavn	16	47
1989	18/12	Skálavík		14
1990	18/3	Sumba		34
1994	14/6	Nólsoy	9	15
1996	9/1	Fróðba	10	>15
1996	12/2	Svínoy	16-18	
1996	14-29/4			

Table 2. Pilot whales (*Globicephala melas*) caught in the Faroe Islands, 1996

Date	Locality	*No.*
27 June	Vestmanna	435
29 June	Miðvágur	270
4 July	Øravík	34
15 July	Hvalvík	16
25 July	Hvannasund	108
26 July	Vestmanna	41
10 August	Hvannasund	40
11 August	Sandavágur	95
23 August	Sandur	52
30 August	Sandavágur	228
18 September	Hvalvík	*137
2 October	Klaksvík	50
10 October	Tórshavn	32
31 December	Fuglafjørður	18
Total	**14 grinds**	**1,524**

* Mixed grind, see Table 3

Table 3. Catches of cetacean species other than *G. melas* in the Faroe Islands, 1996

Date	Locality	Number	*Species*
4 July	Hjalnestanki	1	*Ph. phocoena*
8 August	Tangafjørður	2	*Ph. phocoena*
12 August	Klaksvík	49	*L. acutus*
25 August	Tórshavn	19	*L. acutus*
27 August	Hvalba	19	*T. truncatus*
7 September	Funningsbotnur	13	*L. acutus*
18 September	Hvalvík*	2	*T. truncatus*
5 October	Vágur	30	*L. acutus*
6 October	Porkeri	9	*L. acutus*
7 October	Porkeri	6	*L. acutus*
19 October	Hvalvík	26	*L. acutus*

* Mixed school, see Table 2.

4.2
GREENLAND –
PROGRESS REPORT ON MARINE MAMMAL RESEARCH 1995

1. INTRODUCTION

This report summarises the Greenlandic research on pinnipeds and cetaceans done in 1995. Most of the research was conducted by the Greenland Institute of Natural Resources, but some projects also involved DFO (Department of Fisheries and Oceans, Canada), the National Environmental Research Institute, Department of Arctic Environment, Denmark.

2. RESEARCH

2.1 Species and stocks studied

Pinnipeds

* Harp seals *Phoca groenlandica* - West Greenland
* Hooded seals *Cystophora cristata* - West Greenland

Cetaceans

* Beluga *Delphinapterus leucas* - Northeast Canada/West Greenland
* Narwhal *Monodon monoceros* - Melville Bay, Greenland
* Harbour porpoise *Phocoena phocoena* - Central West Greenland

2.2 Field work

Six belugas were equipped with satellite-linked transmitters in Croker Bay (Northeast Canada), in order to monitor their autumn migration.

2.3 Laboratory work

103 harbour porpoises were dissected, and samples were used for various studies.

2.4 Other work

Pinnipeds

The distribution of the many tagged or branded **harp** and **hooded seals** caught in Greenland has been reviewed and a summary prepared for publication.

Cetaceans

Data on movements, swimming speed and diving behaviour of narwhals equipped with satellite transmitters in 1993 and 1994 has been analysed.

2.5 Research results

Pinnipeds

The review of tagged and branded **harp** and **hooded seals** contributes to knowledge of the general distribution, routes and timing of the annual migrations, but cannot be used

for assessment of stock size (mark-recapture analyses) because reporting efficiency is

variable or unknown.

Cetaceans
The six belugas equipped with satellite transmitters in Northeast Canada all stayed in the North water and did not migrate along the Greenland west coast as expected.

All nine tagged narwhals stayed in the Melville Bay area during the open water period. One whale from 1993 and one from 1994 were tracked after freeze-up. They both went south following the 500-1000 m. slope of eastern Baffin Bay. The overall surfacing periods from August through 18 February constituted 39.3 % of the time.

3. CATCH DATA

In Greenland hunters report their catches in a booklet known as *Piniarneq*, which also functions as an official hunting licence. It is reissued once a year upon submission of the completed records from the previous year. Fin whales and minke whales must however be reported separately to the Ministry of Fisheries

The only cetaceans listed in *Piniarneq* in 1995 were harbour porpoise, beluga and narwhal, but from 1996 killer whales and long-finned pilot whales have been included. Although some incorrect reporting has occurred (e.g. ringed seals reported as harbour seals), the reliability of all data has not been systematically validated.

3.1 Pinnipeds
Catch figures extracted from *Piniarneq* for 1995 were: 403 Walruses; 1,900 bearded seals; 6,884 hooded seals; 72,560 ringed seals; 57,812 harp seals; and 266 harbour seals.

3.2 Cetaceans
Catch figures extracted from *Piniarneq* for 1995 were: 606 belugas; 461 narwhals; 1,135 harbour porpoises; and 163 minke whales (7 on the east coast).

4. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

The Scientific Working Group of the Canada/Greenland Joint Commission on the Conservation and Management of Narwhal and Beluga recommended that the annual removals of belugas should not exceed 250 animals.

Since 17 October 1995 the catch of narwhal and beluga from larger vessels has been restricted, so that vessels from 25 to 50 GRT only are allowed to catch these whales for their own consumption and not for sale. Vessels from 50 to 79.9 GRT are only allowed to take 2 narwhal or beluga a year. Furthermore, the drive hunt (which is a significant factor in the total catch of beluga) has been prohibited.

5. PUBLICATIONS AND DOCUMENTS

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Born, E.W., I. Gjertz and R.R. Reeves, 1995. *Population Assessment of Atlantic Walrus.* Norsk Polarinstittut Meddelelser 138: 100 pp.

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genetic diversity JCNB SWG WP 1995.
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4.3
ICELAND -
PROGRESS REPORT ON MARINE MAMMAL RESEARCH IN 1996

G.A. Víkingsson and E. Hauksson

1. INTRODUCTION

The following reports on studies conducted by or in cooperation with the Marine Research Institute (MRI) and the Research Committee for Biological Seafood Quality (RCBSQ), Reykjavík, Iceland.

2. RESEARCH

2.1 Species/stocks studied

Pinnipeds

Main emphasis was on studying the local Icelandic seal stocks, common seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*). Little work was done on the vagrant species: hooded seals (*Cystophora cristata*) harp (*Phoca groenlandica*), ringed (*Phoca hispida*) and bearded seals (*Erignathus barbatus*).

Cetaceans

In 1996 research on cetaceans conducted by the MRI and cooperating institutions concentrated on the recently exploited minke (*Balaenoptera acutorostrata*), fin (*B. physalus*) and sei (*B. borealis*) whales. Special research projects were also continued on humpback (*Megaptera novaeangliae*) and killer whales (*Orcinus orca*), white-beaked dolphins (*Lagenorhynchus albirostris*) and harbour porpoises (*Phocoena phocoena*).

2.2 Field work

Pinnipeds

Some new and old grey seal haul-out sites were visited to study dispersal of grey seals, and time of breeding and moulting.

Cetaceans

Sampling of incidentally caught harbour porpoises and white-beaked dolphins continued in 1996. This project is a part of MRI's intensified research on multi-species interactions, initiated in the winter 1991/1992. In 1996 post-mortem examinations were conducted on 9 harbour porpoises and 9 white-beaked dolphins. The MRI staff investigated or received information on whales that beached or stranded at the Icelandic coast in 1996. These included:

- 2 northern bottlenose whales (*Hyperoodon ampullatus*) in South and SW Iceland in March and November respectively.
- 1 sperm whale (*Physeter macrocephalus*) in northern Iceland in December.
- 1 minke whale in August in NW-Iceland.

- 1 harbour porpoise in April in SW-Iceland.
- 1 humpback whale in August in NE-Iceland.
- 1 sei whale in September in SW-Iceland.
- 1 long-finned pilot whale (*Globicephala melas*) in November in SW-Iceland.

2.3 Laboratory work

Pinnipeds

Investigations on otolith-size/fish-length relationship of the major prey species of seals were continued.

Cetaceans

Sightings data collected during the NASS-95 sightings survey were analysed in cooperation with scientists from the Mathematical Institute, University of St. Andrews, Scotland. Preliminary results will be presented by the NAMMCO Working Group on Abundance Estimates at the fifth meeting of the Scientific Committee.

Identification of photographs and laboratory work on skin biopsies, obtained as a part of the YONAH project (Years of the North Atlantic Humpback whale, 1992-1993), was continued in cooperation with other participating countries.

Analysis of MRI's photo-id catalogue of killer whales was continued. Classification of photos collected in 1995 was completed and reanalysis of older photos was continued. The catalogue now contains around 350 individuals.

Laboratory work and validation of the data on stomach contents, age and reproduction of harbour porpoises and white-beaked dolphins, collected in 1991-1996 is in its final stage.

Research on genetic variation in baleen whales was continued. The main objective of these studies is to investigate population structure of fin, sei and minke whales in Icelandic and adjacent waters.

2.4 Other studies

A study on dynamic interactions between three cetaceans species and some fish resources in Icelandic and adjacent waters using a simulation model was continued. Grey and common seals were added to the model. Work continued on feeding and energetics of fin and sei whales, based on data collected during 1986-1989 (Víkingsson 1996).

In cooperation with the National Economic Institute of Iceland, work was continued on the development of management models for whaling.

2.5 Research results

Pinnipeds

Results of investigations of vital parameters and food of common seal and grey seal were presented at the Symposium of Multispecies Research, held by the MRI in September 1996. Cod (*Gadus morhua*) is by far the most dominant prey species of the common seal, while the diet of the grey seal is more evenly distributed between various fish species. This data is under final analysis and will be published in 1997.

Cetaceans

Studies on body condition of fin whales of Iceland have shown large variability due to reproductive condition. Thus, calculations on the deposition of energy reserves in the body throughout the summer range from around 30% in immatures to 80% of spring values in pregnant females (Víkingsson 1996). Rough calculations on the feeding rates required to deposit these energy reserves range from around 700 kgs/day (1.8% of body weight) to 1,300 kgs/day (2.8% b.w.) depending on reproductive class. Investigations on the stomach content of fin whales have shown a pronounced diurnal variation in feeding with highest rates during night and early morning (Víkingsson 1996). These studies indicate a mean evacuation rate of the fore-stomach of around 3 hours and a feeding rate of around 1,300 kgs/day for adult fin whales.

Preliminary results from the analysis of the stomach content of harbour porpoises in coastal Icelandic waters indicate that capelin (*Mallotus villosus*) is the predominant prey species, followed by sandeel (*Ammodytidae sp.*) and then gadoids and cephalopods. There was considerable seasonal variation in prey frequency, where capelin appears to be dominant in late winter and spring and sandeel during the summer and through early winter (Sigurjónsson and Víkingsson 1996, Víkingsson and Sigurjónsson 1996).

Analysis of humpback whale fluke photographs has resulted in some matches between Iceland and the West Indies.

3. CATCH DATA

3.1 Pinnipeds

Preliminary catch figures for 1996 are: 935 grey seals, 850 common seals and 9 seals of other species.

3.2 Cetaceans

No directed catch of cetaceans took place in Icelandic waters in 1996.

4. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

No whaling permits were issued in 1996. A precautionary TAC of 100 fin whales and 200 minke whales was recommended by the MRI for the 1997 season. No special management measures were taken regarding seals.

5. PUBLICATIONS AND DOCUMENTS

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in the Northeast Atlantic north of 50 N latitude. *Marine Mammal Science* 12 (1): 125-132.

Bogason, V. 1996. Fæða landsels (*Phoca vitulina*) við Ísland. Proceedings of MRI's Symposium on Multi-Species Research, Reykjavík, 3-4 September 1996 (abstract).

Hauksson, E. 1996. Fæða útsels. Proceedings of MRI's Symposium on Multi-Species Research, Reykjavík, 3-4 September 1996 (abstract).

Hauksson, E. 1996. Studies on the Icelandic grey seal (*Halichoerus grypus*); population status, food preference, interaction with fisheries, and as a source of nematode infection in fish. Paper SC/4/GS/5 presented to the *ad hoc* Working Group on grey seal at the fourth meeting of the Scientific Committee of NAMMCO.

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Fæðunám hnísu við Íslandsstrendur. Proceedings of MRI's Symposium on Multi-Species Research, Reykjavík, 3-4 September 1996 (abstract).

Sigurjónsson J., Gunnlaugsson, Th., Víkingsson, G.A. and Haraldur Guðmundsson. North Atlantic Sightings Survey 1995 (NASS-95): Aerial survey in coastal Icelandic waters July 1995. Paper SC/4/17 presented to the Scientific Committee of NAMMCO Tórshavn, Faroes, 5-9 February 1996. 13 pp.

Sigurjónsson, J., Víkingsson, G.A., Gunnlaugsson, Th. and Halldórsson, S.D. 1996. North Atlantic Sightings Survey 1995 (NASS-95): Shipboard surveys in Icelandic and adjacent waters June-July 1995. Preliminary cruise report. Paper SC/4/18 presented to the Scientific Committee of NAMMCO Tórshavn, Faroes 5.-9. February 1996. 9 pp.

Stefánsson, G., Sigurjónsson, J. and Víkingsson, G.A. 1996. Líkan um samspil þorsks, loðnu, rækju og skíðsihvala. Proceedings of MRI's Symposium on Multi-Species Research, Reykjavík, 3-4 September 1996 (abstract).

Víkingsson, G.A. 1996 Orkubúskapur og fæðunám langreyðar við Ísland. Proceedings of MRI's Symposium on Multi-Species Research, Reykjavík, 3-4 September 1996 (abstract).

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Víkingsson, G.A. and Sigurjónsson, J. 1996. A note on recent developments in satellite tracking of cetaceans with special reference to the long-finned pilot whale (*Globicephala melas*). ICES Study Group on long finned pilot whales, Cambridge, 22-26 April 1996. 4 pp.

Watkins, W.A., Sigurjónsson, J., Wartzok, D, Maiefski, R.R., Howey, P.W. and Daher, M.A. 1996. Fin whale tracked by satellite off Iceland. *Marine Mammal Science* 12(4):564-569.

4.4
NORWAY -
PROGRESS REPORT ON MARINE MAMMAL RESEARCH IN 1996

Sidsel Grønvik, Tore Haug & Nils Øien

1. INTRODUCTION

This report summarises the Norwegian research on pinnipeds and cetaceans conducted in 1996. The research on marine mammals described in this report was conducted at the University of Tromsø: the Department of Arctic Biology (UITØ-AAB) and the Norwegian College of Fishery Research (UITØ-NFH), at the Norwegian College of Veterinary Medicine, Department of Arctic Veterinary Medicine in Tromsø (NVH-IAV), at the National Veterinary Institute, Oslo (NVI) at the Institute of Marine Research in Bergen (IMR), at the Norwegian Institute for Fisheries and Aquaculture in Tromsø (NIFA), at the Norwegian Computing Centre in Oslo (NCC), at the Norwegian Institute for Nature Research in Oslo and Trondheim (NINA) and at the Norwegian Polar Institute in Oslo/Tromsø (NP).

2. RESEARCH

2.1 Species and stocks studied

Pinnipeds

* Walrus *Odobaenus rosmarus* - Barents Sea
* Bearded seals *Erignatus barbatus* - Svalbard
* Ringed seals *Phoca hispida* - Svalbard
* Harp seals *Phoca groenlandica* - Greenland and Barents Seas
* Hooded seals *Cystophora cristata* - Greenland Sea
* Common seals *Phoca vitulina* - Svalbard and Norwegian coastal waters
* Grey seals *Halichoerus grypus* - coastal waters of the Faroe Islands, Norway and Russia
* Crabeater seals *Lobodon carcinophagus* - Weddell Sea

Cetaceans

* Bottlenose whales *Hyperoodon ampullatus* - North Atlantic
* Minke whales *Balaenoptera acutorostrata* - Northeast Atlantic
* Harbour porpoises *Phocoena phocoena* - Norwegian coastal waters
* Killer whales *Orcinus orca* - Norwegian coastal waters
* Belugas *Delphinapterus leucas* - Svalbard

2.1 Field work

Pinnipeds

A surveillance flight with the Coastguard=s Orion for moulting **hooded seals** in the West Ice was conducted in July 1996. No conclusions on the status of hooded seals in this area could be drawn from this survey (IMR).

Studies of age and sex composition, body condition and feeding ecology were performed on **harp seals** invading the coast of North Norway in March/April (NIFA).

The ecology of seal pups, growth, changes in condition and diets, through the initial stages of their independent life, i.e. from weaning until they have started to feed independently, were studied in the Barents Sea (East Ice) and Greenland Sea (West Ice) in March-May. The pup ecology project includes both **harp** and **hooded seals**. Additional data on body condition were collected from adult **harp seals** (NIFA).

The studies on killing methods for seal pups in the West Ice which started in 1995 continued in 1996. Data were collected from 350 seal pups killed with the hakapik during the hunting of weaned seal pups in order to find out how effectively the animals were killed. The number of blows used for each animal, hitting site, eye reflexes and reflex movements were monitored and registered shortly after the animal had been hit by the hakapik. Samples of head and neck were taken from 75 of these animals for further analyses in the laboratory (NVH-IAV).

Studies of Barents Sea **harp seal** feeding ecology were continued with capture of seals for condition and stomach analyses and concurrent estimates of prey abundance using trawling and acoustic methods in July/August. During the survey some **ringed** seals were also captured in order to assess their ecological position in the drift ice belt. Prey specimens and blubber profiles from both seal species were collected for later analyses of fatty acid composition (NIFA - NFH).

Field work for various physiological studies of seals was conducted in the Greenland Sea (West Ice) between March 23 and April 8, 1996. A total of 6 **harp seals** and 6 **hooded seals** were killed for collection of tissue samples (blood, blubber, muscle, heart, spleen, brain, kidneys, liver, adrenal glands), to be analysed for background levels of the environmental pollutant PCB, and for use in histological/physiological studies of spleen function in relation to diving in seals. In addition, 17 harp seals and 2 hooded seals were captured live and transferred to facilities at the Department of Arctic Biology, University of Tromsø, for use in various physiological studies (diving physiology, thermoregulation, osmoregulation, effects of PCB-contamination, etc.) (UITØ-AAB).

Between April 30 and May 10, 1996, 6 female and 4 male White Sea **harp seals** were equipped with head-mounted 0.5 W satellite-linked dive recorders (Wildlife Computers, USA) for studies of the distribution and dive behaviour of seals from this stock after completion of the annual moult. (SevPINRO, Archangelsk, Russia, UITØ-AAB)

Sampling of biological material for studies of breeding biology (including tagging of pups) was performed for **grey seals** in Norwegian waters (NIFA).

Aerial photographic surveys of coastal seals was conducted off mid-Norway in August-October 1996. The surveys were conducted during moulting (**common seals**) and breeding (**grey seals**) seasons (IMR).

On the coast of Møre, 7 **common seals** were radio tagged. The seals were monitored for periods of three months using two automatic directional VHF radio receivers. In June, seals equipped with ultrasonic transmitters were tracked using inflatable boats with hydrophones to obtain detailed data on dive depth, swim speed, heart rate and stomach temperature. Six common seal pups were tagged using conventional flipper tags (NINA).

Field work on **bearded seals** was conducted in May in Kongsfjorden, Svalbard. A total of 37 bearded seals were captured live, weighed and tagged, and some were fitted with time-depth recorders. Material was collected for analyses of vitamins in milk, and about 100 hours of observations of mother-pup interactions were collected for a M.Sc-programme. In addition, some bearded seals were shot as part of two other M.Sc-programmes, one on diet and one on life history parameters. These projects are cooperations between NP, and the Universities of Waterloo, Trondheim and Tromsø.

Ringed seal field work was conducted in St Jonsfjorden for a 14-day period in June/July. 20 ringed seals were captured live, and 8 of these were adults and had moulted and were fitted with satellite-transmitters. This project is a cooperation between NP and the Universities of Waterloo and Oslo. In addition, field work on ringed seals was conducted in Kongsfjorden in May. Here seals were shot and material collected for analyses of pollutants and P450 activity. This project is a cooperation between Akvaplan-niva, the Finnish Fish and Game Research Institute and NP.

Ten **crabeater seals** were equipped with 0.5 W satellite-linked dive recorders (Wildlife Computers, USA) during a U.S. circumantarctic cruise in January/February 1996. The purpose was to monitor seasonal changes in distribution and dive behaviour of this species, and to link this to the seasonal distribution of krill in Antarctic waters (National Marine Mammal Laboratory, U.S.A., UITØ-AAB).

During all seal and whale expeditions conducted in 1996, observations of pinnipeds were systematically recorded by species and position (NIFA).

Age and biological material has been collected on board catching vessels both during sealing (harp seals) and whaling (minke whales) operations (IMR).

Cetaceans

During summer 1996 a sighting survey was conducted in the Norwegian Sea. This was the first year of a six-year program to cover the Northeast Atlantic to ensure a new abundance estimate of **minke whales** every six years for management purposes (IMR).

During the commercial whaling season (May-June), stomach samples, body condition data and biological material for studies of demography, reproduction and stock identity were collected from **minke whales** by scientific personnel on 5 of the participating vessels. Additionally, tissue materials for studies of stock identity were collected by

governmental inspectors from all whales taken by the other vessels participating in the minke whale hunt (NIFA). Times to death and several other data relevant to studies of the effectiveness of the killing process were also recorded (NVH).

A research cruise was performed in the Lofoten/Vesterålen area off northern Norway between 20 June and 2 July, 1996 to tag **minke whales** with VHF-radio transmitters in order to provide further data on surfacing rates for use in evaluation of survey results (UITØ-AAB).

Killer whale surveys were performed during late autumn in North Norway in order to study behaviour, sounds and problems concerning photoidentification of the animals (UITØ-NFH).

In Sognefjord, **harbour porpoise** movements and vocalisation during transit, foraging and resting were recorded on video and acoustic tapes. The objective is to study behaviour of porpoises in close proximity to fishing nets. In 1997, experimental deployment of nets will be conducted at the transit routes, resting and foraging sites of porpoises (NINA).

Field work on **belugas** was conducted for 12 days in July in the Van Mijen/Van Keulen area. Few whales were seen and only one captured. This individual was equipped with a satellite-transmitter, and samples were collected for studies of pollutants and genetics (NP).

2.3 Laboratory work

Pinnipeds

Physiological studies of captive **harp** and **hooded seals** at the Department of Arctic Biology, University of Tromsø: The direction and velocity of blood flow in the extradural intravertebral vein of **harp** and **hooded seals** is studied by use of doppler ultrasound instruments, before, during and after experimental diving of the seals. The purpose is to investigate potential circulatory changes which may enhance the efficiency of oxygen utilisation during diving. Further studies have been conducted on the function of the **hooded seal** spleen as a blood storing organ, in relation to diving. Physiological, anatomical and histological techniques have been used. Brain temperatures were recorded in diving **harp** and **hooded seals**, in order to test the hypothesis that diving seals economise with existing oxygen stores and extend submersion time by allowing brain (and possibly other core) temperatures to fall during diving. Sea water drinking was studied in three mature **harp seals**, by continuous collection of urine and blood during a 12-hour period, after initial experimental sea water administration. The purpose is to investigate how the excretory system of the seal is able to handle such loads, and to find out whether seals may have a net gain of water from drinking sea water.
Thermoregulatory studies are conducted in **harp seals**, to investigate the importance of different body parts (body trunk and flippers) in controlling heat loss rates, and to find out in which way circulatory adjustments are used to change the insulating properties of the blubber layer.

Measurements of metabolic rates are performed in **harp seals**, in order to find out to what extent blubber is metabolically active and contributes to the overall metabolism of the animal. Measurements of metabolism have been combined with studies of body composition in adult harp seals which have been subjected to various feeding regimes, and thus have had a blubber layer of variable thickness.

Experimental studies of physiological and immunological effects of exposure to the environmental pollutant PCB were conducted in **harp seal** pups. Samples from various tissues (blood, blubber, muscles, etc.) were collected from animals which were exposed to daily doses of PCB. The samples will be analysed for PCB levels and for potential immunological and physiological (e.g. hormonal) changes which may have occurred as a result of exposure to PCB.

Analyses of tissue (blood, blubber, hair) samples from **harp** and **hooded seals** are performed in order to investigate turnover rates of naturally occurring isotopes (^{15}N and ^{13}C) and fatty acids, in relation to experimentally induced dietary changes (in cooperation with Texas A&M University, U.S.A.) (UITØ-AAB).

Cardiac cells were isolated from newly killed **harp seals** and studied under *in vitro* conditions, in order to investigate cellular mechanisms which can explain the seal heart's ability to function at extremely low contraction frequencies (heart rates down to 6 beats per minute) and under partially hypoxic conditions (UITØ-IMB/AAB).

A study of Brucellosis, a zoonotic disease which can cause reproduction failure in several domestic and wild animal species, on **harp seals, ringed seals** and **bearded** seals continues. Supplementary specimens have been collected during the commercial catch of **minke** whales during 1996, off the coast of Spitsbergen and Bear Island. Specimens were also collected during the commercial catch of **harp seals** in 1996 from the East Ice. A serologic survey for antibodies capable of recognising *Brucella sp*. is conducted by an ELISA-test. Tissue samples from serum positive animals are being checked for the presence of *Brucella* by direct cultivation and by Polymerase Chain Reaction (PCR) (NVH-IAV in cooperation with Institut National De Recherches Veterinaires, Brussels, Belgium).

Serum samples from **minke** whales (n=202), harp seals (n=335), **ringed seals** (n=48), and **hooded seals**(n=79) have been tested for antibodies against *Toxoplasma gondii*. The purpose of the study has been to find out if pinnipeds and cetaceans from the North Atlantic and Barents Sea have antibodies against *T. gondii*. The question arises whether the proper handling of marine mammal meat should include freezing or thorough cooking to destroy *Toxoplasma* tissue cysts (NVH-IAV).
Age readings from teeth have been conducted on **harp seals** taken during seal invasions and on their feeding grounds in the Barents Sea. Furthermore, data on body condition of adult **harp seals** (taken during the invasions and in the Barents Sea**)** and of **harp** and **hooded seal** pups from breeding grounds have been analysed (NIFA).

Stomach and intestine content samples taken from **harp seals** during invasions and on their feeding areas in the Barents Sea and from **harp** and **hooded seal** pups in the

breeding areas have been analysed using traditional methods where the original biomass of prey items are reconstructed based on remaining hard parts in the contents. Stomach contents data collected on the feeding grounds are compared with data from concurrent estimates of prey abundance (NIFA).

Common seal vocalisations were analysed. Tests for regional variations in male display vocalisations were conducted based on recordings at Orkney in UK, Oslofjord, Møre, Trøndelag, Vesterålen and Finnmark in Norway. Recordings of dive profiles and stomach temperature in free ranging seals were analysed in order to explore the foraging behaviour and habitat use of this species (NINA).

Blood samples from **common seals** are analysed in connection with a phocine distemper virus study (NP).

Age, condition and stomach contents data from **ringed seals** from the Barents Sea drift and **common seals** from the Norwegian coast have been analysed (NIFA-NFH).

Studies of DNA for stock identity of **walruses** from East and West Greenland, Svalbard, and Frants Josef Land are carried out (NP).

Teeth and sex organs from **bearded seals** are analysed for age and sexual maturity. Stomach and intestine contents are analysed for a diet study, blood samples are analysed for different PCBs, and hair samples analysed for mercury content (NP).

Ringed seal blood, hair and samples from different organs are analysed for different studies of pollutants (NP).

Cetaceans

Age determination of bullae from **minke whales** and teeth from seals have been continued. A study on interpretations of zones in minke whale bullae in cooperation with Japanese scientists has been continued (IMR).

A study on reproduction in **minke whales** comparing data from several geographic areas has been initiated (IMR).

Recapture information and databases containing incidental observations of marine mammals have been updated (IMR).

Stomach content samples from **minke whales** have been analysed using traditional methods where the original biomass of prey items are reconstructed based on remaining hard parts in the contents (NIFA).

Material collected from **minke whales** for studies of temporal and regional variations in condition include girth and blubber measurements, meat and blubber masses and meat samples to be used in total lipid and protein content analyses. The analyses of this material is still in progress (NIFA-NFH).

Tissues sampled for stock identity studies of **minke whales** have been analysed using DNA techniques (NIFA).

Chemical analyses were performed on **minke whale** baleens and various prey species, in order to identify substances which may act as indicators of food selection in baleen whales. Isotopes of carbon and nitrogen (^{15}N and ^{13}C) were analysed using a mass spectrometer, while the concentrations of cadmium, fluoride and sulphur were determined by use of atomic absorption spectrometry, ionic analyser and gas chromatography, respectively (UITØ-AAB).

Analysis of polychlorinated biphenyls (PCBs) in different tissues of **harbour porpoises** was completed in 1996 (NINA + IMR), and analysis of toxic butyltins was initiated (NINA + NIVA).

A cooperative project on DNA studies of teeth and fixated reproductive material from earlier catches of **bottlenose whales** has been initiated together with Dalhousie University, Halifax, Canada (IMR).

2.4 Other work

Pinnipeds

Anatomical and feeding data from **harp seals**, collected in February 1993 and October 1995, have been prepared for publication/presentation. Furthermore, results from analyses of recent **harp seal** invasions to coastal waters of North Norway and from analyses of ecological data collected from **harp** and **hooded seal** pups in the East and West Ice have been presented. And finally, results from tagging experiments with **grey seals** in Russia and Norway have been analysed and presented (NIFA).

Seal pups and some harp seal pelts from the East Ice commercial catch were investigated for the presence of blood-sucking lice (*Echinopthirius hordus*) (NVH-IAV).

Cetaceans

Feeding data from **minke whales**, collected in special permit catches in 1992-1994, have been analysed and prepared for presentation/publication (NIFA).

Data from studies of **killer whale** behaviour and ecology, collected in 1990-1993, have been analysed and prepared for publication (UiTø-NFH).
A bioeconomic model has been developed to analyse the annual economic losses from the reduced harvesting of prey species resulting from an increase in a predator stock. The model has been applied to the case of Northeast Atlantic **minke** whale=s consumption of fish (UiTø-NFH).

2.5 Research results

Pinnipeds

Based on biological data collected in the south-eastern Barents Sea in February 1993, and in the north-eastern Barents Sea in October 1995, quantitative analyses of **harp seal** prey preferences have been performed. Both the abundance of prey and the composition of seal diets varied substantially between the two areas. Statistical analyses of potential prey

preferences revealed that in the northern study area, the harp seals appeared to have a negative preference for the very abundant krill. Considering two prey species at a time and comparing the difference between diet and abundance composition, the most reliable prey preference conclusion on a 5% test level was that polar cod was preferred over the pelagic amphipod *Themisto libellula* in this area. An October shift from crustaceans to fish in the seal diets appears to be supported by the material from the northern study area. In parts of the southern area, herring was found in significantly smaller proportions in the seal diet than in the sea. A possible preference for herring over polar cod was also indicated, but this conclusion was more uncertain due to spatial variation in the prey abundance in the area. Two independent statistical methods were applied, one based on a standardised test statistic which was assumed to be normally distributed, and one based on bootstrap. Identical test conclusions were obtained with both methods (NIFA).

Food shortage, particularly the two important prey species capelin and herring, may have contributed to the invasions of **harp seals** that have occurred to the coast of North Norway in recent years. Investigations in 1995 revealed a first mid-winter (December-February) invasion wave of young (mainly one-year-old) animals to most coastal areas of North Norway. Many tags from the East Ice were recovered, and the diet of the young animals was generally dominated by small gadoids, particularly saithe. The body condition of the invading young animals were rather poor, and observed age composition of Barents Sea harp seals in their moulting lairs in 1995 suggests high mortality, with subsequent low recruitment to the stock, of the 1994 cohort. A second invasion wave of adult females occurred (post-weaning) to the northernmost coastal areas of North Norway (Finnmark) in April 1995. These animals were feeding in particular on cod and haddock. In 1996 there was no mid-winter invasion, but adult females occurred as usual in April (NIFA).

Results from the ecological studies of **harp** and **hooded seal** pups indicate that both species are capable of finding prey and feeding independently rather quickly after weaning. The first food of harp seal pups seems to be restricted to crustaceans (particularly krill and *Themisto libellula*) both in the East and West Ice, whereas the hooded seal pups in the West Ice also feed on other prey groups such as fish and cephalopods. Body condition data from harp seal pups taken in the East Ice seems to indicate that the pups are not able to consume sufficient prey to meet energy requirements during the period from weaning (mid-March) to mid June (NIFA).
Data collected from **harp seals** that were satellite-tagged after moult in the White Sea show that the seals all migrated out of the White Sea shortly after the moult, to disperse into the Barents Sea. Tagged animals have mainly stayed in the northern parts of the Barents Sea throughout the study period, both in association with the ice edge and in open water. Dive depth data indicate that the seals mainly dive to depths of less than 100 meters. Data collection is not yet completed (4 transmitters still active on 31 December 1996), and processing and analyses of data are still in progress (SevPINRO, Archangelsk, Russia, UITØ-AAB).

Results of physiological studies at the Department of Arctic Biology, University of Tromsø: Studies of blood flow changes in the extradural intravertebral vein of diving **harp** and **hooded seals** are not yet completed, and results are not available. Studies of

spleen function in **hooded seals** show that this species may store about 13% of its blood volume in the spleen. Spleen hematocrit may reach more than 90%, and the spleen is therefore capable of storing 20% of the total amount of red blood cells. Data suggest that red blood cells may be released through splenic contraction during diving. This process increases the oxygen-carrying capacity of the blood, and, hence, enhances re-oxygenation efficiency during surfacing periods. The mechanisms behind splenic trapping and release of red blood cells are not known, but are under investigation.

Harp and **hooded seals** that were subjected to experimental diving of 10-15 min duration, displayed decreases in brain temperature of 2-3°C. Such brain hypothermia may cause a pronounced reduction in cerebral oxygen consumption, and hence, contribute to extending oxygen stores and submersion endurance.

Preliminary results from a study of sea water drinking in **harp seals** show that adult animals cope with orally administered sea water volumes of 1500 ml by excreting surplus ions through the kidneys. However, this also causes a net loss of water, and harp seals are thus unable to gain body water by drinking sea water.

Thermoregulatory studies of **harp seals** show that at water temperatures close to the lower critical temperature of the animals, the insulative properties of their blubber is close to that of dead blubber, and heat loss from the flippers accounts for 2-6% of total heat loss. As the heat load on the animals increases with increasing water temperatures, the relative contribution of heat loss from the flippers increases to 19-48%, while the fraction lost from the trunk decreases, despite an increase in the active heat transfer through the blubber by enhanced blood perfusion. Studies of differences in metabolic rates between fat and lean **harp seals** imply that blubber makes a rather small contribution to the resting metabolic rate of these animals.

Analyses of tissue samples collected from **harp seals** which have been subjected to experimental PCB-exposure are in progress, and data are not yet available. This also concerns tissue samples for analyses of carbon and nitrogen isotopes and fatty acids, which were collected from **harp** and **hooded seals** which had been subjected to experimental changes in diet (UITØ-AAB).

In vitro studies of isolated cardiac cells from **harp seals** indicate that special adaptations in the cellular regulation of free calcium may help explain the tolerance to low contraction frequencies and partly hypoxic conditions in the phocid seal heart (UITØ-IMB/AAB).

The analyses of the age material from the catches of moulting **harp seals** in the West Ice and in the East Ice show that the 1987 cohort is virtually absent in both areas, and that the recruitment in the East Ice has probably been reduced in recent years (IMR).

Of **harp seals** tagged in the West Ice, six were recaptured in the moulting lairs there, while two were recaptured off Greenland and one recaptured in the East Ice in 1996. Two harp seals tagged in the White Sea in 1991 were recaptured during moulting in the East Ice (IMR).

The analyses of registrations from the studies on killing methods for seal pups in the West Ice have not been concluded. The preliminary results of the collected data and head samples showed that almost every blow with hammer (first blow) of the hakapik hit the scull over the brain, while the spike (second blow) sometimes did not hit exactly in the brain. However, the hammer blow gave extensive haemorrhages in the brain which most probably rendered the animals unconscious very rapidly or instantaneously. "Swimming movements" (reflex movements) of the tail were registered even if the brain was extensively damaged (NVH-IAV). Verification of results from serological screening of seals and whales for *Brucella*-specific antibodies is in progress (NVH-IAV).

No antibodies against Toxoplasma were found in any of the samples from the minke whale and different seal species (NVH-IAV).

Blood-sucking lice were found on harp seal fur from adults. The lice were abundant over the back, more than 200/animal (NVH-IAV).

In May 1996 new rules for management of **coastal seals** were introduced. Management shall be based on sustainable use and this requires the establishment of a survey programme. In 1996, photographic surveys in moulting lairs of common seals and in breeding areas of grey seals in mid-Norway showed numbers similar to previous estimates. The photographic survey information from the most recent years was supplemented with earlier data and information to provide advice in the short term until a satisfactory management system is established. This system also includes the collection of catch statistics (IMR).

Ecological studies of **common seals** in North Norway have revealed a diet dominated by saithe, but also with considerable proportions of herring, cod and sand eels. Methodological studies indicate that use of faeces samples in quantitative analyses is questionable. Common seals appear to feed little during summer (breeding, moulting), but feed sufficiently during autumn and winter to increase their blubber layer significantly (NIFA-NFH).
Studies of **grey seals** in North Norway have revealed a prolonged breeding period, starting in October and lasting to the middle of December. A tagging experiment in North Norway and Russia suggests extensive migrations of young grey seals. Many pups tagged in Russia were recaptured in Norway. By-catches of young grey seals in gill nets appears considerable in that more than 4% of the tagged pups were recaptured in this way within the first year after tagging (NIFA-NFH).

Ecological studies of **ringed seals** in the northern drift ice areas of the Barents Sea indicate that the species feeds mainly on crustaceans (krill and *Themisto libellula*) and polar cod (NIFA-NFH).

Data collected from satellite-tagged **crabeater seals** are presently being processed and analysed. No results are yet available (National Marine Mammal Laboratory, U.S.A., UITØ-AAB).

Cetaceans

During autumn 1995 and spring 1996 a large effort was put into analysing the **minke whale** survey data collected in 1995 as well as a reanalysis of the survey and experimental data from the years 1988-1990. Based on the 1995 survey the abundance of minke whales in the North-eastern stock area was estimated to be 112,000, with a 95% confidence interval of 91,500-137,000 and the revised estimate for 1989 was 65,000, with a 95% confidence interval of 44,500-94,000 (IMR).

Results from fore-stomach analyses of **minke whales**, taken in scientific whaling operations in 1992-1994, indicate a diet dominated by fish. Considerable heterogeneity occurred in prey species composition both between geographical areas, sampling periods and sampling years. Gadoid fish species generally dominated the spring diet. During summer in 1992, capelin dominated the whale diets in the two northernmost study areas (Spitsbergen/Bear Island), while in summer and autumn in 1993 and 1994 krill was the most important food item in these areas, with the addition of only small amounts of capelin. The latter is consistent with a recent increase in krill and severe decrease in capelin availability in the area. In coastal areas of northern Norway and Russia, minke whales had been feeding mostly on herring, to a lesser extent on gadoid fish (particularly during summer). Statistical analyses seem to indicate a preference for herring and capelin. Given the opportunity to choose, it appears that minke whales will generally favour these two prey species over other relevant species such as krill and gadoid fish species (NIFA).

Inclusion of **minke whales** in multispecies modelling of the Barents Sea resources has actualised development of an effective and feasible method designed to provide regular and representative information about stomach contents from the species. It is assumed that this may be obtained most conveniently by collection of data from commercial catches. However, the comprehensive and time- and resource-consuming methods used in scientific catch operations had to be simplified considerably. Experiments designed to achieve this were started on a pilot scale during scientific catches in 1994, and continued more comprehensively during commercial whaling in 1995 and 1996. The results indicate that such simplification is possible. Under certain assumptions, randomised collection of relatively small (2-3 l) sub-samples taken directly from the opened fore-stomach appears to be sufficient for an adequate and representative description of minke whale diets (NIFA).

Attempts to tag **minke** whales with VHF-radio tags failed due to a combination of unfavourable weather conditions and low local abundance of whales during the tagging period (UITØ-AAB).

The results of chemical analyses of **minke whale** baleens indicate that none of the tested elements (^{15}N and ^{13}C, cadmium, fluoride and sulphur) are suitable as indicators in studies of diets of Northeast Atlantic minke whales (UITØ-AAB).

Predation costs are estimated for the Northeast Atlantic **minke whale**. The annual average predation cost per whale in 1991-92 is between $US 1,780 and $US 2,370, using Norwegian cost and earnings data. A ten percent stock increase is estimated to cause an annual loss of almost $US 19 million to the fishers of the prey species (UiTø-NFH).

Abundance estimates for some **odontocete species** based on the survey in 1995 were presented to the IWC Scientific Committee at its annual meeting in June 1996 (IMR).

Killer whales have been shown to occur in different coastal areas of North Norway throughout the year, these areas coinciding with the distributional areas of the Norwegian spring spawning herring. Herring seems to be the main type of killer whale prey both during autumn-winter and summer, although predation upon saithe, mackerel, little auks, eider ducks, northern fulmars and jellyfishes has been observed. The dynamic nature of the seasonal migration patterns of Norwegian spring spawning herring clearly has consequences for the seasonal occurrence and habitat use of killer whales (NFH).

In 1995 the IWC Scientific Committee tentatively divided **harbour porpoises** in Norwegian waters into two populations: the North Norway - Barents Sea population, and the North Sea population. It was agreed to use 66°N to delineate the boundary between the two tentative populations. A morphometric comparison was conducted based on measurements of 53 female and 72 male porpoises north and south of this latitude. There were few significant differences between the groups. Essentially, it could only be concluded that significant differences among the geographic groups are restricted to two girths for males: at axilla and anterior to the dorsal fin. For females, differences are less apparent, but may be present in girth at axilla as well as mass. Definitive differences in both proportional and absolute size can only be determined with the introduction of new data (NINA).

Polychlorinated biphenyls (PCBs) were measured in six female and one male **harbour porpoises** incidentally caught in October 1993 off the Norwegian west coast 60°50'. Mean PCB concentrations (µg/g lipid) were in blubber (7.36), melon (8.08), brain (0.37), liver (2.37), spleen (1.12), kidney (1.05), dorsal muscle (2.35), heart muscle (2.15), blood (4.2) and in females only: mammary gland (1.15). A significant negative correlation in _PCP with age was noted for females. However the maximum concentrations of _PCB were recorded in blubber (12.9 µg/g lipid) and melon (13.9 µg/g lipid) of a six years old female (NINA + IMR).

3. CATCH DATA

3.1 Pinnipeds

Norwegian sealing in 1996 included four vessels, two of which operated in the West Ice (the Greenland Sea) and two in the East Ice (the south-eastern Barents Sea). The Norwegian ban on catching pups was lifted in the 1996 season, and up to half the quotas were allowed to be taken as weaned pups. The following table gives the Norwegian catches of harp and hooded seals in 1996.

Table 3.1 Norwegian catches of harp and hooded seals in 1996. 1+ means one year or older seals.

	The West Ice	*The East Ice*

Species	Pups	1+	Total	Pups	1+	Total
Harp seals	5,649	778	6,427	2,910	6,611[1)]	9,521
Hooded seals	575	236	811			

[1)] Including 22 seals taken for research purposes in July/August.

3.2 Cetaceans

A temporary halt in the commercial minke whaling in Norway was introduced after the 1987 season. With the exception of scientific catches, no whaling was allowed during the period 1988-1992. In 1993, commercial minke whaling was again allowed and quotas were established based on the Revised Management Procedure (RMP) developed by the IWC Scientific Committee. A part of the quota was allocated as scientific catches which were conducted during the period 1992-1994 to study the feeding ecology of minke whales.

The RMP allocates catch quotas to specific management areas. There are five such management areas within the region of interest to Norwegian whalers. These are (1) the Svalbard-Bear Island area (abbreviated ES); (2) the eastern Norwegian Sea and central and north-eastern Barents Sea (EB); (3) the Lofoten area (EC); (4) the North Sea (EN) and (5) the western Norwegian Sea/ Jan Mayen area (CM). During the years 1993-1994, only the EC area was open for scientific catches. Table 3.2 shows the number of minke whales taken in commercial whaling operations during the 1996 season.

Table 3.2 Catches of minke whales in 1996 by management area as defined in RMP

1996	Management area					
	EB	EN	ES	EC	CM	Total
Small-type whaling	200	23	112	13	40	**388**

4. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

4.1 Sealing

Advice on management of harp and hooded seals is based on the deliberations in the ICES/NAFO Working Group on harp and hooded seals. For harp seals in the West Ice, pup production in 1991 has been estimated both from mark-recapture experiments and visual and photographic surveys and found to be 57,800 (95% confidence interval 46,000-69,000) and 55,300 (95% confidence interval 44,500-68,500), respectively. These findings were used to model the population to evaluate the impact of several catch

scenarios. Russia has studied the East Ice harp seal population by conducting photographic surveys in the breeding lairs in the White Sea, and their most recent analyses indicate that the pup production in 1991 was approximately 140,000, but the status of this stock is uncertain due to apparent recruitment failure since the late 1980s. A survey to estimate hooded seal pup production in the West Ice in 1994 failed to meet its goal due to bad weather and ice conditions, and the status of this stock is still poorly known. A new survey is planned for the 1997 breeding season. The present TACs are 13,100 harp seals in the West Ice, 40,000 harp seals in the East Ice and 9,000 hooded seals in the West Ice, all quotas given as 1+ equivalents.

Russia and Norway both take part in the sealing operations in the West Ice and the East Ice and therefore allocate quotas on a bilateral basis. The Norwegian quotas in 1996 were 10,600 harp seals and 1,700 hooded seals in the West Ice and 9,500 harp seals in the East Ice. There is a general ban on catching females in the breeding lairs in the West Ice. The Norwegian ban on catching pups of the year, introduced in 1989, was lifted for the 1996 season. For the 1997 season the same total allowable quotas as in 1996 will be suggested, but the allocation between Russia and Norway will probably differ from last year. The Norwegian share of the harp seal quota in the East Ice will be reduced to 5,000 animals, while the Russian share of the hooded seal quota in the West Ice will be reduced to 2,800 animals. It is expected that at least a part of the Norwegian quota will be allowed as a catch of weaned pups.

4.2 Whaling

At the IWC Annual Meeting in 1992 Norway stated that it intended to resume commercial minke whaling in 1993. So far, the IWC has accepted the RMP developed by its Scientific Committee as a basis for future management decisions, but has not implemented it. The Norwegian Government therefore decided to set quotas for the 1993 and following seasons based on the RMP with parameters tuned to the cautious approach level as expressed by the Commission, and using the best current abundance estimates as judged by the IWC Scientific Committee.

The total quota in 1996 for the Northeast Atlantic and the Jan Mayen area was set to 425 minke whales based on the new estimates from the 1995 survey and the revised estimates for 1989. The catch quotas are set for each of five management areas, and allocated on a per vessel basis, in 1996 10-16 whales per vessel for the 32 vessels which participated. The catching season was from 20 May to 22 July. All the participating vessels had inspectors on board to survey the whaling activity. The quota for 1997 will be 580 minke whales.

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SECTION 5 – SEALING CONFERENCE

SEALING THE FUTURE
NAMMCO International Conference and Exhibition
25-27 November 1997, St John's, Newfoundland, Canada

5.1
CONFERENCE PROGRAMME

Tuesday 25 November

CONFERENCE OPENING

0900	**Introduction**	Kate Sanderson, General Secretary, NAMMCO
0905	**Official Opening**	Arnór Halldórsson, Chairman of the Council of NAMMCO
0910	**Opening Addresses**	***The Hon. R. John Efford***, Minister of Fisheries & Aquaculture, Government of Newfoundland and Labrador; ***The Hon. Pâviâraq Heilmann***, Minister of Fisheries, Hunting and Agriculture, Home Rule Government of Greenland
0930	**Keynote Address**	***Collapse of the Arctic Sealskin Market***: Alfred Jakobsen, Inuit Circumpolar Conference
1000	*Coffee*	

1. SEALING PAST & PRESENT

Chair: Milton M.R. Freeman, H.M.Tory Professor of Anthropology, University of Alberta, Canada

1030 *Chair=s opening remarks*

1.1 Keynote presentations

1035 ***The origins of Newfoundland commercial sealing***: Shannon Ryan, Department of History, Memorial University of Newfoundland

1105 ***The socio-economic basis of subsistence sealing in Arctic Canada and Greenland***: Grete K. Hovelsrud-Broda, Marine Policy Center, Woods Hole Oceanographic Institution, USA and George W. Wenzel, Department of Geography, McGill University, Montréal, Canada

1135 ***Seals and sealing in the Russian Far-East: History, present status and prospects for the future***: Valeriy A. Vladimirov, Marine Mammal Lab, All-Russian Research Institute of Fisheries and Oceanography (VNIRO),Yuri Ponomarev, Magadan Fish and Game Inspection (*Okhotskrybvod*) & Yuri Buktiyarov, Magadan Region Administration

1205 Questions & Discussion

1215 *Lunch*

1.2 Sealing around the world today

1400 ***The importance of marine mammals to Alaska's indigenous people***: Carl Jack, Subsistence Director, Rural Alaska Community Action Program (RurAL CAP)

1415 ***Sealing activities of the Inupiaq communities of the Arctic Coast of Alaska***: Ben Hopson, Jr., Sealer from the North Slope of Alaska & Interim President of Indigenous Survival International

1430 ***Norwegian sealing today - on thin ice?***: Bjørne Kvernmo, Norwegian Sealers= Association

1445 ***Russian sealing in the North-East Atlantic and the Kara Sea - the past and the future***: Vladimir Potelov, SevPINRO Marine Research Institute, Arkhangelsk

1500 Questions & Discussion

1515 *Coffee*

1545 ***The sealing community of Newfoundland***: Mark Small, Canadian Sealers Association

1600 ***The challenges to Inuit sealing communities in Canada***: Okalik Eegeesiak, President, Inuit Tapirisat Canada

1615 ***Testimonial***: Lasarusic Epoo, seal hunter from Northern Quebec

1630 ***The Cape fur seal harvest in Namibia***: Aldert Brink, Sea Lion Products

1645 Questions & Discussion

Wednesday 26 November

2. PRODUCTS & MARKETS

2.1 Seal Oil and Meat

Chair: Kjartan Hoydal, Secretary, Nordic Atlantic Cooperation

0900 *Chair=s opening remarks*

Keynote Presentations:

0905 ***Seal meat, oil and carcass components - potential and problems for product development***: Fereidoon Shahidi, Dept of Biochemistry, Memorial University of Newfoundland, St. John=s

0935 **The *Orsoq* seal oil research project**: Eva Bonefeld Jørgensen, Center of Arctic Environmental Medicine, Dept of Environmental and Occupational Medicine, University of Århus**,** Denmark

1005 Questions & Discussion

1015 *Coffee*

1030 **Seal oil: case studies**
David Hiscock, Gateway Maritime, Newfoundland; Marit Eriksen, Davinor, Norway; Aldert Brink, Sea Lion Products, Namibia

1100 Questions & Discussion

1130 **Seal meat: case studies**
John Ackerman, Indian Bay Frozen Food, Newfoundland; Aldert Brink, SeaLion Products, Namibia

1200 Questions & Discussion

1230 *Lunch*

2.2 Sealskin

Chair: Alison Beal, Executive Director, Fur Institute of Canada
1400 *Chair=s opening remarks*

Keynote Presentation:
1405 ***The international market situation for fur***: Leif Boe Hansen, President & CEO, Saga Furs of Scandinavia & Chairman of the Board of the International Fur Trade Federation

1435 **Sealskin: case studies**
Knut Nygård, Rieber Skinn, Norway; Karl Sullivan, Terra Nova Fishery, Canada; Robert Trudeau, Government of the Northwest Territories, Canada; Eggert Jóhannson, Iceland
1520 Questions & Discussion
1540 *Coffee*

2.3 Overcoming Barriers to International Trade in Seal Products
Chair: Steen Christensen, Ministry of Business and Industry, Denmark
1610 *Chair=s opening remarks*

1615 ***The major barriers to trade in seal products today***: Craig Boljkovac, Acting Research Director, Inuit Tapirisat Canada

1630-1730 **Panel Discussion**

Panellists: Alison Beal, Fur Institute of Canada; Okalik Eeegesiak, President, Inuit Tapirisat Canada; Tina Fagan, Executive Secretary, Canadian Sealers Association; Rune Frøvik, High North Alliance; Reidar Hindrum, Nordic Council of Ministers; Ben Hopson Jr., Interim President, Indigenous Survival International; Alfred Jakobsen, Inuit Circumpolar Conference; Einar Lemche, Greenland Home Rule Government;

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1930 for 2000: Conference Host Dinner and International Fashion Show, Delta St. John=s

Thursday 27 November

3. MANAGING SEALS & SEALING FOR THE FUTURE

Chair: Jean-Eudes Haché, former Assistant Deputy Minister, Dept of Fisheries & Oceans, Canada
0900 *Chair=s opening remarks*

3.1 Seal management in practice
0905 ***Canada***: Jaque Robichaud, Director General, Resource Management, Dept of Fisheries & Oceans
0920 ***Namibia***: Ekkehard Klingelhoeffer, Ministry of Fisheries and Marine Resources
0935 ***Peru***: Milena Arias-Schreiber, Deputy Director of Marine Mammal Research,

IMARPE
0950 Questions & Discussion
1020 *Coffee*

1045 ***Norway***: Jan Frederik Danielsen, Adviser, Ministry of Fisheries
1100 ***Greenland***: Amalie Jessen, Head of Office, Department of Fisheries, Hunting & Agriculture
1115 ***Uruguay***: Alberto Ponce de Leon, Marine Mammal Dept, National Institute of Fisheries
1130 ***Russian Federation***: G.V. Gusev, International Fisheries Policy Division, Department of Fisheries, Ministry of Agriculture and Food
1145 Questions & Discussion
1215 *Lunch*

3.2 Perspectives on management

1330 ***The harp seal - The challenge of managing a valued resource and formidable predator***: Rob Coombs, Dept of Fisheries and Aquaculture, Government of Newfoundland & Labrador
1350 ***Do more seals mean lower TAC's?***: Doug Butterworth, Dept of Applied Mathematics, University of Capetown, South Africa
1410 ***Fish, turnips and conservation: Seals and the human ecology of North Atlantic coastal communities***: Niels Einarsson, Dept of Fisheries Studies, University of Akureyri, Iceland
1430 Questions & Discussion
1440 *Coffee*

1510 ***Concepts and standards for the killing of animals***: Egil Ole Øen, Norwegian College of Veterinary Medicine
1530 ***The need for consistency and cooperation in seal management***: Rune Frøvik, Secretary, High North Alliance
1550 Questions & Discussion

4. SEALING THE FUTURE

1600 ***Concluding discussion*** chaired by Jean-Eudes Haché, with summaries from Session & Panel Chairs.
1715 Closing of Conference

5.2
PRESS RELEASE

November 28, 1997

INTERNATIONAL PANEL CALLS FOR ELIMINATION OF BARRIERS TO INTERNATIONAL TRADE IN SEAL PRODUCTS

ST. JOHN'S: An urgent call was made for the elimination of trade barriers that have constrained the international trade in seal products and impeded the sustainable development of sealing communities around the world at the first ever international forum on sealing, held in St. John's, Newfoundland from November 25th to 27th.

Sealing the Future, a three-day conference and exhibition which concluded here yesterday, drew
more than 200 participants from across the circumpolar north, including North America, northern Europe, and the Russian Federation and from Latin America and southern Africa. The event was organised by the North Atlantic Marine Mammal Commission (NAMMCO) and was hosted by the Government of Newfoundland and Labrador.

NAMMCO's spokesperson and General Secretary, Kate Sanderson said "Seals are major components of the marine ecosystem in the North Atlantic and in many other parts of the world. Seal stocks constitute an important source of meat, oil and skin and have the potential to become the basis of economic activity and employment where few or no other opportunities are available. The Conference heard that sealers all over the world - be they subsistence hunters in the Arctic, or operators of small crafts or larger vessels - are exploring outlets for the full utilisation of seals to secure a cash flow necessary to make their living."

On Wednesday afternoon, a discussion on international trade barriers concluded with a unanimous statement from a panel of sealers and Aboriginal groups, industry, government and trade experts calling for an end to trade barriers that are inconsistent with the principles of the World Trade Organization (WTO).

"WTO-inconsistent trade barriers continue to hamper the economic development of communities around the world that rely on the sustainable use of seals and other wildlife resources," the panel members stated in a joint conclusion. "Governments do not always pursue trade interests in a manner consistent with the rights and interests of the people of coastal communities to maintain their livelihoods from the sustainable harvest of seals and other wildlife resources."

The eight-member panel requested governments to abolish WTO inconsistent barriers to trade in seal products, and urged governments with sealing communities to promote the seal trade interests of these communities without delay. The panel also recommended that the WTO establish a special unit to service the legitimate trade interests of indigenous

people, in accordance with Agenda 21's recognition of the trading interests of indigenous people.

The wide range of possibilities for the total utilisation of seals was clearly indicated in presentations from researchers and product developers at the Conference. Papers were presented on the nutritional value and product possibilities of seal oil and meat, including preliminary results from recent medical research on seal oil which clearly indicate its potential to enhance human health.

Emphasising the need to pursue research into the further development of seal products, Kate Sanderson noted, "Conference attendees also concluded that international cooperation and funding for applied research is crucial in ensuring that seal resources continue to be developed in a sustainable and cost effective manner. Participants called for cooperation on generic marketing of seal products and general information countering the misinformation of the protest industry on sealing."

Already the information available is being put to use and there is a growing interest in several countries in using seal meat and oil in a number of commercial products, many examples of which were on display during the Conference. The use of seal in the fur industry has been increasing in recent years, and an international seal fashion show Wednesday evening in St. John's hosted by the Provincial Government of Newfoundland and Labrador demonstrated the exciting variety and ingenuity of designers in countries all over the world.

The upward trend in sealing and processing and marketing of seal products is, however, being hampered, not only by arbitrarily imposed import restrictions in some countries, but also by the general problems of introducing new products into the market place, and the negative public perceptions of sealing created by multi-million dollar campaigns by the international protest industry.

5.3
CONCLUSIONS & RECOMMENDATIONS OF THE PANEL ON BARRIERS TO INTERNATIONAL TRADE IN SEAL PRODUCTS

26 November 1998

The Panel noted that -

- WTO inconsistent trade barriers continue to hamper the economic development of communities around the world that rely on the sustainable use of seals and other wildlife resources;
- governments do not always pursue trade interests in a manner consistent with the rights and interests of the people of coastal communities to maintain their livelihoods from the sustainable harvest of seals and other wildlife resources;

Based on these observations the Panel -

- requests governments to abolish WTO-inconsistent barriers to trade in seal products;
- requests all governments with sealing communities to promote the seal trade interests of these communities without delay.

In addition, and with reference to the recognition in Agenda 21 of the trading interests of indigenous people, the Panel recommends that -

- as a follow-up to the Rio Conference, the WTO set up a special unit with the task of cooperating with, and servicing, the legitimate trade interests of indigenous people, and of bringing WTO inconsistent trade measures hampering the trade of indigenous people to the attention of the members of the WTO;
- governments support the establishment of a WTO indigenous people=s unit politically and financially.

Panellists:

Chair: Steen Christensen, Ministry of Business and Industry, Denmark

Alison Beal, Fur Institute of Canada; Okalik Eegeesiak, Inuit Tapirisat of Canada; Tina Fagan, Canadian Sealers' Association; Rune Frøvik, High North Alliance (Norway); Reidar Hindrum, Nordic Council of Ministers; Ben Hopson Jr., Indigenous Survival International (Alaska); Alfred Jakobsen, Inuit Circumpolar Conference (Greenland); Einar Lemche, Greenland Home Rule Government

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