Annual Report
2004

North Atlantic Marine Mammal Commission

Layout & editing: NAMMCO Secretariat
Printing: BokstavHuset AS, Tromsø, Norway

ISSN 1025-2045
ISBN 82-91578-16-8

Please cite this report as:
North Atlantic Marine Mammal Commission, 2004.
NAMMCO Annual Report 2004. North Atlantic Marine Mammal Commission,
Tromsø, Norway, 353 pp.

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COMMITTEES AND OFFICE BEARERS

Members of the Commission		**Councillors**
Faroe Islands	(F)	Ms Ulla S. Wang/Mr Andras Kristiansen
Greenland	(G)	Mr Einar Lemche/Ms Amalie Jessen
Iceland	(I)	Mr Stefan Asmundsson/Ms Ásta Einarsdottir
Norway	(N)	Mr Halvard P. Johansen

Council

Chairs –	*1992-1995*	Mr Kjartan Høydal (F)
	1995-1997	Mr Halvard P. Johansen (N)
	1997-1999	Mr Arnór Halldórsson (I)
	1999-2004	Ms Amalie Jessen (G)
	2004….	Ms Kate Sanderson (F)

Committee on Hunting Methods

Chairs –	*1994-1998*	Ms Amalie Jessen (G)
	1998-2005	Mr Jústines Olsen (F)
	2005…	Dr Egil Ole Øen (N)

Management Committee

Chairs –	*1993-1994*	Mr Kjartan Høydal (F) interim
	1994-1998	Mr Einar Lemche (G)
	1998-2004	Mr Kaj P. Mortensen (F)
	2004…	Mr Halvard P. Johansen (N)

Management Committee Sub-Committee on Inspection and Observation

Chairs –	*1993-1995*	Mr Einar Lemche (G)
	1995-2005	Dr Egil Ole Øen (N)
	2005…	Ms Karen A. Motzfeldt (G)

Management Committee Working Group on By-catch

Chairs –	*1998-1999*	Mr Gísli A. Víkingsson (I)
	1999-2003	Dr Arne Bjørge (N)
	2003-2004	Mr Kim Mathiasen (G)
	2004…	Ms Droplaug Ólavsdóttir (I)

Scientific Committee

Chairs –	*1993-1995*	Mr Jóhann Sigurjónsson (I)
	1995-1997	Prof. Tore Haug (N)
	1997-2000	Dr Mads Peter Heide-Jørgensen (G)
	2000-2004	Mr Gísli A. Víkingsson (I)
	2004…	Prof. Lars Walløe (N)

Scientific Committee Working Group on Management Procedures

Chair –	*1993…*	Dr Nils Øien (N)

Scientific Committee Working Group on Abundance Estimates

Chair –	*1996…*	Dr Nils Øien (N)

Scientific Committee Working Group on the Economic Aspects of Marine Mammal – Fisheries Interactions

Chairs –	*1998-1999*	Dr Gunnar Stefánsson (I)
	1999-2000	Mr Aqqalu Rosing-Asvid (G)
	2000 …	Prof. Lars Walløe (N)

Scientific Committee Working Group on the Population Status of Narwhal and Beluga

Chair –	*1999…*	Prof. Øystein Wiig (N)

Scientific Committee Working Group on the North Atlantic Fin Whales

Chair –	*1999…*	Mr Gísli A. Víkingsson (I)

Finance and Administration Committee

Chairs –	*1999-2000*	Mr Øyvind Rasmussen (N)
	2000-2005	Mr Einar Lemche (G)
	2005…	Ms Ásta Einarsdóttir (I)

The NAMMCO Fund

Chairs –	*1998-2000*	Ms Ulla S. Wang (F)
	2000-2001	Ms Kate Sanderson (F)
	2001-2005	Ms Ulla S. Wang (F)

Secretariat

Outgoing General Secretary	Dr Grete Hovelsrud-Broda until October 2004
Incoming General Secretary	Dr Christina Lockyer from March 2005
Scientific Secretary	Mr Daniel Gordon Pike
Administrative Coordinator	Ms Charlotte Winsnes

In the interim period (October – March) Ms Charlotte Winsnes held the position of Acting General Secretary

SECTION 1 - COUNCIL

1.1
REPORT OF THE FOURTEENTH MEETING OF THE COUNCIL

Tromsø, Norway 1-3 March 2005

EXECUTIVE SUMMARY –
MAIN ACTIONS AND RECOMMENDATIONS BY AGENDA ITEM

2. FINANCE AND ADMINISTRATION:

- Adoption of the audited 2004 financial accounts.
- Adoption of the 2005 budget and a future goal for maintenance of a reserve that should not fall below 100,000 NOK in any financial year.
- Adoption of the draft 2006 budget.
- Dissolving of the NAMMCO Fund and transfer of the remaining funds (100,000 NOK) to Information budget line 7. in 2006.
- Guidelines to be developed by the FAC on permissibility of continued salary payments to staff during leave to participate in future fieldwork and/or other work of relevance to NAMMCO.

3. SCIENTIFIC COMMITTEE:

New requests for advice

Harp seals. The Scientific Committee is requested to evaluate how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland. Advice on catch quotas should be provided in the light of potential ecosystem management requirements. For the Greenland Sea and Barents/White Sea stocks of harp seals, advice should be provided on catch quotas that would result in varying degrees of stock reduction over a defined period of time. The Scientific Committee should specify harvest levels for these two stocks that would result in a population reduction of 20% over a period of 20 years.

Narwhal. The Scientific Committee is requested to carry out an assessment of East Greenland narwhal, and provide an estimate of sustainable yield for the stock. The management objective in this case is to maintain the stock at a stable level. If the assessment cannot be completed with available information, the Scientific Committee should provide a list of research that would be required to complete the assessment.

Humpback whales. The Scientific Committee is requested to assess the sustainable yield levels for humpback whales, particularly those feeding in West Greenlandic waters. The Scientific Committee is requested to continue its assessment of humpback whale stocks in the North Atlantic. For West Greenland, the Scientific Committee should assess the long-term effects of annual removals of 0, 2, 5, 10 and

20 whales. For the Northeast Atlantic, the Scientific Committee should provide estimates of sustainable yield for the stocks. In all cases the management objective would be to maintain the stocks at a stable level. The Scientific Committee should identify information gaps that must be filled in order to complete the assessments.

Harbour seal. The Scientific Committee is requested to:
- Review and assess the status of harbour seals throughout the North Atlantic;
- Review and evaluate the applied survey methods;
- Assess stock delineation using available data on genetics, spatial and temporal distribution and other sources;
- Review available information about harbour seal ecology;
- Identify interactions with fisheries and aquaculture.

Recommendations for scientific research

Multi-species models. The Scientific Committee is recommended to plan for continuation of their work on multi-species models in 2006 if sufficient new information becomes available. It has been noted that progress in the assessment of multi-species interactions cannot be made unless significant additional resources are dedicated to it. The importance of this work is emphasised and members are urged to proceed with the research required for completion.

Harbour porpoises. Pertaining to harbour porpoises around Iceland, the Scientific Committee is recommended to obtain better estimates of the present by-catch levels as well as an estimate of absolute abundance for the area, in order to estimate the sustainability of the ongoing by-catch. Aerial surveys will be carried out over the next two years as part of the Icelandic Research Programme, and it is recommended that the feasibility of modifying these surveys to generate valid estimates of absolute abundance for this species be investigated.

Beluga and Narwhal. Noting the importance of the West Greenland index survey series to the continued assessment of both West Greenland narwhal and beluga, it is recommended that this survey series be continued.

Fin whales. The highest priority relates to questions of fin whale stock identity and relationships to other stocks, and it is emphasised that the assessment of fin whale stocks cannot be continued until these questions are resolved. It is recommended that the Scientific Committee investigate the option of holding a joint inter-sessional workshop of IWC and NAMMCO to address the issue of stock structure, if it is not fully resolved at the IWC Scientific Committee meeting in May 2005. However, it is emphasised that any such coordination should not compromise the independence of the NAMMCO Scientific Committee's continuing assessment of North Atlantic fin whales.

Humpback whales. For West Greenland the most urgent requirement is for a new estimate of abundance. In this regard it was noted that a survey was completed in 2004, and that a new estimate should be available sometime in 2005.

Killer whales. There is currently insufficient information to carry out the assessment that was requested in 2004, particularly for the West Greenland area, and the Scientific Committee is asked to review new information on killer whales annually with the aim of completing the assessment once sufficient information becomes available for a particular area.

North Atlantic Sightings Survey. It has been noted that for various reasons, 2007 would be the optimal year to carry out the next NASS, rather than 2006 as originally planned. Efforts of the Scientific Committee to expand the NASS to include involvement from countries in the Western and Eastern Atlantic should be continued.

4. CONSERVATION AND MANAGEMENT:

Beluga and Narwhal. It was considered that the collaboration with the JCNB at the scientific level has been productive and the plan of the Scientific Committee to hold a joint meeting with the JCNB Scientific Working Group in 2005 was endorsed. While general concern was expressed that reductions in take of both narwhal and beluga were still unsustainable and were hindering recovery of the stocks, the Council expressed appreciation for the action taken so far by Greenland in reducing quotas.

Grey seal. Iceland reported a new management objective adopted for grey seals in response to earlier requests from the SC in 2004. Norway was also developing management objectives.

By-catch. The By-catch group was requested to continue its work with renewed terms of reference as outlined in the main MC report (NAMMCO/14/6).

Ecosystem based management. The *Ad Hoc* Working Group on enhancing ecosystem based management is requested to meet again prior to the next annual meeting of NAMMCO. They should examine more closely the management objectives and experiences in applying ecosystem based management in countries across the North Atlantic where marine mammals are utilised. Precise goals have been provided for addressing the 2003 WG Terms of Reference.

International observer scheme. There will be NAMMCO international observation of Norwegian sealing in 2005. Members should submit proposals for updates to provision of the scheme where these are considered necessary.

5. HUNTING METHODS:

- A “Struck and lost” workshop is planned in autumn 2006.

- There should be a finalisation of guidelines for weapons in marine mammal killing.

- Publication of all reports and workshops on hunting and killing methods should be done after the 2006 workshop.

6. NAMMCO FUND:

The NAMMCO Fund was dissolved – see above under item 2. on FAC.

8. EXTERNAL RELATIONS:

ICES and NAMMCO will finalise a formal reciprocal memorandum of understanding.

11. CLOSING ARRANGEMENTS

Next annual Council meeting is scheduled for spring 2006 in Iceland

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REPORT OF THE FOURTEENTH MEETING OF THE COUNCIL

Tromsø, Norway 1-3 March 2005

MAIN REPORT

The NAMMCO Council held its 14th Meeting at the Rica Ishavshotel in Tromsø, Norway, 1 - 3 March 2005. The meeting was attended by delegations from all Contracting Parties, the Faroe Islands, Greenland, Iceland and Norway, as well as observers from the Governments of Canada, Denmark, Russian Federation and Japan. A number of intergovernmental and non-governmental organisations were also represented at the meeting. See Section 5.1 of this volume for the List of Participants.

The Chair of the Council, Kate Sanderson convened the meeting.

1. OPENING PROCEDURES

1.1 Welcome Address

The Chair of the Council welcomed all delegates and the Mayor of Tromsø, and also the new General Secretary, Christina Lockyer, to the 14th NAMMCO Council meeting. She also thanked Charlotte Winsnes and Daniel Pike for their support in maintaining the Secretariat during the period between the outgoing and incoming General Secretaries. The Chair of Council reflected on the importance of the regional approach to management and some of the achievements of the past year including the Joint Observer Scheme and the Workshop on Hunting Methods for Seals and Walrus held in September 2004. She welcomed the continued participation of observer countries Canada, Russian Federation and Japan, not only at the Council level but also in the work of the Scientific Committee, as well as collaboration on hunting methods, and discussions on ecosystem approaches to management.

There followed a welcoming address by the Mayor of Tromsø, Hermann Kristoffersen, who welcomed the participants and commented on the strong historic cultural and financial association of Tromsø ("seal city") with Arctic whaling and especially sealing activities as well as polar research. He expressed the view that 9 years had been too long a time ago since NAMMCO last met in Tromsø, and that it should be regarded as an appropriate and welcoming venue for NAMMCO's future meetings.

Shilpha Rajkumar from the University of Wollongong, Australia, made a presentation entitled "The conservation and management of pinnipeds under international law". This presentation which gave a historic review of the evolution of major treaties of relevance to international cooperation on the management of seals, gave an important overview of the aims, roles, perspectives and scale (global, regional and local) of the many existing instruments, noting where there was both overlap and divergence of interests. She concluded with a look to the future and possible developments in relation to NAMMCO. There was much interest in her presentation and many questions were posed. [A summary of the presentation is available at NAMMCO Secretariat as a Powerpoint file.]

1.2 Opening Statements

The heads of the delegations of the Faroe Islands, Greenland, Iceland and Norway made opening statements to the meeting. In addition, a written statement was provided by Japan. Statements are contained in Appendix 3.

1.3 Admission of Observers

On behalf of the Council, the Chair welcomed the observers from governments, inter-governmental and non-governmental organisations.

The Council was informed that the following had sent their regrets in not being able to attend NAMMCO/14: the USA, NASCO, OSPAR, CITES, IUCN, ICC (Greenland).

1.4 Adoption of Agenda

The agenda as contained in Appendix 1 was adopted.

1.5 Meeting Arrangements

The Secretariat outlined the practical and social arrangements for the meeting. The participants were invited to a cultural reception at the Art Museum of Northern Norway hosted by NAMMCO on the evening of the opening day of the meeting, and participants were also invited to join a dinner hosted by the High North Alliance during the evening of the second day of the meeting.

The list of documents presented to the meeting is contained in Appendix 2.

2. FINANCE AND ADMINISTRATION

2.1 Report of the Finance and Administration Committee

The new Chair of the Finance and Administration Committee, Ásta Einarsdottir (Iceland) presented the report to the Council.

The Finance and Administration Committee had held two telephone conference meetings since NAMMCO/13 in March 2004: the first on 15 September 2004 and the second 8 February 2005. The tasks of the Committee had been to review the audited accounts for 2004, to develop a draft budget for 2005 and a forecast budget for 2006 (see under item 2.2). In line with the practice established at NAMMCO 12 in March 2003 (see NAMMCO Annual Report 2002: 12), the Committee had received a preliminary spending authorisation from the Council for 2005, awaiting the Council's approval of the draft budget for 2005 at the current meeting (see under item 2.2). The reports of the Committee were available to the meeting as NAMMCO/14/4 inclusive of NAMMCO/14/4 Annex 1. During the February meeting Ásta Einarsdottir, Iceland, was elected Chair, replacing Einar Lemche, Greenland and Ulla S. Wang, Faroe Islands, was elected as vice-Chair.

2.1.1 Other Matters

The Council thanked the Finance and Administration Committee for their report (see also under items 2.2 and 2.3), and also thanked Einar Lemche for his chairmanship of the Committee during the past 5 years.

2.2 Final Accounts 2004, Commission Budget 2005, Forecast Budget 2006

2.2.1 Final Accounts 2004

The Council noted that the Finance and Administration Committee had reviewed the final accounts of the Commission for 2004 in February 2005. The Council formally approved the audited accounts for 2004 (see Appendix 4).

2.2.2 Commission Budget 2005

For the draft 2005 budget, there were several points of discussion. The first of these items was the NAMMCO Fund, which on recommendation of the Board of the NAMMCO Fund, was dissolved (see Agenda item 6. NAMMCO Fund, pp. 33-34 in this report). The Chair drew the Council's attention to the NAMMCO Fund statutes regarding disposal of funds in the event of dissolving the Fund. Greenland commented that the balance in item 7. Information would be available for an overdue update of the NAMMCO website. The principle was agreed that a Total General Reserve (budget item 27.) of no less than 100,000 NOK should be maintained, and the Council approved that the presently large reserve from 2004 should be reduced during 2005 on a one time only basis by exceptionally not adjusting the national contributions for inflation in 2005.

The 2005 budget was thus adopted by Council, as contained in NAMMCO/14/4 - Annex 1.

2.2.3 Forecast Budget for 2006

The Council adopted on a preliminary basis the forecast budget for 2006, as contained in NAMMCO/14/4 – Annex 1. It was agreed that the assets from the Fund, currently 100,000 NOK, be transferred to the budget line 7. Information (see also Agenda item 6, the NAMMCO Fund), in accordance with the Fund statutes. The Faroe Islands however, cautioned that presently the forecast 2006 budget predicts a reduced Total General Reserve of less than the desired minimum of 100,000 NOK. This should be revisited in 2006.

2.3 Other Business

Attention was drawn to item 9. of the Report of the Finance and Administration Committee (NAMMCO/14/4) regarding participation in fieldwork by staff members in the Secretariat. This question was resolved for 2005, but the Finance and Administration Committee was requested to develop definite guidelines on principle to the Secretariat for future years.

3. SCIENTIFIC COMMITTEE

3.1 Report of the Scientific Committee

Lars Walløe, Chair of the Scientific Committee, presented the Report of the 12th Meeting, which was held 26 - 29 October 2004 at Viđareiđi, Faroe Islands. The full report is included in Section 3 of this volume. The Council Chair thanked him and the Scientific Committee for their efforts in the preceding year.

3.1.1 Cooperation with other organisations

The Scientific Committee reported on cooperation with IWC, ICES and the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB), and the desirability of varying degrees of collaboration on topics of mutual interest. Council discussion and recommendations regarding ICES and JCNB are recorded under items 3.1.3 and 3.1.5 respectively.

<u>Council discussion</u>

IWC and RMP: Iceland raised the question of whether or not Norway had made a decision on pre-implementation of the RMP (Revised Management Procedure) for baleen whales. Norway responded that the work was ongoing but will not be finished for the 2005 meeting of the IWC. Norway drew attention to its new White Paper and the planned increased quotas for minke whales. The work was however scheduled for completion by 2006, and a political decision was necessary regarding possible implementation in 2007.

IWC and Icelandic Fin Whales: Council discussed the desirability of a joint cooperation on work on fin whales. Generally there was a recommendation for joint work and the Faroe Islands stated that there should be cooperation with other relevant scientific bodies. Norway commented that most questions relate to stocks and stock boundaries while abundance numbers are not controversial. The question of stock delineation may take a long time to resolve, and the proposal by the Scientific Committee to collaborate on a joint IWC/NAMMCO workshop solely on stock delineation was generally supported. However, concerns were expressed over there being a clear distinction between the two organisations and their roles in the work. NAMMCO's efforts should be accredited. Iceland informed the Council that Icelandic fin whales were second priority in line of stock consideration by the IWC Scientific Committee in May 2005. It was therefore determined that the NAMMCO work on stock identity should not be held up from progressing by delays in the work of the IWC.

3.1.2 Role of Marine Mammals in the Marine Ecosystem

At its 8th meeting in Oslo, September 1998, the NAMMCO Council tasked the Scientific Committee with providing advice on the economic consequences of different levels of harvest of marine mammals, especially harp seals and minke whales, in different areas. Working groups established by the Scientific Committee have met on four occasions to deal with this and related requests, recognizing that the process of developing predictive multi-species models is a long-term one. Information was reported to Council on the progress that has been made in the last two years in two specific areas: 1) quantifying the diet and consumption of marine mammals, and 2) the application of multi-species models that include marine mammals to candidate areas of the North Atlantic.

The report of the Scientific Committee (see Section 3.1, Annex 1, pp.255 - 274) detailed results and findings from the Icelandic research programme on feeding ecology of the minke whale, and also recent work on the diet of Barents and Greenland Sea harp and hooded seals. It was noted that recent satellite tracking studies supply important information on the distribution of seals in time and space that may be used to make inferences concerning their diet. Important work on minke whale energy consumption using a new method for estimating urine production and food ingestion of minke whales was discussed and considered promising.

Recent work was reported on captive seals that has provided some direct measurements of the diving metabolic rate (DMR) in a quasi-natural setting, resulting in mean DMR of both juveniles and adults being 1.7 times the predicted basal metabolic rate of terrestrial mammals of equal size. This is an important parameter that could be applied to free-living seals to estimate energy consumption.

The Council heard that the preliminary GADGET model has been set up to model the grey seal population around Iceland, and that although only in the early stages of its development, it has shown that some aspects of marine mammal populations can be modelled using the framework provided by the GADGET software. Further work, however, is required before a model that includes the effects of predation by marine mammals on other species is attempted. It was again emphasised that progress in this area will not be made unless significant additional resources are dedicated to it.

The Council received a report on the status of the Scenario C model which is intended for exploring the comparative effects on the catch of cod, herring and capelin of various choices of management regimes for minke whaling and harp sealing, in the Barents Sea. Despite the project period soon coming to an end, the model is still inadequate.

Conclusions

Council noted the Working Group recommendations for research that were endorsed by the Scientific Committee (see Section 3.1 Annex 1, p.229). While some progress had been made in further development of the Scenario C model and development of the GADGET platform, it remains the case that the development of multi-species modelling is not proceeding as fast as it should, given the emphasis politicians and management authorities have placed on multi-species (ecosystem) approaches to the management of marine resources. It was noted that progress in this area will not be possible unless significant additional resources are dedicated to it.

Given this, the Council took note of the intention that the Working Group continue to monitor progress in this area, with the possibility of holding another workshop in 2006 if sufficient progress has been made to warrant it, and perhaps also an earlier smaller task group meeting if helpful to maintain momentum. The Council accepted the Scientific Committee's recommendation that the Scenario C model be finished and its properties thoroughly tested; also that the GADGET platform be developed as a model capable of simulating management scenarios, and that the template models including marine mammals be developed as soon as possible.

Discussion by the Council

Greenland regretted the insufficiency of funding that was leading to delays in the work, and suggested an evaluation of the work process in relation to funding. Iceland explained that there were delays in incorporating other marine mammals into GADGET and also delays in collecting data on minke whales. Iceland commented that there were political reasons for these delays in minke whale sampling and that so far only 61 animals (only a third of the projected sample) had been processed. The importance of investigating possible seasonal abundance and annual variations was noted. The Council urged members to continue this important work to enable the grey seal GADGET model to become functional, and data collecting programmes to continue with additional resources where possible. Norway commented that there would be a Scenario C model meeting in the spring of 2005 to evaluate progress. Council supported the goal of holding a meeting in 2006 to finalise models for the Barents Sea and assess models for other areas, if progress on the identified research and modelling priorities has been sufficient to warrant such a meeting. An interim meeting in 2005 would also be appropriate if this would help gather momentum.

3.1.3 Harp and Hooded Seals

Harp seals

In 2004, the Scientific Committee was requested to discuss annually the scientific information available on harp and hooded seals and advice on catch quotas for these species given by the ICES/NAFO Working Group on Harp and Hooded Seals. The ICES/NAFO Working Group will be meeting in 2005, after which their advice will become available to the NAMMCO Scientific Committee for consideration. In this regard, the Scientific Committee requested that the Council consider the feasibility of NAMMCO assuming a more formal involvement with ICES and NAFO in the Working Group on Harp and Hooded Seals.

Noting that Canada has instituted a multi-year management plan, the Scientific Committee had been requested to provide advice on the likely impact on stock size, age composition, and catches in West Greenland and Canada under the conditions of this plan. Details of the Canadian management plan are provided in the Scientific Committee report (see Section 3.1, Annex 1, pp. 210 - 212). The Scientific Committee noted that Greenlandic harp seal catches had decreased substantially since 2000, and therefore the forecast Greenlandic catch used in the model projections may have been too high. In addition the assumed struck and loss rate of 50% used for the Greenlandic hunt may be too high, but there are no data to support a lower level. The effect of using a lower Greenlandic catch in the model would be to increase the length of time before the reference level is reached under most projections. The TAC levels in the Canadian Management Plan in combination with the Greenlandic harvest exceed the estimated replacement yield and would, if taken, lead to a decline in the size of the stock. In this regard the Scientific Committee recommended that the ICES/NAFO Working Group should be requested to address the question of how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland.

Hooded Seals

The question as to the effects of the Canadian Management Plan on the West Greenland catch (see Harp Seals) was also addressed for this species. Under this plan hooded seals are a "data poor" population as no current estimates of population size are available. The current TAC in Canada is set at 10,000 animals but recent harvests have been very low, as under current regulations the take of bluebacks is prohibited. Currently, therefore, the effect of Canadian management measures on the stock of hooded seals is negligible.

A new population survey for hooded seal is planned for March 2005 as a cooperative effort between Canada, Greenland and Norway. The survey will probably cover all the known pupping areas for the species.

Discussion by the Council

Council noted the desirability of the proposed formal collaboration between ICES/NAFO Working Group and NAMMCO and the feasibility of joint cooperation here. Greenland supported the main proposal for a Working Group but requested a priority for "struck and lost", although Norway commented that they did not have a problem with "struck and lost". The Faroe Islands commented that it made sense to pool efforts rather than duplicate them in separate working groups, and thus supported a joint collaboration, in the absence of a dedicated NAMMCO working group on these stocks, which may however be a possibility in the future. Tore Haug (Norway), Chairman of the joint ICES/NAFO Working group explained that work was already being undertaken in parallel. One important point was to note that the ICES/NAFO group included all sealing nations in the northern hemisphere including USA and Germany. Individual nations have the responsibility of setting their own quotas; hence the different harvesting strategies adopted as to sustainability levels, for example Norway doubling the take and Russia maintaining take at SY level. There has been a practice of a stock assessment every 5 years with the Working Group meeting every two years. This year, 2005, the Working Group will meet in the autumn. There will also be a meeting in May/June 2006 to discuss the results of a big survey for hooded seals planned for spring 2005. The Chair of the Council recommended a return to this topic of collaboration with ICES/NAFO later in the meeting, and to report any recommendations under item 8. External relations (p. 37).

3.1.4 Harbour Porpoise

The Council noted the analysis of the distribution, abundance and trends in abundance of cetaceans in Icelandic coastal waters from four aerial surveys carried out under the NASS programme in 1986, 1987, 1995 and 2001. The distribution of harbour porpoise sightings varied greatly between surveys but their occurrence was mainly inshore. Estimates derived from the surveys are likely severely negatively biased because of animals that were missed by the observers and animals that were underwater when the plane passed over. The relative abundance of harbour porpoises decreased over the period at a rate of -4.9% (CV 0.47), with the negative trend due mainly to the low numbers seen in 2001.

The Council also noted the Scientific Committee's agreement that the apparent decline in relative abundance between 1986 and 2001 is cause for concern and should be investigated further in the light of a likely substantial level of by-catch for this species in Icelandic fisheries. In order to estimate the sustainability of the ongoing by-catch, better estimates of the present by-catch levels of harbour porpoises are required as well as an estimate of absolute abundance for the area. Aerial surveys will be carried out over the next two years as part of the Icelandic Research Programme, and the Scientific Committee recommended that the feasibility of modifying these surveys to generate valid estimates of absolute abundance for this species be investigated. The Council endorsed this recommendation.

3.1.5 Narwhal and Beluga

Narwhal

The aerial survey attempted off West Greenland in March 2004 was not successful due mainly to poor weather conditions. The Scientific Committee emphasised the importance of continuing this survey series to the continued assessment of both West Greenland narwhal and beluga, and therefore strongly recommended that this survey be attempted again in 2005. This recommendation was taken up in the Management Committee (see Section 2, p 134), and the Council endorsed it.

The Scientific Committee was informed about recent changes in the management regime for narwhal and beluga in West Greenland. The total quota for narwhal is 300: 200 for West Greenland and 100 for Qaanaaq area. The Scientific Committee welcomed this information and recognised that this was a significant step towards the sustainable management of West Greenland narwhal. Nevertheless the Committee recalled its recommendation from 2004 (NAMMCO 2004), that the total removals should be reduced to no more than 135 individuals, and that there should be no narwhal hunting in the Melville Bay area. The Committee once again advised that delay in implementing catch reductions to the recommended levels will result in delay in stock recovery and probably in lower available catches in the medium term. The Council endorsed the Scientific Committee's concerns.

Noting that the scientific collaboration between JCNB and NAMMCO has been very successful to date, the Scientific Committee recommended that the respective Scientific Working Groups meet jointly to further assessment work in 2005.

Beluga

As noted above the West Greenland survey attempted in 2004 was not successful and the Council again supported the Scientific Committee's recommendation that this survey be attempted again in 2005.

The Council noted that the new management measures in Greenland have established a total quota of 320 beluga for West Greenland and the Qanaaq area. The Scientific Committee had recognised that this was a significant step in the right direction in the management of this stock. Nevertheless, the Scientific Committee has advised on two occasions (2000 and 2001) that the West Greenland stock is substantially depleted and that present harvests are several times the sustainable yield, and that harvests must be substantially reduced if the stock is to recover. The Committee once again stressed that the delay in reducing the total removal to about 100 animals per year will result in further population decline and will further delay the recovery of this stock. The Council endorsed the Scientific Committee's concerns.

Discussion by the Council

While general concern was expressed that reductions in take of both narwhal and beluga were still unsustainable and were hindering recovery of the stocks, the Council expressed appreciation for the action taken so far by Greenland in reducing quotas.

3.1.6 Fin Whales

New abundance estimates for fin, humpback and sperm whales from the Norwegian 1996-2001 shipboard surveys, which covered a large part of the northeastern Atlantic through annual partial coverages, were presented. For the total area surveyed through the six-year period 1996-2001, the abundance of fin whales was 10,500 (CV 0.239). The substantial increase over the 1995 estimate can be explained by the inclusion of an area north of Iceland that was not surveyed in 1995. Analyses of sighting rates in Icelandic NASS and other surveys conducted between 1982 and 2003 showed an increasing trend in abundance for fin and humpback whales while sperm whale sightings showed the reverse trend.

In 2003 the Scientific Committee recommended that the scheduling of future assessment meetings for fin whales be dependent on the progress made in fulfilling recommendations for research. In October 2004, the Scientific Committee provided a list of high priority tasks that must be completed before a productive assessment meeting can be held. If such a meeting is to be held in autumn 2005, these tasks should be completed and reported by July 2005.

The Council noted the advice of the Scientific Committee on this matter and urged that this schedule be followed.

3.1.7 Minke Whales

An aerial digital photographic survey had been conducted in West Greenland over 2.5 months in summer/fall 2004. The target species were minke and fin whales. Estimates from this survey should be available by June 2005. In Norway the sightings survey programme continued this year with a ship survey in the North Sea.

3.1.8 White-beaked, White-sided Dolphins and Bottlenose Dolphins

Aerial surveys conducted in Icelandic coastal waters between 1986 and 2001 show no significant trend in relative abundance of *Lagenorhynchus* spp. (mainly *L. albirostris* (white-beaked)) dolphins over that period. There were an estimated 31,653 (CV 0.30) dolphins in the survey area in 2001.

The Council noted that the Scientific Committee concluded last year that there was still insufficient information on abundance, stock relationships, life history and feeding ecology to go forward with the requested assessments for these species. This may become feasible once feeding, genetic and life history studies have been completed in Iceland, the Faroe Islands and Norway, and when new abundance estimates become available from the SCANS II, NASS and other sightings surveys. Such an assessment could probably be conducted by 2008 at the earliest.

3.1.9 Grey Seals

In 2003 the Scientific Committee strongly recommended immediate efforts to obtain better information on the population of Faroese grey seals, and on the nature and impact of the take in the Faroe Islands. Noting that this had not yet begun, the Scientific Committee reiterated the recommendations made last year.

The Scientific Committee welcomed the information that Iceland was continuing its survey programme for this species as recommended last year. The Committee reiterated its previous recommendations for management of this stock, most notably the immediate establishment of management objectives and conservation reference limits as an urgent priority.

For Norway, the Scientific Committee noted as in 2003 that the new quota levels implemented for this area would, if filled, almost certainly lead to a rapid reduction in population in the area. A formal analysis of the effect of the quota levels of harvest on the population, including the risk of extinction and the sensitivity of the survey programme to detect a population decline, should be conducted as soon as possible.

Discussion by the Council

The Faroe Islands responded that although no action had yet been taken to investigate the impact of take of grey seals, they would endeavour to do this in the future.

Iceland commented that they had already achieved management objectives in response to requests from the Scientific Committee, and these were:

- To maintain the stock at the current level;
- To take protective measures should there be evidence of a decline in stock.

Careful monitoring would accompany these measures.

In response to comments regarding grey seal quotas, Norway responded that although the current quotas were very high, the catches were as recommended by scientists with respect to a strategy of reducing the current stock.

3.1.10 Humpback Whales

The Council noted its request to the Scientific Committee in 2004 to assess the sustainable yield levels for humpback whales, particularly those feeding in West Greenlandic waters. The management objective in this case would be to maintain the stock at a stable level. The Scientific Committee reviewed the available new information on this species and reported back that they could not apply the apparent rate of increase observed for the stock around Iceland to the West Greenland stock as there is no information on a similar trend in abundance from this area. The existing abundance estimate for West Greenland is more than 10 years old and a new estimate may become available from recent surveys off West Greenland. Even so, the uncertainty in the new estimate is likely to be high. For these reasons the Scientific Committee is unable to recommend sustainable yield levels for this stock at this time, and would be unable to do so without additional information on present abundance.

For areas east of Greenland there is current information on abundance and trends in abundance available, so it would be feasible to estimate sustainable yield levels for these areas. The Scientific Committee could establish a working group to carry out this task, if the Council identifies this as having high priority.

Discussion by the Council
Greenland noted the lack of information and also the question of research required in order to obtain SY levels for populations around Greenland. The Council deferred further discussion and decisions on this matter to the Management Committee (see item 4, pp.28 - 29).

3.1.11 Killer Whales
In 2004 the Council requested the Scientific Committee to review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic with priority to be given to killer whales in the West Greenland – Eastern Canada area, and also to provide advice on research needs to improve this knowledge.

In West Greenland there are insufficient data to estimate abundance or trends in abundance of this species. In recent years, incidental reports suggest that sightings have become more frequent, and the catch has increased in the past two years. Given the clumped distribution and sporadic incursions of killer whales in the area, it was considered very unlikely that the aerial surveys conducted in 2004 would provide a useful estimate of abundance for this species. It was considered unlikely that suitable data could be obtained in the near term, even if significant resources for research become available. The Council recommended that immediate steps be taken to improve the available information on this species, and to review progress under this item annually with the view to conducting an assessment when sufficient information becomes available.

3.1.12 Walrus
In 2004 the Council noted that the Scientific Committee had last provided an assessment of walrus in 1994, and requested the Scientific Committee to provide an updated assessment of walrus, to include stock delineation, abundance, harvest, stock status and priorities for research. The Council noted that the Working Group on Walrus met 11-14 January 2005 to deal with the request, and the report awaits review by the Scientific Committee at its 2005 meeting.

3.1.13 Satellite tagging correspondence group
In 2002 the Scientific Committee decided to establish an inter-sessional correspondence group to:

- Identify progress in satellite tagging made in NAMMCO member countries and elsewhere;
- Explore the technical aspects of satellite tagging, including deployment systems;
- Briefly consider what tagging experiments have been done and the rates of success;

- Recommend ways to further the development and success of this technique in NAMMCO member countries.

It was reported that little progress had been made in 2004. The Scientific Committee considered that the importance of this issue warranted a continued effort to try to resolve the problems in tagging whales, particularly large whales that cannot be captured and handled. Efforts would therefore continue by broadening the membership of the group to include key experts from member and non-member countries. The idea of holding a workshop would also be considered, but again the participation of researchers and technical experts active in this field must be ensured.

The Council noted the lack of progress to date and recommended that this work continue.

3.1.14 Planning for Future North Atlantic Sightings Surveys (NASS)

In 2003 the Council recommended that member countries continue to coordinate cetacean surveys across the North Atlantic, and attempt to broaden the coverage of these surveys through the inclusion of other participants, particularly in the Northwest Atlantic. In 2004 the Scientific Committee agreed that 2006 would be the best year to hold an international sightings survey, in conjunction with a possible SCANS II and other surveys.

The Scientific Secretary reported that he had contacted those responsible for planning the SCANS II survey to discuss the possibility of co-ordinating the offshore portion of that survey with the NASS. The response to this idea was favourable. However, due to lack of funding, the offshore portion of SCANS II has been postponed until 2007, and it is at this point uncertain whether it will be carried out. A research scientist at the Department of Fisheries and Oceans, Canada, was also contacted, and expressed great interest in co-ordinating future surveys off Eastern Canada with the NASS. It was noted that the Icelandic Research Programme would likely continue throughout 2006, which would leave researchers there little time to participate in a sightings survey. Also, an international redfish survey, with which the Icelandic NASS successfully shared a survey platform in 2001, may occur again in 2007. Given this information, the Scientific Committee decided that the next NASS should be planned for 2007. The Council concurred with this decision.

Discussion by the Council

In response to a question from the General Secretary, regarding participation of NAMMCO members in SCANS II, Norway informed that they would be participating in the SCANS II survey.

3.1.15 By-catch of Marine Mammals

In 2004 the Scientific Committee was requested to carry out an evaluation of the data collection and estimation procedures used in the Icelandic by-catch monitoring programme. In 2002 a procedure of monitoring marine mammal by-catch was introduced to the gillnet fishery in Iceland. In October 2004 a questionnaire was presented to the fishermen in order to evaluate the efficiency of the monitoring system and the quality of the by-catch data obtained from the log books. Results of comparing the different recording methods indicated a low efficiency of the monitoring system for marine mammal by-catch using the log book reports in the Icelandic gillnet fishery. A discussion of the reasons for this was provided in the report of the Scientific Committee (see Section 3, p. 217 and pp. 245 - 247).

The Scientific Committee made a number of recommendations to improve the estimation of by-catch in Icelandic fisheries. The Committee commended the authors for producing the first direct estimation of marine mammal by-catch from a NAMMCO member country, and strongly recommended that other member countries establish by-catch reporting systems for their fisheries.

Discussion by the Council
This topic is discussed further under the Management Committee (see Section 2, pp. 187 -. 196). However, there were several comments. Norway reported that the long-line fishery for halibut had experienced problems with interactions with sperm whales that took fish off the line. Greenland expressed alarm at the increasing numbers of entangled humpback whales and also killer whales that disrupted both the beluga and narwhal hunting in the Disco Bay area. Iceland similarly informed about long-line fisheries interactions with sperm and killer whales. The Faroe Islands had nothing new to report. With respect to the by-catch monitoring programme, Iceland accepts the recommendations of the Scientific Committee for improvements.

3.1.16 Publications
Five volumes of *NAMMCO Scientific Publications* have been published to date, the most recent in 2003. Two more are planned: Vol. 6 on the NASS, scheduled for publication in 2005 and Vol. 7 on grey seals.

3.1.17 Workplan
The Council noted that the next meeting of the Scientific Committee would be held in Reine, Lofoten in Norway, 25-27 October 2005.
Other working groups that will meet in 2005:

- Narwhal and Beluga, 11-14 October 2005, jointly with the JCNB Scientific Working Group;
- Fin whales, 20-22 October 2005.

The Council noted that the Walrus meeting scheduled for January 2005 in Copenhagen had taken place, but the report will not be considered by the main Scientific Committee until its 13th meeting.

4. MANAGEMENT COMMITTEE

4.1 Report of the Management Committee
The Chair of the Management Committee, Halvard Johansen (Norway) reported to the Council on the meeting of the Management Committee, which was held in Tromsø, 2 March 2005. A draft report was distributed as NAMMCO/14/6, containing the substantive issues agreed to by the Management Committee. (The final edited version of the report was adopted by correspondence after the meeting (see Section 2, p. 129).

4.1.1 National Progress Reports
The Council noted that National Progress Reports for the year 2004 were available from the Faroe Islands, Greenland, Iceland and Norway. In addition, the Council expressed appreciation for the Progress Report provided by Canada to the Management Committee. The Council was also appreciative of a verbal presentation from Russia in the Management Committee, that detailed ongoing research, biological sampling programmes and surveys on cetaceans and harp seals in the Barents and White seas involving aerial remote sensing surveys in the White Sea for seal pups in March and ground searches using calibrated squares on ice during the hunting season. Although there had been no harp seals taken in 2004, catches in 2005 will follow ICES recommendations. The Council noted the annual ecosystem surveys carried out in the north Barents and Norwegian seas relating marine mammals and fish, and facilitated by good research relations with Norwegian colleagues.

4.1.2 Enhancing Ecosystem-Based Management
The Council recalled that an *ad hoc* Working Group on enhancing ecosystem-based management had been established in 2003 with specific terms of reference – see item 12, pp. 142 - 143 of the Management Committee Report. The *ad hoc* Working Group met in Copenhagen in December 2003 and reported to the Management Committee at its last meeting (NAMMCO/13/MC/9), but had been unable to meet and continue its work during 2004 as was decided at the last meeting of the Management Committee. The *ad hoc* Working Group met briefly during the 2005 Council meeting, and proposed that before proceeding with specific tasks, a clearer focus within NAMMCO on ecosystem-based management should be developed, and that it would be beneficial to examine more closely the broader context in which ecosystem-based approaches to management of marine resources, including marine mammals, are being applied across the North Atlantic. It was felt that a continuation of these discussions in a larger forum with a broader range of participants would help to better examine the basis for a common understanding of this approach in the NAMMCO context. In addition it was felt that there was a need to identify the gaps in scientific knowledge on the interactions between marine mammals and fisheries resources more clearly in a dedicated forum, and the implications of these gaps for the application of ecosystem-based management. NAMMCO views management of marine mammals as being seen in the context of the management of marine resources in general.

The Council therefore support Management Committee's decision that the *ad hoc* Working Group should meet again prior to the next annual meeting of NAMMCO in 2006. In order to be able to address in more detail the Terms of Reference developed for the Working Group in 2003, specific aims were outlined for the next meeting, as set out in Section 2, p. 143.

4.2 New requests for advice from the Scientific Committee and recommendations for scientific research
Economic aspects of marine mammal - fisheries interactions
The Council agreed to the Management Committee's endorsement of the recommendations for scientific research by the Scientific Committee, contained in Section 2.1, p 132 of this report, and the plan to continue the work in 2006 if sufficient

new information becomes available.

The Council noted that progress in the assessment of multi-species interactions would not be made unless significant additional resources are dedicated to it. Norway informed the Council that it was now giving consideration to furthering the multi-species modelling work for the Barents Sea. The Council was also informed by Iceland that the Icelandic Research Programme is addressing one of the major knowledge gaps in this area: that of the diet of minke whales around Iceland. The programme has been delayed but it is expected to be completed in 2006. Once these data become available the Icelandic modelling work can proceed. The Council recognised the importance of this work and urged members to proceed with the research required to complete it.

Harp and hooded seals

The Council endorsed the Management Committee's recommendation that the Scientific Committee evaluate how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland.

The Council further elaborated on its request to the Scientific Committee from 2004, that advice on catch quotas should be provided in the light of potential ecosystem management requirements. For the Greenland Sea and Barents/White Sea stocks of harp seals, advice should be provided on catch quotas that would result in varying degrees of stock reduction over a defined period of time. The specified harvest levels for these two stocks that would result in a population reduction of 20% over a period of 20 years are thus requested. It was recognised that the terms of reference of the ICES/NAFO Working Group would have to be revised if the advice is to be provided through that group.

The Council discussed the potential for a more formal involvement with the ICES and NAFO Joint Working Group on Harp and Hooded Seals. The Observer from ICES suggested that a more formalised relationship could be realised either by revising the terms of reference of the Working Group such that NAMMCO is a formal partner, or by establishing a Memorandum of Understanding between NAMMCO and ICES. These options are discussed below by the Council under Item 8.1, p.35.

Harbour porpoise

The Council supported the Management Committee's endorsement of the recommendations of the Scientific Committee pertaining to harbour porpoises around Iceland: that in order to estimate the sustainability of the ongoing by-catch, better estimates of the present by-catch levels are required as well as an estimate of absolute abundance for the area. Aerial surveys will be carried out over the next two years as part of the Icelandic Research Programme, and it was recommended that the feasibility of modifying these surveys to generate valid estimates of absolute abundance for this species be investigated.

Beluga - West Greenland

The Council endorsed the plan of the Scientific Committee to hold a joint meeting with the JCNB Scientific Working Group in 2005.

Noting the importance of the West Greenland index survey series to the continued assessment of both West Greenland narwhal and beluga, the Council endorsed the Management Committee's support of the Scientific Committee's recommendation that this survey series be continued.

Narwhal - West Greenland

The Council supported the Management Committee's request that the Scientific Committee undertake an assessment of East Greenland narwhal, and provide an estimate of sustainable yield for the stock. The management objective in this case is to maintain the stock at a stable level. If the assessment cannot be completed with available information, the Scientific Committee should provide a list of research that would be required to complete the assessment.

Fin whales

The Council endorsed the Management Committee's support for the Scientific Committee's recommendations for research on fin whales which emphasised that the assessment of fin whale stocks could not be continued until these tasks were carried out (see Section 2.1, p. 134).

As in 2004 it was noted that questions of stock identity and relationships to other stocks are of highest priority. The IWC Scientific Committee is carrying out a pre-implementation assessment of fin whales, beginning in 2005 with the development of stock hypotheses. Noting that the IWC Scientific Committee had suggested that the pre-implementation assessment could benefit from coordination between the two committees, the Council agreed to investigate the option of holding a joint inter-sessional workshop to address the issue of stock structure, if it is not fully resolved at the IWC Scientific Committee meeting in May 2005. It was emphasised however that any such coordination should not compromise the independence of the NAMMCO Scientific Committee's continuing assessment of North Atlantic fin whales.

Humpback whales

The Council supported the recommendation of the Management Committee that the Scientific Committee continue its assessment of humpback whale stocks in the North Atlantic. For West Greenland, the Scientific Committee should assess the long-term effects of annual removals of 0, 2, 5, 10 and 20 whales. For the Northeast Atlantic the Scientific Committee should provide estimates of sustainable yield for the stocks. In all cases the management objective would be to maintain the stocks at a stable level. The Scientific Committee should identify information gaps that must be filled in order to complete the assessments.

The Council noted that to complete the assessment for West Greenland, the most urgent requirement is for a new estimate of abundance. In this regard it was noted that a survey was completed in 2004, and that a new estimate should be available sometime in 2005.

Killer whales
Noting that there was not enough information to carry out the assessment that was requested in 2004, particularly for the West Greenland area, the Council supported the Management Committee's recommendation that the Scientific Committee review new information on killer whales annually with the aim of completing the assessment once sufficient information becomes available for a particular area.

North Atlantic Sightings Surveys
Noting the recommendation of the Management Committee that, for various reasons, 2007 would be the optimal year to carry out the next NASS, rather than 2006 as originally planned, the Council supported this change in survey planning, along with the efforts of the Scientific Committee to expand the NASS to include involvement from countries in the Western and Eastern Atlantic.

Harbour seal
The Council endorsed the recommendation of the Management Committee that the Scientific Committee should:

- Review and assess the status of harbour seals throughout the North Atlantic;
- Review and evaluate the applied survey methods;
- Assess stock delineation using available data on genetics, spatial and temporal distribution and other sources;
- Review available information about harbour seal ecology;
- Identify interactions with fisheries and aquaculture.

The Council anticipates that this request can be addressed by the Scientific Committee in 2006.

4.3 International Observation Scheme
The Council noted the Management Committee's review of the implementation of the Observation Scheme 2004 under the Joint Control Scheme for the Hunting of Marine Mammals, and for the planned observation activities for 2005 (see Section 2.1, p. 141).

The Council noted that it had proven beneficial to focus on one region per year.

4.3.1 Report of the Sub-Committee on Inspection and Observation
The Council reiterated the Management Committee's commendation of the Sub-Committee on Inspection and Observation for their thorough evaluation of the Observation Scheme, and noted that it continues to function as the only operating scheme of its kind for marine mammals. The Council furthermore noted the Management Committee's endorsement of the conclusions of the Sub-Committee regarding the implementation of the Scheme, and supports the recommendations of the Management Committee that member countries be encouraged to submit proposals for

amendments to the Scheme to the Management Committee (see Section 2.1, item 9, p. 141).

Council noted the Management Committee's agreement that observations in 2005 would focus on sealing activities in Norway and Iceland.

4.4 Any other business

Establishment of a separate Management Committee for seal stocks

The Council was alerted by Halvard Johansen, Norway, to the situation in the latest few years where more attention has been given to the management of seal stocks, and requests for advice on coastal seal stocks such as grey and harbour seals have been referred to the Scientific Committee. Following the report from the Scientific Committee in 2004, the Management Committee recommended that member countries improve their management of grey seals. However, there is currently no international body from which management advice on coastal seal stocks can be sought as for example in the case of the management of harp and hooded seal stocks in the North Atlantic based on advice from the ICES/NAFO Working Group on Harp and Hooded Seals. In the NAMMCO Agreement it is provided for the establishment of a number of management committees, (Article 3). On this basis, and after some informal consultations, Norway agreed to undertake the preparation of a formal proposal that NAMMCO establishes a separate Management Committee for seal stocks, to be presented at the 2006 meeting of Council. The sequence of functioning will then be that advice from the Scientific Committee will be sought, and then, based on the scientific advice, the Management Committee for Seal Stocks could give advice to Governments upon request. There was some internal support for this idea and interest from non-member countries such as Canada and Russia.

5. HUNTING METHODS

5.1 Report of the Committee on Hunting Methods

The Chair of the Committee on Hunting Methods, Jústines Olsen, the Faroe Islands, presented the report to the Council. The Committee met in Copenhagen 26-27 January 2005. The report is contained in Section 1.2.

The Council noted the updated lists of regulations and references on hunting methods (see Section1.2, appendices 1 and 2) and the updated information on hunting methods and developments in the member countries, presented to the Committee at the January meeting.

The Chairman presented an update on the recommendations resulting from the NAMMCO Workshop on Hunting Methods held in Greenland in 1999 (see NAMMCO Annual Report 1999, page 71) and the NAMMCO Workshop on Marine Mammals: Weapons, Ammunition and Ballistics held in Norway in 2001 (see NAMMCO Annual Report 2001, page 89). Annual updates on the completion of these recommendations have been presented at each consecutive annual meeting.

Recommendations 3a. from the 1999 workshop and 1. from the 2001 workshop both pertain to determination of best ammunition for use in the hunt and to developing guidelines for methods used to undertake more controlled and standardised studies of the effect of different weapons and ammunition on different species. These recommendations are awaiting guidelines on shooting tests on dead animals. An essential part of this task was the shooting tests conducted in September 2004 in the Faroe Islands. A first step will be to describe the trials, what kinds of results were obtained and determine what conclusions can be drawn from these trials. However, in order to make guidelines one needs to make a very thorough and detailed description that takes into account all aspects of such a trial from how to perform autopsy and inspection of wounds and bullet paths to what sort of equipment is necessary for labelling heads and bodies. Ammunition has also to be tested with respect to shots from different angles and distances.

The Council noted that the development of the guidelines will build on the experiences from the shooting tests and will represent the second and final step in meeting these recommendations. Both the description of the shooting tests and the development of the guidelines are expected to be ready for presentation to the Council at the next annual meeting in 2006.

With respect to recommendation 3b. from the 1999 workshop pertaining to the development of objective descriptions of hunting methods, equipment and how efficient these are in small cetacean hunting, considering regional variations, the Council noted that Greenland had been tasked with going through the reports from all three workshops with the aim of making a recommendation on how best to move this work forward. The workshops represent a lot of the sought after information and it was therefore deemed important to find out what descriptions already exist.

The Council noted that the price difference for the penthrite grenade from the manufacturer in Norway to retailer in Greenland now (2005) is the same as in Norway.

The Council noted that the NAMMCO Workshop on Hunting Methods for Seals and Walrus held in Copenhagen in 2004 (see item 5.2. below) was a response to recommendations 2. and 3. from the 2001 workshop on harmonising weapons and ammunition types for different species with due considerations to variation in hunting conditions in the different countries and to focus on seals and seal hunting. Norway remarked that they would use the results of the Copenhagen workshop in their work on revising the guidelines for the seal hunt.

The Council agreed to the Committee's recommendation on future priorities for its work as follows:

- To finalise the work on standardising guidelines for methods used to undertake more controlled and standardised studies of the effect of different weapons and ammunition on different species. The work is two-fold, first to conduct the report of the shooting trials on heads of pilot whales in the Faroe Islands in September 2004, and second to finalise the guidelines to be presented to the Council at its meeting in 2006.

- To convene a workshop on "struck and lost" in whale and seal hunting, tentatively in the autumn of 2006, bearing in mind the three previous NAMMCO Workshops in 1999, 2001 and 2004 arranged by the NAMMCO Hunting Committee. The aim will be to elucidate and to analyse the problem of "struck and lost" in whale and seal hunting and make very specific recommendations on how to reduce this problem.

The Committee reiterated its intention of collecting the proceedings from all hunting method workshops held by NAMMCO in one publication. Taking into account the plan to convene a new workshop in 2006 the Committee proposed to schedule the publication in order to include the upcoming Workshop on "Struck and Lost". The Committee was of the opinion that the workshops represent a significant amount of relevant and valuable information, and the publication would be built upon the results from all four Workshops organised by the Committee.

The Council endorsed the recommendations from the Copenhagen Workshop (see item 5.2 below) and endorsed the Committee's plans to organise a workshop focusing on "struck and lost" in whale and seal hunting in 2006.

The Council noted that Egil Ole Øen (Norway) had been elected as the new Chair and Kristjan Loftsson (Iceland) as Vice-Chair, both for the next two years (2005/2006). The outgoing Chair, Jústines Olsen had held the position since 1998, and the Council thanked Olsen for his very able chairmanship during many years.

5.2 Report from the Workshop on Hunting Methods for Seals and Walrus, 7-9 September 2004, Copenhagen, Denmark.

Egil Øen, Norway, presented the report of the Workshop on Hunting Methods for Seals and Walrus which was held in Copenhagen 7 – 9 September 2004. (see Section 1.3, p. 63). The terms of reference for the workshop were:

- To review existing seal and walrus hunting methods known.
- To evaluate methods used in seal and walrus hunting in relation to killing efficiency and struck and loss rates.
- To examine possibilities for technical innovation and further enhancement of efficiency and safety of hunting methods, with a view to providing recommendations for improvement, where relevant, and
- If possible, determine minimum requirements for safe and efficient killing of walrus and different seal species, considering variations in hunting methods.

In summary, seal and walrus hunting are conducted in widely differing environments and under variable regulatory regimes. The equipment used is often restricted by the regulatory framework but is also adapted to the local conditions. Hunters from different areas have much to learn from one another, and should be open to new ideas, equipment and techniques, and willing to change their hunting methods if better methods are available. Hunters from different areas need to cooperate with one another to preserve their way of life. Hunters should have reason to be proud of what they do, and this requires that they be well educated and use the best available equipment and techniques.

The following themes had been suggested for integration into the recommendations from the Workshop:

- Hunters should aim for full utilisation of their catch;
- Hunters should acknowledge the importance of conservation and consider themselves as conservationists;
- Hunters do not agree that the results of some studies that show very high struck and loss rates for seal and walrus hunts can be applied to all hunts. Further research on struck and loss rates is required.
- Hunters need to find practical and effective measures to reduce struck and loss rates in some hunts;
- There is a need for more effective hunter training in some areas;
- There is a need for more research on the effectiveness of various rifles and bullet types for killing seals and walrus.

The Workshop recommendations (see Section 1.3, pp. 83 - 84) were based on the presentations and the discussions at the Workshop, discussed one by one, revised if necessary, and adopted by consensus. These recommendations are intended for implementation by management authorities, hunters and researchers.

The Council endorsed the recommendations and expressed its appreciation for the Workshop Report.

6. THE NAMMCO FUND

6.1 Report of the NAMMCO Fund

Charlotte Winsnes, Secretariat, on behalf of the Chair of the Board of the NAMMCO Fund, Ulla S.Wang (Faroe Islands), presented the report of the Board to the Council (NAMMCO/14/8). There had been a telephone meeting on 19 January 2005 to address the future of the Fund.

Following a growing concern that the NAMMCO Fund did not produce the intended outcome, the Fund was put on hold in 2004 and the Board of the NAMMCO Fund was tasked with developing alternative approaches to the Fund and providing recommendations as to the restructuring of the Fund. Based on a background paper prepared by the Secretariat, the following alternative approaches were discussed: *status quo*, production of a yearly newsletter, establishment of a NAMMCO prize, establishment of travel support for students to international meetings and to dissolve the Fund.

The Council unanimously agreed to the recommendation of the Board that the NAMMCO Fund be dissolved. The Chair of Council commented that the Fund had accomplished a lot during the time of its existence, and had supported a wide scope and range of projects. However, the financial and human resources put into the Fund would be better spent on producing more information related to the work of

NAMMCO itself.

The Council furthermore endorsed the recommendation from the Board that the remaining assets in the Fund, NOK 100,000, be transferred to the budget item 7. Information. The Statutes of the NAMMCO Fund state that “if the NAMMCO Fund should be dissolved, the Council shall decide on the use to be made of any balance remaining, in accordance with the aim of the Fund”.

The Council noted that there are still four projects running under the NAMMCO Fund.

7. ENVIRONMENTAL QUESTIONS

At the 2004 Council meeting, it was agreed to keep this item on the agenda as a means of exchanging ideas and information on the topic among member countries. The Chair of the Council referred the meeting to the published report *The Arctic Climate Impact Assessment (ACIA) Report*. The Arctic Council had called for the report and charged two of its working groups AMAP and CAFF along with IASC, with its coordination. The ACIA report is an evaluation of Arctic climate change and its impacts for the region and the world.

Greenland commented that climate change had inflicted very severe consequences during the last 5-10 years in Greenland, having effects on both land animals and fisheries. Greenland has produced a pamphlet for public information regarding the current climate changes, in both Danish and Greenlandic, for distribution. The information explained the effects and expectations both locally and worldwide, and what challenges would have to be met and solved. The pamphlet was aimed at providing information to children in the schoolroom, and to adults in the workplace, and where more information could be retrieved. Amalie Jessen commented that Greenland may be experiencing some of the biggest change impacts. In addition, the socio-economic impacts on hunters have been very hard in recent years, necessitating subsidies to be made from the government. A copy of the pamphlet was provided to the Secretariat as a reference. Greenland expressed concern over the impacts on hunting communities, and has initiated a report on the socio-economic impacts of climate change, where there will be an English resumé of the text provided.

Iceland commented on the potential impacts of Arctic oil exploration and oil transport in hunting areas, especially in the future. Environmental safety had become a matter of paramount importance, and while Norway now had remote tracking of oil tankers in Arctic waters, Iceland did not yet have such a facility although it was planned for. Norway responded that they anticipated an increase in oil transport in their area, but considered that the main concerns are more appropriately addressed by other organisations, such as the IMO (International Maritime Organisation), although it would be important for NAMMCO to be kept updated about developments. Attention was drawn to the Arctic Marine Strategic Plan adopted by the Arctic Council in November 2004. The Council agreed that NAMMCO should be vigilant, and ensure the provision of relevant information from other organisations that were concerned with environmental issues.

8. EXTERNAL RELATIONS

Under this item the Council reviewed relations with those organisations with which NAMMCO exchanges observers, and took note of meetings NAMMCO had been attending during 2004. Attention was drawn to document NAMMCO/14/9.

8.1 Cooperation with other international organisations

ICES – International Council for the Exploration of the Sea

Grete Hovelsrud-Broda, Secretariat, represented NAMMCO at the 13th ICES CIEM Dialogue meeting held in Dublin 26 – 27 April 2004. The report from the meeting was available as document NAMMCO/14/9-2.

Mindful that NAMMCO and ICES had agreed to draft a Memorandum of Understanding (MoU) for approval by the NAMMCO Council inter-sessionally and by the ICES Bureau Meeting in June 2004, ICES reiterated their commitment to follow through on this matter. A draft MoU modelled upon the existing MoU between ICES and the Food and Agriculture Organisations of the UN (FAO), was prepared by the ICES representative during the meeting. The Council noted that this had been a lengthy process and anticipated that the NAMMCO Secretariat will move forward on this matter as soon as possible to finalise the MoU during 2005. The Council appreciated the renewed interest shown by ICES and is eager to have a formal basis for collaboration on specific areas of mutual interest, such as the ICES/NAFO joint Working Group on harp and hooded seals, and the scientific basis for ecosystems approaches to management.

IWC International Whaling Commission

Grete Hovelsrud-Broda and Charlotte Winsnes, Secretariat, represented NAMMCO at the 56th Annual Meeting of the IWC, which was held in Italy in June 2004. NAMMCO's Opening Statement to the IWC, providing updated information on recent activities in NAMMCO, was available to the Council as document NAMMCO/14/9-5. Daniel Pike, Secretariat, represented NAMMCO at the IWC Scientific Committee meeting (29 June – 10 July). Items of relevance to the NAMMCO Scientific Committee were available to the meeting as document NAMMCO/14/9-4.

Arctic Council

Iceland represented NAMMCO at the Senior Arctic Officials meeting and the Ministerial meeting in the Arctic Council held in Reykjavik 22 – 24 November 2004. In addition to reports on ongoing and future work-plans for the working groups under the Arctic Council, the Arctic Climate Impact Assessment, the Arctic Human Development Report and the Arctic Marine Strategic Plan were presented. The report from the meetings was available to the meeting as document NAMMCO/14/9-12.

The Council reiterated its recommendations from the last Council meeting in 2004 that the level of involvement would be dependent on the relevance of the topics considered at the Arctic Council and that the Secretariat continue to monitor the Arctic Council activities and circulate the relevant agenda items to the Council in order for the Council members to better coordinate their own efforts.

NEAFC – North East Atlantic Fisheries Commission
Norway represented NAMMCO at the 23rd Annual Meeting of NEAFC held in London 8 - 12 November 2004. The report from the meeting was available as document NAMMCO/14/9-7.

NAFO – Northwest Atlantic Fisheries Organisation
Iceland represented NAMMCO at the 26th Annual Meeting of NAFO held in Dartmouth 13 – 17 September 2004. The report from the meeting was available as document NAMMCO/14/9-11.

NASCO – North Atlantic Salmon Conservation Organisation
The Faroe Islands represented NAMMCO at the 21st Annual Meeting of NASCO held in Reykjavik 7 – 11 June 2004. The report from the meeting was available as document NAMMCO/14/9-3.

OSPAR Convention
Daniel Pike, Secretariat, attended the OSPAR Working Group on Marine Protected Areas Species and Habitats (MASH) held in Tromsø 5 – 8 October 2004. Topics discussed at the meeting included: ecological quality objectives, list of threatened and/or declining species and habitats and marine protected areas. The report from the meeting was available as document NAMMCO/14/9-6.

The North Atlantic Regional Fisheries Management Organisations (NARFMO)
Grete Hovelsrud-Broda and Charlotte Winsnes, Secretariat, attended the third meeting of NARFMO in London 21 April 2004. The meeting of Secretariats addressed a number of topics including: ecosystem approach to fisheries management and integration of fisheries and environmental concerns, scientific advice and management, internet website and public education, transparency and practical cooperation on IUU fishing. The report from the meeting was available as document NAMMCO/14/9-1.

Norwegian Small Whalers Association
Charlotte Winsnes, Secretariat, represented NAMMCO at the Annual Meeting of the Norwegian Small Whalers Association held 3 – 4 December 2004 in Svolvær. The meeting considered in particular the following issues: promotion of whale products – prices and distribution, the “Blue-Box” system and the White paper no. 27 (2003 – 2004): Norway’s policy on Marine Mammals.

The meeting once again emphasised that the management of whales should lie within NAMMCO. The report from the meeting was available as document NAMMCO/14/9-8.

The 6th Conference of Parliamentarians of the Arctic Region
Amalie Jessen, Greenland, represented NAMMCO at the 6th Conference of Parliamentarians of the Arctic Region held in Nuuk 3 – 6 September 2004. The conference’s focus was on Arctic climate change and issues related to this. The Arctic Climate Impact Assessment Report and the Arctic Human Development Report were

both addressed. The report from the meeting was available as document NAMMCO/14/9-10.

Other meetings and reports
The reports referred to under this agenda item were available as document NAMMCO/14/9-9.

Visits to the NAMMCO Secretariat
The British Embassy had twice paid the Secretariat a visit and the Canadian Embassy had visited once.

American Institute of Biological Sciences review of Administrative Report LJ-03-08 for the Alaska Harbour Seal Co-Management Committee
Daniel Pike, Secretariat, had been recruited to review the Administrative Report LJ-03-08 and submitted a written critique of the report and attended a meeting held 12 – 14 October in Juneau, Alaska. The report from this review will be used by the Alaska Harbor Seal Co-management Committee to refine their management of Alaskan stocks of harbour seals.

9. INFORMATION

Book reviews
Favourable book reviews of the NAMMCO Scientific publication volume 4 entitled “Belugas in the North Atlantic and in the Russian Arctic” had been published in the scientific journals, *Marine Mammal Science* and *Canadian Field Naturalist*. The reviews were available to the meeting, and the Chair of Council expressed satisfaction that NAMMCO publications were being taken seriously within the scientific community.

European Bureau for Conservation and Development
Despina Symons presented information on the current status of the proposed unilateral ban on imports of all seal products in Belgium which has been under consideration for over a year. Concerns had been expressed to Belgium by Canada and Greenland as well as comments by the European Commission (EC). According to the EC, when it comes to imports from third countries, this action would not be against the EU regulation as member states are allowed to take stricter measures if they wish. Questions were raised however, as to whether Belgium had consulted with the World Trade Organisation (WTO). Secondly when it comes to the internal EU market, such a ban would be in contradiction with Article 28 of the Treaty and Belgium was asked to look further into this.

On the other hand this proposed ban was an issue at the IUCN World Conservation Congress, November 2004, where a resolution had been tabled by the Inuit Tapirissat of Canada against the Belgian Government. This became controversial especially for the EU but it was finally adopted after direct reference to Belgium was removed and the resolution was given a more general character. This resolution asks IUCN members (and therefore Belgium) to abide by the sustainable use principles adopted by the Convention on Biological Diversity (CBD). As a result of this resolution, Belgium has reconsidered the issue yet has nevertheless decided to go ahead pending Parliamentary approval.

High North Alliance
Rune Frøvik of the High North Alliance (HNA) presented information on the activities of the organisation over the past year. He reported satisfaction with the White Paper on Norway's policy on marine mammals, which in their view sets the stage for a positive future development. HNA reported an active participation at IWC, IUCN, CITES and other meetings, as well as media communication work and press interviews. HNA has continued development of their websites.

10. ANY OTHER BUSINESS

There was no other business.

11. CLOSING ARRANGEMENTS

11.1 Next Meeting

The Council welcomed the invitation of Iceland to host the next meeting of the Council, likely in early March 2006. The exact time and place will be determined at a later date.

11.2 Adoption of Press Release

A drafting group finalised the press release after the conclusion of the meeting. This item was released shortly after closing of the meeting on the 3 March (see Appendix 5).

Appendix 1

AGENDA

1. Opening Procedures
   - 1.1 Welcome address: Herman Kristoffersen, Mayor of Tromsø
     Key Note Speaker: Shilpha Rajkumar, University of Wollongong
     "The conservation and management of pinnipeds under international law: An Overview"
   - 1.2 Opening statements
   - 1.3 Observers
   - 1.4 Adoption of agenda
   - 1.5 Meeting arrangements
2. Finance and Administration
   - 2.1 Report of the Finance and Administration Committee
   - 2.2 Commission Budget 2005 & Forecast Budget 2006
     Final Accounts 2004
   - 2.3 Other business
3. Scientific Committee
   - 3.1 Report of the Scientific Committee
   - 3.2.Other business
4. Management Committee
   - 4.1 Report of the Management Committee
   - 4.2 Recommendations for Requests for advice
   - 4.3 International Observation Scheme
   - 4.4 Other business
5. Hunting Methods
   - 5.1 Report of the Committee on Hunting Methods
   - 5.2 Report from the Workshop on Hunting Methods for Seals and Walrus, September 2004
   - 5.3 Other business
6. NAMMCO Fund
   - 6.1 Report of the Board of the NAMMCO Fund
   - 6.2 Other business
7. Environmental questions
8. External relations
   - 8.1 Cooperation with other international organisations
   - 8.2 Other business
9. Information
10. Any other business
11. Closing arrangements
    - 11.1 Next meeting
    - 11.2 Adoption of press release

Appendix 2

LIST OF DOCUMENTS

NAMMCO/14/1	List of Participants
NAMMCO/14/2	Agenda
NAMMCO/14/3	List of Documents
NAMMCO/14/4	Report of the Finance and Administration Committee
NAMMCO/14/4 – Annex 1	Final Accounts 2004, Draft Budget 2005 and Forecast Budget 2006
NAMMCO/14/5	Report of the Scientific Committee, 27-29 October 2004
NAMMCO/14/6	Report of the Management Committee, 2 March 2005
NAMMCO/14/7	Report of the Committee on Hunting Methods
NAMMCO/14/7- Annex 1	Report of the Workshop on Hunting Methods on Seals and Walrus, 7 – 9 September 2004
NAMMCO/14/8	Report of the NAMMCO Fund
NAMMCO/14/8 - Annex 1	List of Funded Projects
NAMMCO/14/9 – Compendium of reports 1-12	External Relations
NAMMCO/14/10	Information

Appendix 3

OPENING STATEMENTS TO THE COUNCIL BY MEMBER DELEGATIONS AND OBSERVER GOVERNMENTS

THE FAROE ISLANDS – OPENING STATEMENT

Madam Chair, Delegates, Observers, Distinguished guests, Ladies and Gentlemen,

It is a pleasure for the Faroes to be attending this fourteenth meeting of the Council of NAMMCO here in Tromsø. I would also like to extend a warm welcome to our new General Secretary, Dr Lockyer.

The Faroes are pleased to have been able to contribute over the years to the development of NAMMCO as a serious and credible body for cooperation on management, conservation and research on marine mammals. We have done so by trying to ensure that the advice we request from the scientists is based on realistic priorities and concerns in terms of conservation and management. We must continue to keep our priorities focussed. We must also be willing to act on the advice we receive, knowing as we do that there will always be degrees of uncertainty involved.

The management and conservation of marine mammals also means taking account of a wide range of other factors – from the review and improvement of hunting methods, to international transparency in national regulations, to a more effective incorporation of economic, social and cultural factors into our resource management decisions.

We welcome therefore further discussion on ecosystem approaches to management. We are seeing the same concept on the agenda in many other regional bodies where we also participate actively. We need to make sure that we are consistent in the way we define such an approach in relation to both fisheries and marine mammal utilisation.

We look forward to making our contribution to this process and to working with other delegations during this meeting.

GREENLAND – OPENING STATEMENT

Madam Chair, Mayor of Tromsø, Delegates, Observers, Ladies and Gentlemen,

On behalf of the Greenlandic Delegation, I would like to express our appreciation to be here in Tromsø, home of the NAMMCO Secretariat, for the fourteenth meeting of the Council.

It is our feeling in Greenland that NAMMCO has come to a level where we can call the regional organisation an adult, ready to continue with its goal and assignments – ready for new challenges. NAMMCO has grown up to be a respected science and management organisation on marine mammals: especially when we talk about science of marine mammals, inspection and observation of hunting activities and hunting methods, NAMMCO have continuing achievements. Let me refer to the various annual reports and the meeting documents where we can read about all the constructive results that have been reached during the last 13 years.

The next step Greenland sees in relation to the future of NAMMCO, is to focus on selected agendas and items, and finalise some of the main topics and priorities one can see arising from past advice from the Management and Scientific committees and decisions made by the Council.

As reported at last year's NAMMCO annual meeting, Greenland has passed a mile stone by introducing quotas on narwhal and beluga in West Greenland. This was and still is an important step for us, and Greenland is working further on the basis of the scientific recommendations. The introduction of quotas has had a severe impact on Greenlandic hunters, for whom the need both for meat and income has been greatly compromised.

With Greenland as the proponent, the Council endorsed the establishment of a planning group and conducted a conference on user knowledge in the decision making process in January 2003. Greenland is looking forward to build on the outcome and will participate in the follow up on the recommendations from the conference. Greenland is also looking forward to receiving the finalisation of the volume of the conference.

In conclusion, Greenland supports work that leads to enhancing the regional cooperation on the conservation, management and study of marine mammals in the North Atlantic, not only between the NAMMCO member countries, but also among non-member countries with whom we share marine mammal resources. Thus Greenland would invite such countries to join NAMMCO, because only by working together can we become stronger and achieve greater results.

ICELAND – OPENING STATEMENT

Mr. Chairman, Delegates, Observers and dear Friends.

It is with great pleasure that the Icelandic delegation attends the 14th Annual Meeting of NAMMCO here in Tromsö. Firstly we would like to express our gratitude to the Secretariat that has done a great work in preparing this meeting and providing us with excelent meeting facilites.

We are confident that, as past meetings, this meeting will be fruitful and constructive, based on an objectivie, and science-based approach.

In June last year the Icelandic Government formally adopted its policy on ocean issues. This policy is based on maintaining the future health, biodiversity and sustainablility of the ocean surrounding Iceland, in order that it may continue to be a resource that sustains and promotes the nation´s welfare. This means sustainable utilisation, conservation and management of the resource based on scientific research and applied expertise guided by respect for the marine ecosystem. And of course marine mammals are an integral part of our ocean policy where they form a large component of the marine ecosystem. Unfortunately, not all countries treat marine mammals this way but give them some special status as being outside the ecosystem.

As everyone here knows, sustainable utilisation of marine mammals is the key word for all of the NAMMCO member states. The main basis for our economic welfare is utilising the living resources of the sea, and we see no logical reason for treating marine mammals differently then other living resources of the sea. The sustainability of all living marine resources is therefore essential for the long-term prosperity of our countries.

For this reason international cooperation in this field is of a great importance to us all and we need to work together for the sustainable utilisation, conservation and study of these resources. NAMMCO has made valuable contributions to the conservation and sustainable management of marine mammals, not least through the work of the Scientific Committee. Therefore the objective and science-based approach used in NAMMCO is of utmost importance.

NAMMCO´s increased focus on the ecosystem approach is of great importance and Iceland sees the work carried out by NAMMCO on the role of marine mammals in the ecosystem as essential in the international fora in this field.

NAMMCO´s importance also lies in the fact that its work builds up on cooperation of countries with common concerns, shared values and a clear vision for conservation and sustainable use of marine mammals as other living resources of the sea. We must keep on bringing our message to the world society and make them understand how the Northern communities rely upon the sustainable use of these resources.

NORWAY – OPENING STATEMENT

Madam Chair, Minister, Delegates, Observers and Guests, dear Friends,

On behalf of the Norwegian Minister of Fisheries and Coastal Affairs and the Norwegian delegation to this Fourteenth Meeting of the Council I would like to echo the words of welcome by Herman Kristoffersen, the Mayor of Tromsø. It is a pleasure to see the NAMMCO Council gathered in Tromsø. During this meeting we will contribute to the further building of this regional management body for marine mammals.

A year ago the Government of Norway presented a White Paper to the Parliament (Stortinget) on marine mammal policy. The White Paper describes the situation as of today in our whaling and sealing industries, and indicates which way we want to go in order to establish an ecosystem-based management regime for the vast stocks of whales and seals in Norwegian waters. It is stated that the conservation of vulnerable stocks is as important as rational management of stocks that can sustain harvest.

The purpose of the white paper was to present a proposal for a new, coherent and active management regime for marine mammals in areas under Norwegian jurisdiction, based on modern principles for the management of species, habitats and ecosystems. This is in accordance with one of the goals of the World Summit on Sustainable Development in Johannesburg in 2002, which was to encourage the application by 2010 of the ecosystem approach to fisheries management. In order to meet that time limit, it is mandatory to speed up the work in this field.

The white paper is a follow up to a previous white paper presented by the Government entitled "Clean and Prosperous Ocean" in which the principles of ecosystem-based management of human activities in Norwegian marine and coastal areas are laid down. We know that it will take some time before this can be fulfilled, but the white paper on marine mammal policy proposes steps that can be taken towards this goal in the marine mammal sector. One of these steps is to devise harvesting strategies and propose measures to implement them.

In this respect the work of the NAMMCO *Ad Hoc* Working Group on Enhancing Ecosystem-based Management is important. We believe that the work of NAMMCO on the ecosystem-based approach to resource management could contribute considerably to a better management of living marine resources if we act expeditiously and coordinate our research in this field. Norway attaches great importance to the work of NAMMCO. This was clearly stated when the Parliament discussed the white paper on marine mammal policy.

Today I will particularly commend the achievements of the Committee on Hunting Methods. This committee has arranged three workshops since 1999, the most recent one in September 2004, on hunting methods for seals and walrus. At this workshop five countries outside the NAMMCO members participated, i.e. all the Nordic countries, Canada, The Russian Federation and the United States. Also, several regions within the participating countries were present. Consequently, a wide range of hunting regions contributed to the success of this workshop. The recommendations from the workshop were agreed by consensus, and the recommendations will be the basis for updating of the hunting regulations in many countries. The work of the Committee on Hunting Methods thus contributes to setting standards for all of us, both in the traditional hunt and the aboriginal hunt, based on the experiences from a wide range of hunting communities.

It is often said that there is a lot of scepticism to the use of products of marine mammals. I was, therefore, pleasantly surprised when I registered that the IUCN Congress in Bangkok in November last year adopted a positive resolution on the conservation and sustainable use of seals (REC006-Rev1). The recommendation urges its members who are also members to the Convention on Biological Diversity (CBD), to honour their earlier commitments to apply the Addis Ababa Principles and Guidelines on Sustainable Use of Biodiversity. Furthermore it urges IUCN members to put their sustainable use principles into action by not introducing new legislations that bans the importation and commercialisation of seal products from abundant seal populations. I think this is an encouraging development.

Finally, I take this opportunity to formally welcome our new General Secretary, Dr. Christina Lockyer. We look forward to working closely with you. Also, I would like to extend my appreciation to the Secretariat for the solid preparations of this meeting. We all know it has been a tough task during this period of transition with reduced staff. I would like to congratulate both Charlotte and Dan for their commitment to the running of the Secretariat in this period.

JAPAN – OPENING STATEMENT

On behalf of the Government of Japan I would like to expresses sincere appreciation for having been invited to participate as an observer at this Fourteenth Meeting of the NAMMCO Council. NAMMCO's continuing achievements concerning the science and management of marine mammals and as a model intergovernmental resource management regime are particularly important given the contrasting continuing failure of the International Whaling Commission to carry out its mandate.

Last year, Japan's Commissioner to the IWC informed the Council that Japan's Liberal Democratic Party's Parliamentary League for Preservation of Whaling had established a Project Team to examine options for the normalization of the IWC and resumption of commercial whaling. I can inform you that this Project Team has continued its work and examined the developments after the 56th IWC meeting in Sorrento including the failure of the IWC to support the Chair's package proposal to complete the RMS and lift the commercial whaling moratorium. The Project Team will determine how we handle the 57th meeting of the IWC in Ulsan, Korea and also how we will proceed following the meeting if it fails to make progress. The context for future decisions is of course the IWC's failure to agree and implement a reasonable management scheme and Japan's position that Paragraph 10(e) of the ICRW's Schedule is no longer in effect. Japan shares a common understanding with NAMMCO members that scientific findings must be the basis of management regimes for the sustainable use of all living marine resources and we hope to enhance our cooperation in this matter.

Research on interactions between whales and fisheries and ecosystem modelling is another subject of shared interest between Japan and the members of NAMMCO. We believe that Japan's whale research programmes and the efforts of NAMMCO members and the NAMMCO Scientific Committee on this issue are complimentary and that collectively they will provide the basis for improved management of all marine resources. Japan will therefore be submitting the details of a new whale research programme for the Antarctic to the IWC's Scientific Committee by the end of this month and we look forward to continuing expressions of support for our research programmes from NAMMCO members as a part of our continuing cooperation.

Thank you.

Appendix 4

AUDITED ACCOUNTS FOR 2003 and 2004

1. PROFIT AND LOSS ACCOUNT (NOK)

	2003	**2004**
Income		
Contributions	*3,028,200*	3,119,500
Interest received (net)	*51,100*	21,775
Book Sale	*19,035*	18,458
Employers Tax	*75,397*	73,102
Employees	*398,969*	440,870
Total Income	***3,572,701***	**3,673,705**
Expenditure		
Secretariat costs	*3,141,517*	2,679,169
Meetings	*74,652*	94,848
Scientific Committee	*295,422*	344,546
Projects, NAMMCO Fund	*20,000*	196,860
Conference	*-103,990*	60,309
Total operating expenses	***3,427,601***	**3,375,732**
Operating result	***145,100***	**297,973**

2. BALANCE SHEET 31 DECEMBER 2003 and 2004

Current assets		
Bank deposits (restricted 200,000)	*860,829*	1,444,018
Outstanding claims	*314,829*	130,160
Total assets	***1,175,048***	**1,574,178**
Current liabilities		
Employers tax	*10,605*	29,290
Creditors	*229,829*	47,846
NAMMCO Fund*	*203,355*	163,005
Other	*239,515*	544,320
Total current liabilities	***683,304***	**784,461**
Equity		
Restricted equity (Relocation fund)	*200,000*	200,000
Distributable equity (General reserve)	*291,744*	589,717
Total equity	***491,744***	**789,717**
Total liabilities and equity	***1,175,048***	**1,574,178**

* The NAMMCO Fund account is audited separately.

Appendix 5

PRESS RELEASE

The North Atlantic Marine Mammal Commission (NAMMCO) held its 14th meeting 1 - 3 March 2005 in Tromsø, Norway. 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, Japan and the Russian Federation, and representatives from a number of international organisations, including the International Council for the Exploration of the Sea and the International Whaling Commission.

Among issues discussed and decisions taken at the fourteenth meeting were the following:

International cooperation on seals and sealing
Under the UN Convention on the Law of the Sea, States are obliged to cooperate on the management of all marine mammals. As an international body for cooperation on the conservation and management of marine mammals in the North Atlantic, NAMMCO's work in coordinating research, conservation and management measures for seal stocks is filling an important gap in international cooperation. Among the broad range of international instruments relevant to conservation and management of marine resources, there are in fact few, other than NAMMCO, that are dealing with management and sustainable utilisation of seal stocks.

In addition to ongoing assessments of stocks and the review of management measures for grey seals, harp seals, hooded seals, ringed seals and walruses across the North Atlantic, NAMMCO has now decided to look more closely at the status of harbour seals, also an important resource for many coastal communties.

Focus on hunting methods
NAMMCO provides a unique forum for the exchange of information and experiences in hunting methods used in marine mammal hunts across the North Atlantic. The NAMMCO Committee on Hunting Methods organised a workshop in 2004 focussing on hunting methods for seals and walruses. Recommendations from the workshop dealing with such issues as hunter training and safety and technical innovation were endorsed by NAMMCO. Future work will include a workshop on the issue of struck and lost animals in hunting, and the development of guidelines on the use of different weapons and ammunition on different species.

Ecosystem-based management
Cooperation through NAMMCO is based firmly on the importance of considering the role of marine mammals in the marine ecosystem and developing multi-species approaches to management. The NAMMCO Scientific Committee is reviewing ongoing work to develop multi-species models suitable for use in management. NAMMCO plans to examine more closely the management objectives and experiences in applying ecosystem based management in countries across the North Atlantic where marine mammals are utilised.

International observation of whaling and sealing
NAMMCO has since 1998 had a fully operational international scheme for the observation of whaling and sealing activities in member countries. At this year's meeting NAMMCO reviewed the implementation of this scheme and noted the valuable experiences gained from having NAMMCO observers active in the field, both land-based and on board vessels, observing a range of different hunts. One of the main focuses of NAMMCO observation activities in 2005 will be the Norwegian seal hunt.

Narwhal and beluga
Having previously expressed its grave concern on the apparent decline of stocks of narwhal and belugas in West Greenland, NAMMCO commended the recent measures taken by the Government of Greenland to reduce catches by implementing quotas for these stocks. There are however continuing concerns about the sustainability of the catch and the effects of the new management measures will be followed closely.

Fin whales
In order to complete the requested assessment of fin whale stocks in the North Atlantic, questions related to stock identity and historical catch data in particular still need to be resolved. The NAMMCO Scientific Committee will be taking steps to complete this work as soon as possible.

Humpback whales
NAMMCO has in recent years also focussed its attention on the status of humpback whales in the North Atlantic, which are increasing in some areas. This year the Scientific Committee has been requested to continue its assessment and in particular to assess the long-term effects of annual removals of from 0, 2, 5, 10 and 20 humpback whales in West Greenland, as well as providing estimates of sustainable yields for stocks in the Northeast Atlantic.

New General Secretary – NAMMCO welcomed the new General Secretary, Dr Christina Lockyer, who took up her official duties during the 14th Annual Meeting in Tromsø. Dr Lockyer joins existing staff members of the Secretariat, Mr Daniel Pike, Scientific Secretary and Ms Charlotte Winsnes, Administrative Coordinator.

The next annual meeting of NAMMCO will be hosted by Iceland in the spring of 2006.

1.2
REPORT OF THE COMMITTEE ON HUNTING METHODS

The Committee on Hunting Methods met on 26 and 27 January 2005 from 9:15 to 16:30 and 09:00-10:45 in the Faroe Islands Representation in Copenhagen. Present were Jústines Olsen, Chair, (Faroe Islands), Ole Heinrich and Mads Brinck Lillelund (Greenland), Kristjan Loftsson (Iceland), Egil Ole Øen (Norway), and Christina Lockyer and Charlotte Winsnes from the Secretariat.

1. - 3 INTRODUCTORY REMARKS, ADOPTION OF AGENDA AND APPOINTMENT OF RAPPORTEUR

The Chair of the Committee, Jústines Olsen, welcomed the Committee members to the meeting. The draft agenda was adopted and Charlotte Winsnes was appointed as rapporteur.

4. UPDATES ON HUNTING METHODS IN MEMBER COUNTRIES

The lists of laws and regulations in member countries (NAMMCO/HM/2005-3), and of references on hunting methods (NAMMCO/HM/2005-4) were updated (see Appendices 1 and 2 of this report).

Faroe Islands
Olsen (Faroe Islands) reported that there had been no changes in the regulations for pilot whale hunting in the Faroe Islands this past year. Olsen informed the Committee that an incident involving some young hunters taking up the old tradition of killing adult seals with wooden clubs had resulted in a statement by the authorities that this method is a violation of the law on the protection of animals. The law has only one regulation directly governing the hunting of seals. This regulation states that shooting seals and other large sea animals with a shotgun is not allowed. The interpretation and practice in the Faroe Islands is thus that you may only hunt seals with a rifle in which case you need to get a licence.

Olsen furthermore informed the Committee that trials are still being conducted with the new knife developed for the pilot whale hunt.

Greenland
Lillelund (Greenland) reported that the new Executive Order no. 2 of 12 February 2004 on Protection and Hunting of Beluga and Narwhal was implemented 1 March 2004. The first quota year is from 1 July 2004 to 30 June 2005. The quotas set for narwhal and beluga are less than 50 % of recent harvest levels, but are still above the catch level recommended by the Scientific Committee. Another stipulation of the Executive Order is that boats over 42 feet in length may not participate in the hunt for beluga and narwhal and they may not function as a mother-ship (flensing area at sea). Lillelund also presented the Committee with a copy of the mandatory hunting report form that the hunters must fill out when an animal is hunted.

The Executive Orders on walrus, polar bears and small cetaceans were not finalised in 2004 as originally planned. In 2005 the Department of Fisheries and Hunting will have increased resources (an additional staff member) and it is hoped that the work with the Executive Orders will gain momentum. Pending the decision on whether or not the Executive Orders will be sent out for new public hearings, it is difficult to predict if the orders will be finalised and implemented in 2005 or 2006. It is planned to regulate the catch of these species through quotas.

In 2004, 141 whale grenades were sold in Greenland, and two courses on how to handle the grenades and the harpoons were held for hunters. Lillelund noted that the price of the grenade has decreased and at the same time the subsidy from the Department of Fishing and Hunting has decreased. Furthermore, in 2004 the quota for the rifle hunt of minke whales was reduced. The catch figures for 2004 were as follows:

In West Greenland 179 minke whales were taken of a quota of 180, 13 fin whales were taken of a quota of 19 and in East Greenland 9 minke whales were taken of a quota of 12.

Lillelund distributed a copy of PINIARNEQ 2005 to all committee members. This is a booklet giving information on hunting seasons, laws and regulations, registration forms and hunting statistics for the period 1998 - 2003.

Iceland
Loftsson (Iceland) informed the Committee that 25 minke whales had been taken in 2004 under the scientific whaling programme that had started in 2003. The hunting method used is the same as in Norway, and because no whales have been hunted since 1985, Dr Øen was called in to hold a course in 2003 on how to use the Norwegian grenade (Whale Grenade '99). The rifles used as secondary weapons or backup were the same calibre as in Norway (.375 and .458). Loftsson drew attention to the Workshop on Hunting Methods for Seals and Walrus in Copenhagen in September 2004, in which hunting methods for seals in Iceland had been presented.

Norway
Øen (Norway) noted that in Norway quota regulations on seal and whale hunting are revised every year. At its last meeting in November 2004 the Marine Mammal Council (*Sjøpattedyrrådet*) decided to review and improve the existing regulations on seal hunting methods (*utøvelsesforskriften*). This work should have been finalised before the commencement of the 2005 season, but has been postponed a year.

Øen informed the Committee of the ongoing work with the "Blue Box" system. Briefly sketched, the Blue Box is a trip recorder, a tamper-proof automated computing system designed to independently monitor and log the activities associated with data on certain events on board provided by different sensors, including independent GPS, shock transducers, strain transducers, heel sensors located in different places on a vessel that independently or in sum indicate or proves that a whale is shot and taken on board. The system is configured and calibrated for each individual vessel. The system is automated with programmes designed for the continuous operation and logging of data for minimum four months with backup batteries and automatically restarting function following system interruption. The mandatory logbook is an important part of the overall system. Prototypes have been tested for three seasons and during the 2004 season 13 out of 34 whaling vessels were equipped with the "Blue Box". Based on the data and results from the 2004 season, the system has been upgraded, and for the 2005 season the plan is to install a "Blue Box" on all whaling vessels. National inspectors will still be present on some boats in 2005 to monitor its function and from 2006 it is anticipated that the system will be fully operational, and national inspectors will only make random inspections on board vessels.

Implementation of the "Blue Box" system will ease some of the unnecessary and unintended restrictions of the current monitoring system. It provides a lower cost alternative bringing the hunt back to the traditional opportunistic "good weather" hunt and still secure that the harvest fit within long-term resource conservation targets and sustainable goals. It takes no space, it does not sleep, eat, and does not socialize with anyone. The system probably saves the cost of an estimated 6 million NOK every year.

5. UPDATE ON THE RECOMMENDATIONS FROM THE WORKSHOP ON HUNTING METHODS, 9 - 11 FEBRUARY 1999.

The Chairman asked the members to present the status of the follow-up to those recommendations from the 1999 Nuuk workshop that were not finalised at the last meeting.

Recommendation 3a: "*The workshop recommends that Greenland initiates studies in cooperation with the hunters, testing both pointed and blunt bullets on whale carcasses to determine the best ammunition for use in the hunt."*
The fulfilment of this recommendation is awaiting guidelines on shooting tests on dead animals. The shooting tests took place in September 2004 in the Faroe Islands. The work with the guidelines for standardising methods on how to perform the shooting tests must be completed before the tests can take place (see also Item 6 in this report.).

Recommendation 3b: "*The Workshop recommends that Greenland develop objective descriptions of hunting methods, equipment and how efficient these are in small cetacean hunting, considering regional variations."*
The Committee has in a previous meeting noted the following:
Such descriptions, to be all inclusive of the various hunting methods and regional variations in Greenland would be a major effort to produce. The descriptions would have to be created in cooperation with the hunters in the different regions of Greenland, and must be adapted to the different hunting methods. Jessen suggested that Greenland could start with a set of main points that would cover the different methods and the different regions. The Committee agreed to this idea and noted that such descriptions would also be an important contribution to the cultural history of Greenland (NAMMCO Annual Report 2002: 64).

The three workshops held in 1999, 2001 and 2004 produced a lot of information pertaining to this recommendation. It was deemed important to find out what descriptions already exist and hence what needs to be done. The Committee tasked Lillelund (Greenland) with the responsibility of going through the reports with the aim of making a recommendation on how best to move this work forward.

Recommendations under 4: Baleen whale hunting pertaining to Greenland:
Heinrich (Greenland) informed the Committee that the price on the penthrite grenade to Pilersuisoq a/s (the retailer) from the producer has been reduced for 2005. At the same time the Home Rule Government has reduced their subsidy by the same amount, so in effect the price the hunters have to pay for the grenade is unaltered from 2004 to 2005. The price cut from the producers reflects the fact that the development costs have been paid off. Ideally the price from the producer in Norway should be the same in Norway and in Greenland. Even when taking freight costs and import taxes into account, the price difference between Norway and Greenland should be minor. In Greenland the prices were:
2004: price to retailer DKK 4 517, price to the hunters: DKK 6 625
2005: price to retailer DKK 3 549, price to the hunters DKK 5 625

Because the Home Rule Government has reduced their subsidy with the same amount as the reduction in price into the retailer, the hunter must pay DKK 6 625.
For comparison the prices in Norway were: 2004: NOK 2595 and 2005: Not decided

6. UPDATE ON THE RECOMMENDATIONS FROM THE WORKSHOP ON BALLISTICS SANDEFJORD 13 -15 NOVEMBER 2001

At its 11th meeting in Ilulissat, Greenland in February 2002, the Council agreed to the Committee's recommendations:

- To develop guidelines for methods used to undertake more controlled and standardised studies of the effect of different weapons and ammunition on different species.
- To harmonise weapons and ammunition types for different species with due considerations to variation in hunting conditions in the different countries.
- To focus on seals and seal hunting.

Olsen (Faroe Islands) noted that with respect to the first recommendation, an essential part of this task was the shooting tests conducted in September 2004 in the Faroe Islands. A first step will be to describe the trials, what kinds of results were obtained and determine what conclusions can be drawn from these trials. However, in order to make guidelines one needs to make a very thorough and detailed description that takes into account all aspects of such a trial from how to perform autopsy and inspection of wounds and bullet paths to what sort of equipment is necessary for labelling heads and bodies. Ammunition has also to be tested with respect to shots from different angles and distances. The development of the guidelines will build on the experiences from the shooting tests and represents the second and final step in meeting this first recommendation.

Olsen and Øen will finalise the description of the shooting tests that took place in the Faroe Islands and present this document to the Council at its meeting in March this year. The second and final phase of the work will presumably be ready for presentation to the Council at the next annual meeting in 2006.

With respect to the second and third recommendations, the Committee postponed the discussion to the next item on the agenda, since the Workshop in question was convened as a response to these recommendations.

7. WORKSHOP ON HUNTING METHODS FOR SEALS AND WALRUS, 7 - 9 SEPTEMBER 2004.

The Workshop on Hunting Methods for Seals and Walrus was held in Copenhagen 7 – 9 September 2004. The terms of reference for the workshop were:

- To review existing seal and walrus hunting methods known.
- To evaluate methods used in seal and walrus hunting in relation to killing efficiency and struck and lost rates.
- To examine possibilities for technical innovation and further enhancement of efficiency and safety of hunting methods, with a view to providing recommendations for improvement, where relevant, and
- If possible, determine minimum requirements for safe and efficient killing of walrus and different seal species, considering variations in hunting methods.

The Committee discussed the draft Report from the Workshop making some minor editorial changes that are reflected in the final version of the Workshop Report. The Committee emphasised the importance of the procedure by which the recommendations had evolved. At the outset of the Workshop a Drafting Committee had been established with representative participation from the Workshop participants. The Drafting Committee was tasked with developing a set of draft recommendations based on the presentations and the discussions at the Workshop. These draft recommendations were then presented to the workshop participants and discussed one by one, revised if necessary, and adopted by consensus.

The Committee emphasised the importance of obtaining more reliable information on rates of struck and lost in walrus and seal hunts, and of reducing the rates of struck and lost. To this end the Committee recommended that the member countries take special note of the relationship among hunters' safety, technical innovation in developing new equipment and hunting techniques, and the need to establish minimum requirements for firearms and ammunition for seal and walrus hunts in order to reduce struck and lost rates.

The report from the Workshop will be presented to the Council at its meeting in March 2005. As part of the presentation, Øen and the Secretariat will make a table depicting both what the hunters regard as functional weapons and ammunition in regard to the different hunts, and the existing laws and regulations pertaining to this in the specific hunt.

8. FUTURE WORK OF THE COMMITTEE

The Committee agreed on the following future priorities:

- To finalise the work on standardising guidelines for methods used to undertake more controlled and standardised studies of the effect of different weapons and ammunition on different species. The work is two-fold, first to present the report of shooting trials on heads of pilot whales in the Faroe Islands in September 2004 to the Council at its meeting in March 2005, and second to finalise the guidelines to be presented to the Council at its meeting in 2006.
- To convene a workshop on "struck and lost" in whale- and seal hunting, tentatively in the autumn of 2006, bearing in mind the three previous NAMMCO Workshops in 1999, 2001 and 2004 arranged by the NAMMCO Hunting Committee. The aim will be to elucidate and to analyse the problem of struck and lost in whale- and seal hunting and make very specific recommendations on how to reduce this problem.
- The Committee reiterated its intention of collecting the proceedings from all hunting method-workshops held by NAMMCO in one publication. Taking into account the plan to convene a new workshop in 2006 the Committee proposed to schedule the publication in order to include the upcoming Workshop on Struck and Lost. The Committee was of the opinion that the workshops represent a significant amount of relevant and valuable information, and the publication would be built upon the results from all four Workshops organised by the Committee.

9. ELECTION OF OFFICERS

The Committee elected Egil Ole Øen (Norway) as its Chair and Kristjan Loftsson (Iceland) as Vice-Chair, both for the next two years (2005/2006). The outgoing Chair, Jústines Olsen had held the position since 1998, and the Committee thanked Olsen for his able chairmanship during many years.

10. ANY OTHER BUSINESS

There was no other business.

11. APPROVAL OF THE REPORT

The report was approved through correspondence on 11 February 2005.

Appendix 1

LIST OF LAWS AND REGULATIONS IN NAMMCO MEMBER COUNTRIES

(Updated February 2005)

FAROE ISLANDS

Parliamentary Act

- No. 57 of 5 June 1984 on whale hunting
- No. 54 of 20 May 1996 amending Parliamentary Act on whale hunting
- No. 9 of 14 March 1985 on the protection of animals, as last amended by Parliamentary Act no. 60 of 30 May 1990
- No. 43 of 22 May 1969 on weapons etc. as amended by Parliamentary Act No. 54 of 12 May 1980
- No. 128 of 25 October 1988 on hare hunting

Executive order

- No. 57 of 12 September 1969 on weapons etc.
- No. 19 of 1 March 1996 on exemption from protection of whales
- No. 126 of 23 June 1997 on protection of whales
- No. 46 of 8 April 1998 on pilot whaling
- No. 107 of 21 November 1989 on authorisation of whaling bays, as amended by executive order no. 64 of 11 May 1992, executive order No. 127 of 27 August 1992, executive order no. 141 of 23 June 1993, executive order no. 34 of 24 March 1994 and executive order no. 94 of 31 May 2001
- No. 166 of 27 August 1993 on provisional authorisation of whaling bays
- No. 118 of 23 October1996 on provisional authorisation of whaling bays
- No. 72 of 17 May 2000 on provisional authorisation of whaling bays

GREENLAND

Greenland Home Rule Act

- No. 12 of 29 October 1999 on hunting
- No. 11 of 12 November 2001 on revisions to Greenland Home Rule Act no. 12 of 29 October 1999 on hunting
- No. 9 of 15 April 2003 on revisions to Greenland Home Rule Act no. 12 of 29 October 1999 on hunting
- No. 25 of 18 December 2003 on animal welfare
- No. 29 of 18 December 2003 on nature protection

Executive Order

- No. 20 of 11 May 1994 on polar bear hunting in Greenland
- No. 26 of 24 October 1997 on extraordinary check and approval of harpoon canons
- No 7 of 26 February 1998 on protection and hunting of walrus
- No. 13 of 3 April 1998 on reporting from hunting and strike of large whales

- No. 12 of 3 April 1998 on hunting of large whales
- No. 22 of 19 August 2002 on trophy-hunting and fishing
- No. 20 of 27 November 2003 on hunting licenses for full time hunters
- No. 21 of 28 November 2003 on hunting licenses for part-time and/or sport hunters
- No. 2 of 12 February 2004 on protection and hunting of beluga and narwhal

Catch registration form (1993)
Greenland Parliament Regulations of 31 August 1959, ratified on 12 February 1960 on the protection of harbour seals (Phoca vitulina)

ICELAND

Whaling Act No. 26,May 3, 1949

Regulation
No. 163, May 30, 1973 on whaling
No. 304, May 9, 1983 on amendments to Regulation No. 163 of May 30, 1973 on whaling
No. 239, May 10, 1984 on amendments to Regulation no. 163 of May 30, 1973 on whaling (cf. Regulation no. 304/1983)
Agreement No. 9 of 26. June 1991 between Iceland and Spain on an international observer scheme for land-based whaling stations in the North Atlantic area.

NORWAY

Act of 20 December 1974 no. 73 concerning the welfare of animals
Act of 29 May 1981 relating to wildlife and wildlife habitats (the Wildlife act)
Act of 3 June 1983 no. 40 relating to seawater fisheries, etc.
Act of 27 March 1999 No 15 relating to the right to participate in fisheries and hunting (Participants act)

Executive Order from the Director of Fisheries:

J-45-1989, 14.3.1989	Regulation on control of the practice of seal hunting
J-34-2003, 11.2.2003	Regulation on the practice of seal hunting in the West and East Ice
J-11-2005, 13.1.2005	Regulation on the permission to hunt seals in the West and East Ice
J-74-2003, 14.3.2003	Regulation on control and permission of hunting minke whales in 2003.
J-74-2000, 31.3.2000	Regulation on the practice of hunting minke whales.
J-85-2003, 03.4.2003	Regulation on maximum quotas for hunting minke whales in 2003.
J-112-2003, 22.5.2003	Amendment to regulation on maximum quotas for hunting minke whales in 2003

Instructions for inspectors during the minke whale hunt in 2003.

Appendix 2

LIST OF REFERENCES ON HUNTING METHODS

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1.3
REPORT OF THE NAMMCO WORKSHOP ON HUNTING METHODS FOR SEALS AND WALRUS

North Atlantic House Copenhagen, Denmark
7 – 9 September 2004

At its 12th Annual Meeting in March 2003 the Council agreed to the recommendation from the Committee on Hunting Methods to hold a Workshop on Hunting Methods for Seals and Walrus. The Council approved the following terms of reference for the Workshop: The NAMMCO Council at its 12th Annual Meeting in March 2003 adopted the following Terms of Reference for the Workshop:

- To review existing seal and walrus hunting methods known
- To evaluate methods used in seal and walrus hunting in relation to killing efficiency and struck and loss rates
- To examine possibilities for technical innovation and further enhancement of efficiency and safety of hunting methods, with a view to providing recommendations for improvement, where relevant, and,
- If possible, determine minimum requirements for safe and efficient killing of different seal species and walrus, considering variations in hunting methods.

The Overall Goal for the Workshop was stated as: To ensure a safe and efficient hunt based on hunters' knowledge, science and the best available technology, and the **Workshop objective:** To formulate recommendations on best practice, minimum requirements, enhancements and technical innovations for weapons and ammunition.

1. APPOINTMENT OF CHAIR AND CO-CHAIR

Dr Egil Ole Øen from the Norwegian School of Veterinary Science, Section of Arctic Veterinary Medicine, Norway chaired the Workshop, while Mr Glenn Williams, Wildlife Advisor to the Wildlife Department of the Nunavut Tunngavik Incorporated (NTI), Canada served as co-chair.

2. APPOINTMENT OF RAPPORTEURS

Members of the NAMMCO Secretariat were appointed as rapporteurs.

3. INTRODUCTORY REMARKS

Jústines Olsen (Faroe Islands), Chair of the NAMMCO Committee on Hunting Methods welcomed the participants to the Workshop, and noted that the Committee was very pleased to find that the topic of seal and walrus hunting methods was of interest to so many people from different parts of the world. Mr Olsen also expressed gratitude for the financial support to the Workshop from the Nordic Council of Ministers, the North Atlantic Cooperation (NORA), Indigenous Survival International Greenland and the Norwegian Foreign Ministry. Finally he thanked the Representation

Offices of Greenland and the Faeroes for hosting a reception on 7 September for the workshop participants.

Dr Egil Ole Øen (Norway), Chair of the Workshop in his introductory remarks noted that this was the third in a series of NAMMCO Workshops on hunting methods. The first was held in Nuuk, Greenland in 1999, and the second in Sandefjord, Norway in 2001. In addition he drew attention to the linkages between these Workshops and the NAMMCO Conference on User Knowledge and Scientific Knowledge in Management Decision Making held in Reykjavik, Iceland in 2003, in which a number of resource users from 11 countries discussed the important role of user knowledge in the management decision-making process. Dr Øen drew attention to the Terms of Reference for the Workshop and noted that the success of the Workshop was dependent upon an open exchange of knowledge amongst the participants. The participants were asked to evaluate, with an open mind, the various methods and look at possibilities for innovation, and finally suggest minimum requirements for safe and efficient killing methods. Dr Øen emphasised that the broad range of participants from other countries than the NAMMCO members would help the Workshop to achieve the best results. The workshop programme is in Appendix 1, p. 86.

4. PRESENTATIONS

4.1 Physical features, biology and behaviour of seals and walrus

In this introductory session the speakers described the anatomy and behaviour of significance for the choice of equipment and methods used in the hunt. The complete papers are included in Appendix 3, p. 98.

Seals: Siri K. Knudsen, Norway

The family of pinnipeds consists of three sub-families: (1) the Family *Odobenidae* that only contains the walrus; (2) the Family *Otariidae*, which consists of the seal lions and the fur seals. The species in this family all have a visible external ear flap and are therefore often referred to as “eared seals”; (3) the Family *Phocida* are often referred to as true seals or “earless seals”.

All pinnipeds have much shorter limbs compared to terrestrial mammals of the same size. Phocids and otariids swim differently, which is reflected by some anatomical differences. Seals, as other diving mammals, have increased storage capacity for oxygen in their musculature, with the result that muscular movement can persist long after the animal is dead. The skeleton of all seals consists of the skull, the spinal vertebra, four limbs and the ribs. The skull of pinnipeds is characterised by a short snout and large orbits. During hunting, seals are usually shot in the head, with the brain being the main target. Consequently, for hunters this area is the most important. The thickness of the cranium varies in different parts of the skull. It is generally thickest over the frontal and basal parts of the brain, where it may be several centimetres thick. It becomes thinner at the upper hind part and on the laterally sides. The thickness also varies to some extent among different species, but most importantly it varies between animals of different size.

The nervous system of pinnipeds is built and functions in the same manner as in other mammals. It consists of a central part, which is the brain and spinal cord, and a peripheral part which is the nerves and nerve cells in the rest of the body. The brain can be regarded as the true centre of the body responsible for survival, consciousness and the maintenance of physiological conditions. By consciousness we mean awareness of the world around and of the body. Thus, someone who is unconscious will not perceive pain. Generally it can be said that during seal hunting the same applies as for other mammals: in order to render the animal instantaneously unconscious some specific brain areas have to be put out of function, which includes the cerebral cortex, deep central parts of the cerebrum and/or the brain stem, which contain the centres for consciousness and control units for respiration and heart activity. It is the brain and spinal cord that are responsible for the reflexes and involuntary reactions in dead animals. Most of such reflexes do not require cerebral coordination and thus can be elicited in the insensible animal.

The major tasks of the heart and blood vessels are to transport oxygen rich blood from the lungs to all organs and tissues in the body - a job carried out by the arteries - and to remove carbon dioxide from these tissues and transport it through the veins to the lungs where it is breathed out. Physiologically, it is the circulatory system of seals that is most different compared to terrestrial animals and these adaptations are related to diving. The heart of pinnipeds is of normal mammalian construction, though it tends to be broader and flatter than the hearts of terrestrial mammals. Also the heart musculature has higher oxygen storage capacity than in terrestrial mammals. This is important for hunters, as the heart can carry on beating a long time after the animal is in fact dead. Optimal regulation of the blood pressure is essential. Too low blood pressure results in shock and eventually death. After severe injury the blood pressure will drop almost immediately and the animal will be unconscious, not immediately, but very rapidly. This may, however, be time enough for an animal that for instance is lying near the ice edge to haul itself into the water and sink. As most organs in marine mammals are similar to those of terrestrial mammals, their central blood supplies are also similar.

The respiratory system of seals is similar to other mammals, although the lungs tend to be larger than those of terrestrial mammals.

The thorax and abdomen are separated by the diaphragm, a thin muscular wall that is essential for respiration. It is traversed by the *aorta*, the *vena cava caudalis* and the *oesophagus*. The marine mammal liver is generally not too different from that of other mammals. It has a rich blood supply and is located immediately caudal to the diaphragm. The kidney typically lies against the musculature of the back.

At the end of the presentation an overview on the seals species that were most topical for the workshop was given, with special emphasis on important anatomical and behavioural differences.

Walrus: Joel Garlich-Miller, Alaska, USA

Walrus (*Odobenus rosmarus)* have a discontinuous, although nearly circumpolar distribution around the perimeter of the Arctic Ocean and contiguous sub-arctic seas. Their distribution appears to be constrained by water depth and ice conditions. Walrus rely on floating pack ice as a substrate for resting and giving birth. They are gregarious animals and usually found in groups.

Walrus are specialised predators of benthic invertebrates. They use sensitive whiskers to locate food items on the sea floor and dislodge prey using powerful jets of water and suction.

Hunters usually prefer to target walruses hauled out onto large flat ice pans. The brain is normally targeted with the objective of killing the animal outright, on the ice, in place for butchering. Although the front of the skull is greatly enlarged to accommodate the tusks, the lateral walls of the cranium are relatively thin. When hunting in open water, injured animals are usually harpooned before a killing shot is made because walrus generally sink upon death. The lungs and spinal cord are frequently targeted. Accounts of struck and loss rates for modern walrus hunting practices range from less than 10 % to more than 50%. Loss rates can be minimised through appropriate target selection and by utilising suitable hunting practices and gear.

4.2 Weapons and other hunting equipment: ballistics and effects

In his opening remarks the Workshop co-chair Mr Glenn Williams noted that we need to know about ballistics and the effects of weapons and other hunting equipment in order to improve the hunters' hunting abilities and thus make the hunt itself more efficient. The complete papers are included in Appendix 3, p. 98.

Ballistics: Egil Ole Øen, Norway

Ballistics is the science of the motion; the propulsion and the impact of a projectile. Although closely interrelated, it is commonly divided in internal, external and terminal ballistics. The term calibre is used to designate the diameter of the slug or weapon bore.

Internal ballistics ("interior ballistics") covers the events that take place within the gun from the moment the primer ignites to the moment the bullet leaves the barrel. This is a complex system that involves the case and the primer characteristics, the propellant, bullet and the barrel characteristics.

External ballistics ("exterior ballistics") is the science of the flight of the missile between the barrel muzzle and the target. External ballistics studies and predicts the projectile's trajectory or path relative to a frame of reference. It is *i.a*. used to set up firing tables, which information includes the bullet path, its remaining velocity at any distance, and the time of flight at different ranges. By knowing this, the shooter can predict where the bullet will strike and decide how to "zero" the firearm for best results. By knowing the remaining velocity (and energy) of a projectile at any point along its path, the shooter can estimate its energy and thus its effectiveness at any distance.

Terminal ballistics ("target ballistics") is the science of the stopping process of the projectile at the target. Penetration, wounding effect, energy dissipation, projectile formation and stability are all important processes covered by this branch of ballistics. The seriousness of the bullet wounds is often considered to be limited to the tissues in the direct path of the projectile, but the wounding potential of projectiles is much more complex.

The bullet's ability of penetration is important because it usually must get well inside the animal to reach and disrupt the function of vital organs and bring the animal down. A number of factors are affecting the performance of penetration and killing like the projectile's calibre, its kinetic energy (E), which is dependent of bullet velocity and mass, its sectional density (SD) which is the ratio of weight to the square of the bullet diameter, and the bullet design and other characteristics. For example full-jacketed bullets will generally promote greater penetration into the target than bullets that expand and/or flatten or mushroom on impact, and thereby increase the resistance during penetration and passage. For expanding bullets the expansion is affected by the type of tissues, thickness and strength of the jacket, hardness of the core, and the amount of core exposed.

Terminal ballistic: Siri K. Knudsen, Norway

Terminal ballistics describes the effect a projectile causes while striking the body as well as the effects upon the projectile. The main mechanisms of injury after gunshots were described, including cut, stretch, shock and heat. The typical characteristics of ballistic injuries to the skull and brain were given, and emphasis was put on which damages cause instantaneously loss of consciousness. The typical features of ballistic injuries to the chest, abdomen and soft tissue were also presented.

Discussion

In response to a query as to whether a bullet would change direction upon impact with a relatively soft and thin skull, Knudsen indicated that the velocity and angle of impact of the bullet were most important in determining what would happen. Changes in direction were more likely with low velocity and/or high angle impacts.

Animal welfare and the Canadian Harp Seal hunt: Pierre-Yves Daoust, Canada

The annual harp seal (*Phoca groenlandica*) hunt in Atlantic Canada is the largest seal hunt in the world. However, it is the animal welfare issues surrounding this hunt that have dominated the public attention for decades. Since the mid 1980s, beaters (3-4 weeks old) have been the main age group targeted in this hunt.

The two types of weapons used to harvest these animals include the hakapik (see description p. 89, article 5) and high-calibre rifles, the selection of these weapons being influenced in large part by ice conditions.

In order to adequately address whether various methods used to harvest wild animals are humane, the anatomic and physiologic bases for removal of pain perception (destruction of both cerebral hemispheres) and for causing rapid death (destruction of the brain stem) must be understood. In this context, this author believes that one or a few blows from a hakapik can rapidly and efficiently render a beater at least irreversibly unconscious and probably dead, because the top of the skull of these young animals is very thin and can easily be crushed. Subsequent verification that the skull of the animal is completely crushed and/or that its blinking reflex is absent, followed by immediate and rapid bleeding, will ensure that the process of humane killing is complete.

Some sealers have suggested that rifles authorised under the current Canadian Marine Mammal Regulations for the harp seal hunt are unnecessarily powerful. However, a recent ballistic study under controlled conditions by the author suggests that these Regulations should be upheld, although field observations are needed in order to confirm this conclusion.

The swimming reflex is a stereotypic, sometimes vigorous, movement of a recently killed seal. Attempts should be made to better understand the physiologic basis of this movement, as it has often been used by animal welfare groups as an indication that the animal harvested is still alive.

In conclusion, this author believes that the killing methods used at the Canadian harp seal hunt are appropriate from an animal welfare perspective, when properly applied, but that they could be further improved through careful application of some simple techniques. Monitoring of the hunt by independent observers should also continue in order to encourage compliance with proper hunting practices. Finally, this author recommends a return to the replacement yield as the basis for annual quotas at the hunt. This would ensure a sustainable harvest; it would also promote a less hurried hunt and, therefore, more opportunity for careful handling of individual animals.

<u>Discussion</u>
Based on their experiences the hunters in the Canadian seal hunt stated that the .22 Magnum is more effective than the .22 Rimfire. There are no regulations on maximum distance for firing a gun but the sealers rarely shoot from beyond 50 m to facilitate retrieval of the animals. The bleeding of the seals is good for the pelts and for the meat. In Canada the blunt end of the hakapik is used to crack the skull and the pick itself to move animal, while in Norway the blunt end is used first and then the pick is used to palpitate the brain. Palpation of the skull is a good method for determining death and is more reliable than observing reflexes. Most hunters prefer the hakapik to the rifle because the hakapik is more secure and also cheaper in use. However the hakapik is not advised for killing adult seals.

4.3 Video presentations

The following VIDEO presentations of hunting activities from different regions were presented during the Workshop:

- “Waiting at the Ice Edge”, from Nunavut, Canada
- “But Seal is our daily bread”, Seal hunting in Greenland
- Walrus hunting from Chukotka, the Russian Federation
- Harp and hooded seal hunting in the West Ice, Norway
- Coastal seal hunting for harbour seals in Norway

- Faroes Pilot Whaling
- Sealing in Iceland

John K. Boone gave a presentation on the Alaska Native Harbour Seal Commission.

4.4 Descriptions of seal and walrus hunting

Walrus hunting

Vladilen Kavry, Chukotka, Russian Federation

The Chukchi and the Bering Sea are the habitat of the Pacific Walrus (*Odobenus rosmarus divergens*). The walrus come in the spring when the sea breaks up and leave in the late fall when the seas starts freezing. They are harvested on the Pacific coast from the spring until the fall, and on the Arctic coast in the summer and in the fall.

The walrus is harvested in all native villages located on the Pacific and Arctic coasts of Chukotka. Walrus hunting methods have been developing over many centuries and are maintained by the present generation. All along the thousand-kilometre coast the hunters apply practically the same methods with only seasonal differences.

Almost all marine mammal hunting settlements of Chukotka are located nearby the coastal walrus haulouts. The walrus appear on the haulouts only when the ice disappears from the sea. In the Bering Sea the summer coastal haulouts form in the middle of July, while in the Chukchi Sea the haulouts form at the end of August and in September. At these locations the walrus is slaughtered in fall when the walrus migrate from the north to the south. Usually the walrus rest on the haulouts for several days. The first walrus are very cautious but become less so as the beach fills. The experienced hunters and elders take the decision regarding the beginning of the slaughter. The hunters use long lances aiming at the heart to kill the walrus. They do not use rifles because the sound of the shot would alert the walrus and cause them to stampede into the water.

The harvesting season starts in spring when the walrus migrate with the passing ice. The hunters approach the walrus herd very carefully and try not to make any noise. They try to approach unnoticed as closely as possible and kill the walrus with one shot. The gunners aim at the vital organs of the walrus (neck, brain *etc.*) to kill or immobilise instantaneously. The hunters use large-calibre rifles.

Ice haulouts are the favourite resting-place of the walrus. They choose mainly the edge of pack ice but sometimes female walrus with calves are found in the centre of the pack. In large herds on the ice the walrus tend not to be so alert as when they are in smaller groups.

In an ideal situation the hunters debark on the ice floe with walrus or on a neighbouring ice floe. The walruses get anxious and will leave if provoked. If the hunter does not make any sudden movements and stays in the same place visible to the walrus, they relax and lie down to rest again. After 15 to 20 minutes the hunter makes the first shot at the chosen animal and then remains motionless. The sound of the rifle resembles that of ice cracking, and it frightens the animals. They become agitated again and will flee if provoked. They look around but, not seeing anything out of the ordinary, become calm and lie down again. In about 10 minutes after the first shot the hunter makes the second and again freezes. This pattern is repeated until the hunter has killed as many walrus as he needs. The remaining animals are then chased away from the haulout.

If the hunter cannot debark onto the ice, he must shoot the animals from the boat. The walrus is approached either very carefully and slowly, or, conversely, very quickly. In either case the objective is to harpoon the walrus before it escapes into the water. If the walrus cannot be harpooned at once, the hunters sometimes shoot the walrus first. In such a case they try not to kill the animal so that it does not sink. They then harpoon the animal and make the killing shot. This process can take 10 to 15 minutes.

At some locations the haulouts can be approached by boat. The hunt starts very early in the morning when the walrus are asleep. The sleeping walrus are approached with the outboards off. The sleeping walrus is harpooned and then killed using a long lance. Then the walrus is tugged away from the haulout. If these methods are used the walrus do not get frightened.

According to many researchers the struck and loss rates for the Pacific walrus can reach 40-50%. The loss rates depend on different factors and vary greatly. Loss rates are highest in the open-water hunt. If the walrus is harvested on the ice haulouts, the loss rate is reduced.

Charlie Brower, Alaska, USA
The Eskimo Walrus Commission (EWC) was established in 1978. The EWC represents coastal walrus hunting communities throughout Alaska, and is recognised as addressing issues of state-wide interests. Walrus (Walrus (*Odobenus rosmarus divergens)* are considered to be a cultural subsistence resource, a primary food source, and used in objects crafted from ivory and bones. The EWC currently has co-operative agreements, with the US Fish and Wildlife Service and with the Russians. Through extensive cooperation the Commission focuses on education, research, hunt monitoring, tagging of walrus and inspection of all boats carried out by monitors elected amongst the tribal organisations. Self-regulation and management are encouraged. The Commission gathers traditional knowledge on walrus conservation and management, and a book on traditional management practices has been published.

Walrus hunting takes place in July/August. Walrus on ice floes are preferred targets, therefore hunting is dependent upon favourable ice conditions. Open water hunts are much less successful. Also, killing the animal on the ice makes it much easier to butcher. The hunters use boats, harpoons, high-powered rifles, sharp knives and a come-along. The hunters can tell from the behaviour of the animal whether or not it is accompanied by a calf. The hunter shoots the animal behind the ear to hit the brain, at which point the brain is destroyed and the head falls down. The type of rifle used varies **[**.30-30, .30-06, .278, .22-250, .223] depending on how proficient the hunter is.

Walrus hunting is dangerous because of the ice and unpredictable weather. The current is also strong in the areas where walrus are hunted. Hunters tend to go to areas to the west of their villages, because there is a strong easterly current and by the time butchering is completed they will have drifted back towards their village. The hunters are trying to improve the struck and loss rates by using more high powered rifles, attach more floats to the animals, and by shooting at as close a range as possible. The hunters always approach the animals from the leeward side when the animals are lying on the ice floes, but the walrus often fall in the water after being shot, increasing the struck and lost rates.

<u>Discussion</u>
Although some Alaskan hunters use ammunition as small as .222 and .223 for walrus hunting, it was noted that the animal must be shot at close range and precisely for these light calibres to be effective. All hunters generally use full metal jacket bullets. Even hunters taking animals on the ice should have a harpoon ready, because injured animals are sometimes pushed into the water by other walrus.

Charlie Johnson, Alaska, USA gave a presentation of the Marine Mammal Protection Act (see Appendix 2, p. 93, for a résumé).

Glenn Williams, Canada
Mr Glenn Williams gave the presentation on walrus (*Odobenus rosmarus rosmarus*) hunting in Nunavut on behalf of Ben Kovic the Chair of Nunavut Wildlife Management Board. The largest concentrations of walrus are found in Foxe Basin and northern Hudson Bay. Walrus hunting is a recognised right under the Nunavut Land Claims Agreement, and is governed by the Fisheries Act. Indians and Inuit can harvest up to four walrus without licence per year, and in some cases community quotas are issued. Walrus are hunted in all the six seasons. The hunters are required to report harvests to the Department of Fisheries and Oceans. The average annual kill is 241 animals, with some reduction over the past 20 years. This may be because hunters no longer use large boats to access very remote areas, and other changes in equipment, rather than a reduction in the number of animals. The struck and loss rates vary with seasons, weather, location, animal behaviour and experience of hunters. Currently there are no reliable estimates of struck and loss rates.

Hunters in Nunavut use a combination of traditional methods and modern equipment, such as boats with outboard motors and snow machines with more traditional sleds. Harpoons with seal skin lines and floats are still very important, although hunters often find that the modern floats are more resilient. In most cases the rifles used for killing walrus are .30 calibre, .303 calibre or smaller, depending on what the hunters' have available to them. The .303 calibre is commonly used because the ammunition is widely available in the communities. In the last several years the .303 full metal jacket ammunition has become less available and has been replaced by soft point bullets.

Walrus are hunted from boats while they are on ice floes and while swimming in open water. Hunting them on ice floes is preferred because loss rates are lower and it is more convenient for butchering the animals. Animals on the ice are approached slowly and shot at as close a range as possible, with the objective of killing them outright before they can enter the water. When hunting in open water, the walrus is often slowed down with a body shot, allowing the hunters to get close enough to harpoon and secure the animal before administering the killing shot. This reduces loss rates.

Walrus hunting through the ice is done during the winter, by harpooning the walrus as it breathes through a hole in the thin young ice. Once harpooned the walrus is secured and held until it returns to breathe again, then shot through the roof of the mouth where the skull bone is thinner.

Nunavut Tunngavik Incorporated, the Nunavut Wildlife Management Board and the Department of Fisheries and Oceans have established a working group of experienced hunters to make recommendations on harvesting methods and equipment for marine mammals, and to also test new equipment and technologies. This past summer, hunters tested new rifle calibres and ammunition on walrus. Experienced hunters were supplied with 338 Win Mag and 375 H&H rifles. The test ammunition was hand loaded, round nose solids, round nose full metal jacket and solid Barnes XP bullets. The results of these tests are now being collated. The Working Group also identified training at the community level as important. Training materials are being developed and will be published in appropriate formats for dissemination in the communities.

Walrus is an important source of food and every edible part is utilised and distributed through the communities. The by-products from the walrus hunt, such as tusks for carving, are also important as a source of cash for the hunters.

Discussion
The hunters prefer full metal jacket ammunition because they find that with smaller guns (.303) they get better penetration, and it is readily available in the communities. The latter is important for determining the ammunition used. It may be better to use soft point bullets with bigger rifles, but this is currently being tested. There is concern about bullet deflection, which may be more acute for full metal jacket ammunition in smaller calibres. The bullet's design and shape also influence deflection, and research into this problem is underway in Nunavut.

Leif Fontaine, Greenland
The hunting of walrus (*Odobenus rosmarus rosmarus*) in Greenland varies greatly both by region and season.

In North Greenland (Avanersuaq), walrus occur from October until April. When they first appear in October, they are hunted from motor boats and dinghies, and are shot first with a body shot to slow the animal, and then harpooned in order to prevent them from sinking. When the first ice appears in November, the walrus is harpooned from the floe edge, and the harpoon line is secured using a lance. The lance is thrust into the ice, thus "fastening" the walrus. When it surfaces it is shot using a calibre .30-06 rifle.

In northwestern Greenland, walrus occur infrequently in the fjords, and are therefore rarely hunted there. In recent years hunting walrus at the floe edge by means of dog sled has become more common, resulting in increased catch. Again the walrus is shot using a .30-06 calibre rifle.

In central western Greenland, walrus are found at the floe edge in February. In harsher winters with more ice, walrus can be seen in abundance, but leave the area in May. Due to the thinning of sea ice off Sisimiut in recent years, walrus tend to be further offshore and therefore harder to reach by boat.

Hunting walrus around Sisimiut is locally restricted to the months of March and April. Whenever harsh winters occur with more ice, walrus catches increase. Hunting walrus is practised utilising larger vessels since ice conditions and strong currents would make the use of very small vessels dangerous. Walrus hunting from smaller boats occurs only when sea ice is less dense. Calibre .30-06 rifles are commonly used in the hunt. As in other areas the walrus is shot while on the ice if possible, and in open water if not. In open water every effort is made to harpoon the animal before it is killed.

In Eastern Greenland, walrus appear rarely around Kuummiut from about May to July. Walrus are hunted in open water by shooting them first, then harpooning them to prevent them from sinking. .30-06, .30-30 and .243 calibre guns are commonly used.

Mr Fontaine emphasised that hunter safety was very important in walrus hunting. He also recommended the use of ear protection when hunting with rifles.

Discussion
It was clarified that full metal jacket, sharp point ammunition is the type most commonly used for walrus hunting in Greenland

Seal Hunting

Edward Zdor, Chukotka, Russian Federation
Seals are harvested in all villages on the Chukotkan Arctic and Pacific coasts. Four species other than walrus are hunted: ringed (*Phoca hispida*), ribbon (*Phoca fasciata*), bearded (*Erignathus barbatus*) and spotted seals (*Phoca largha*). The ringed seal is the most commonly hunted seal, and is taken on the ice or in open water at all times of the year. The other seal species appear in the spring when the sea ice breaks up and depart in the late fall when the sea freezes, and are harvested when they are present in the hunting areas.

Netting is a very commonly used method for taking seals in Chukotka. Several types of seal nets are used. The summer net is 15 to 20 m in length and is used in open water, in the same manner as a fishing net. It is most effective in darkness. The winter net is 5-6 m in length and is set across fractures in the ice. A special type of net, a square of about 2.5 m, is set beneath seal holes in the ice, hanging below the hole like a sack. The seal is able to come up the hole but gets stuck in the net when it tries to dive down again.

Seal traps are used on rivers where seals swim up the river following fish. The trap is a partially submerged mesh box with a trap door in the upper part which remains at the surface. When a seal hauls out on the box, it falls through the trap door into the trap.
Seals are also hunted using rifles and associated equipment to retrieve the seal. In the summer seals are shot from boats, floating ice, or hiding places on shore. In the spring and early summer seals are shot as they lie by their breathing holes. In the fall and winter seals are hunted from the ice edge or at open water leads. Some hunters also hunt seals at the breathing hole using traditional methods.

Bearded seals are large and very cautious animals and require specialised hunting methods. In the spring and summer bearded seals haul out on the ice and are hunted by carefully stalking the animal to within firing range. In the fall they haul out on the new ice edge and are hunted from boats. Open water hunting is difficult because the seals sink when killed. If they are killed outright they must be harpooned very quickly to ensure retrieval. If a bearded seal is shot and injured just before it submerges, the hunter waits at the spot where the seal went down. The seal tends to emerge at or near the same spot, at which point it is shot and harpooned.

John K. Boone, Alaska, USA
Mr Boone focussed on seal hunting in southeast Alaska, where 3 species are commonly taken: northern fur seals (*Callorhinus ursinus*), Steller sea lions (*Eumetopias jubatus*) and harbour seals (*Phoca vitulina*). In addition sea otters (*Enhydra lutris*) are hunted.

The methods used in seal hunting are always dependent on the prevailing environmental conditions. There is little sea ice in southeast Alaska, but icebergs from glaciers are common in some areas. Shorelines are typically steep and the water is deep in most areas. Therefore it is common practice to shoot animals while they are on shore, or to herd them into shallow water before shooting them. These practices minimise the number that are struck and lost. If animals sink to the bottom in shallow water they can be retrieved using a grappling hook. Another way of minimising struck and lost is to shoot the animal just as it takes a breath: its lungs are then full of air which causes it to float.

The local knowledge held by hunters enables them to locate seals on a seasonal basis. Seals commonly follow their sources of food; therefore knowledge of fish migrations is very helpful in finding seals.

Equipment used in seal hunting is similar to that used in other areas. All equipment must be able to withstand a salt-water environment and hard use. To this end equipment maintenance is also crucial. The .222 calibre with full metal jacket ammunition is the most commonly used for seal hunting. Larger calibres are sometimes used for long range shooting from fixed positions. The full metal jacket bullet does not fragment upon impact and does less damage to the hide and meat. A club is used to kill injured seals. A grappling hook and rope is necessary to retrieve seals that sink in shallow water. Sharp stainless steel knives are used for skinning and butchering.

Some studies have estimated high struck and lost rates for open water seal hunting, but this is very dependent on environmental conditions and the skill and experience of the hunters. To minimise struck and lost animals, hunters should concentrate on one species at a time, and focus their hunting approach on that species. Seals that sink when shot should be hunted in shallow water, where they can be retrieved, whenever possible. Equipment should be well maintained, and rifles should be sighted in regularly. Target practice is important even for experienced hunters, and it is especially critical to practice shooting from a boat.

Discussion

It was agreed that .222 and .223 calibre rifles using full metal jacket ammunition were excellent weapons for hunting smaller seals, as they gave good penetration and minimal damage to the skin and the meat. Soft point ammunition was acceptable for short and medium range shooting.

Mark Small, Canada, and additional information from Department of Fisheries and Oceans: Commercial harp seal (Phoca groenlandica) hunt

In Atlantic Canada, the typical professional sealer is an active fisherman who participates in the seal hunt for only a few weeks of the year. Both small vessels (<35 feet) and longliners (35-65 feet) participate in the hunt, but vessels larger than 65 feet participate as collector vessels only. The small vessels carry a crew of 2-5 sealers, operate close to shore, and usually land their catch daily. The larger vessels carry larger crews and may stay out for several days at a time.

There are presently over 15,000 licensed sealers in Atlantic Canada, of which over 9,000 are professional sealers. To become a professional sealer, a sealer must apprentice under a professional for two years. This ensures that the appropriate training and skills are passed on.

The hunt is strictly regulated and the Gulf and Front whelping areas have separate annual quotas. Weaned harp seal pups are most commonly taken. Very few hooded seals are taken because the hunting of bluebacks is prohibited in Canada. Harvests of harp seals over the past 9 years have averaged 256,000 animals. The hunt is profitable for participants and is not subsidised in any way.

The hakapik and club are the primary hunting tools used in the Gulf hunt, while rifles and shotguns are preferred at the Front, where ice conditions make it difficult to approach seals on foot. The exact specifications of the hakapik and club are specified by Canadian regulations (see Appendix 2, p. 92). These regulations also specify that hunters must crush the skull with the hakapik or club, and then manually check the skull, or administer a blinking reflex test, to confirm that it is dead before proceeding to strike another seal. In addition, no person may start to skin or bleed a seal until a blinking reflex test has been administered, and it confirms that the seal is dead.

About 95% of the seals taken at the front are shot with rifles. The vessels steam through the ice shooting seals, recovering them using a small skiff. Under Canadian law a rifle and bullets that are not full metal-jacketed that produce a muzzle velocity of not less than 1,800 feet per second and a muzzle energy of not less than 1,100 foot pounds must be used in the seal hunt. Shotguns of 20 gauge or greater, with rifled slugs, may also be used. The most commonly used rifles are of calibres .243, .223 and .222.

Most seals are killed instantly. Recent studies have shown that the struck and loss rates for young seals taken on the ice varied from 0-1.9%, and from 0-10% when taken in the water. Loss rates were higher for older seals, but these are rarely taken.

Mr Small believed that, for the seal hunt to be considered ethically acceptable, the existence of the species must not be threatened, no unnecessary pain or cruelty should be inflicted, the killing should serve an important use, and should involve a minimum of waste. In his view most present day sealing activities satisfied these criteria.

Glenn Williams, Canada: Arctic seal hunts

There are five species of seals in Nunavut that are hunted. Ringed seals are the most common, with a distribution that is year-round throughout Nunavut. This is the seal that is harvested the most, for its meat and skin by all communities in Nunavut (except Baker Lake). Bearded seals also have a year-round distribution throughout Nunavut. Although this seal is not harvested as much, it is very important for its meat, and the skin is used for the making of soles for kamiks and skin ropes. Harp seals migrate annually between the Arctic and sub-Arctic regions. This seal arrives in Nunavut in June and July, returning to the east coast of Canada in October and November as the sea ice forms in the northern parts of its range. Harp seals are only harvested occasionally in Nunavut as a source of feed for dogs. Their skins are used in the sewing of traditional clothing. Hooded seals (*Cystophora cristata*) migrate annually from offshore areas to the near shore in the late fall. Hunters only harvest this seal occasionally, but the numbers and frequency of hooded seals being caught is increasing in the past few years. Harbor seals are found in the very southern parts of Nunavut, at the northern limit of their range. This seal is only taken occasionally, but the meat and skins of the young seals are prized by hunters.

Seal hunting is subject to the terms of the Nunavut Land Claims Agreement, and is legislated under the Marine Mammal Regulations of the Fisheries Act. There are currently no restrictions on the seasons or numbers of seals that can be harvested by an Inuk in Nunavut. Seals are harvested year round in Nunavut, but the migratory seal species are only hunted during open water seasons. Seal harvesting during the ice-covered seasons is restricted to ringed seals and bearded seals. It is estimated that 30 000 ringed seals, 1000-2000 bearded seals, 1000-2000 harp seals and less than 200-300 harbour and hooded seals are harvested annually in Nunavut.

The majority of seals are shot from a boat in the water. Occasionally, seals are shot while out of the water on ice or rocks. The shooting of ringed, harp, harbour and hooded seals in the water is done with a .22 calibre rifle, with a shot to the head. The seal is then either hooked with a long handled *niksik* (gaff), or harpooned.

During the first few weeks of the open water hunt, the loss due to sinking is slightly higher than during the remainder of the open water season. Hunters report that this is due to the physical condition of the seals (blubber thickness) and the lower salinity of the water due to melting ice and snow

The harvesting method used for bearded seals in open water is similar to that used for walrus. It is shot in the body first, then harpooned with a float attached and then shot in the head.

Jakob Petersen, Greenland

The availability of seals and the methods and weaponry used in seal hunting varies regionally and seasonally in Greenland.

In northern Greenland (Avanersuaq), during the winter when there is sea ice (during the dark period) ringed seals and bearded seals are hunted by their breathing holes in the ice and also by using nets closer to the shore. The seal is shot using a calibre .30-06 rifle, then using the *Iimaq* (lance), designed for winter use, to ensure a swift kill. During the spring (April to June) when seals are up on the ice, they are hunted using shooting screens with .222, .243 and .30-06 calibre rifles. During the summer and early fall (July to September), harp seals appear in the Qaanaaq region. Hooded seals have become rare in the Avanersuaq and are sighted infrequently, since the range of the sea ice is decreasing and moving further north due to the warming of the climate.

In northern West Greenland, ringed seals are to be encountered year round. Young and adult harp seals appear around June, and are hunted until November - December. Bearded seals appear in during the summer and can be seen until the sea ice appears. During the summer, smaller boats as well as larger vessels (up to 30 feet) are used in hunting seals. During the winter time hunting is conducted by using dog sledge and only ringed seals are caught using nets. Magnum .22, Sako .22 and .30-06 calibre rifles are commonly used in the hunt.

In central Western Greenland, Harp seals appear in June. By early fall some disappear, but numerous seals are to be encountered even in late fall. They disappear around March – April while they are breeding on the sea ice. Hunters catch the harp seals using dinghies and smaller vessels and the catch is sold at local meat and fish markets. Fishermen in larger fishing boats also hunt the seals for subsistence, as do recreational hunters. Younger harp seals appear by the end of June and disappear during March-April and are hunted primarily by hunters in dinghies, using calibre .22 Magnum and .222 rifles.

Hunters in the Maniitsoq region have noted that the frequency of appearance of younger harp seals can vary a great deal depending on ice conditions. Another factor, which is believed to be the cause of a recent decrease in the numbers of young seals seen, is the Southern Canadian hunt for baby seals, which is believed to have an influence on the number of seals reaching Greenland.

Hooded seals appear in April and new-born seal pups of this species appear on the floe edge or in the drifting ice. In May their numbers decrease. Subsistence hunters using dinghies primarily hunt this seal using .222's up to .30-06's.

The fjords around Sisimiut are no longer covered with ice in the wintertime and as a consequence ringed seals rarely are encountered. In earlier years when the fjords were covered with ice, ringed seals could be encountered at the mouths of the fjords and were caught using nets. During the early spring in March – April as the sun grows stronger, numerous seals would be basking in the sun on top of the ice, and they were hunted by walking on the ice or using dog sled. Now they are hunted using dinghies or smaller vessels. Calibre .222 up to .30-06 rifles are used in the hunt.

In southern Greenland, ringed and harp seals are to be encountered year round. They are hunted throughout the year, except during their moulting period in May and June, using dinghies. Calibre .22 Magnum and .222 rifles are used for the hunt. Hooded seals frequent the area of Nanortalik from the beginning of April until the end of June and are primarily hunted by subsistence hunters from dinghies, using calibre .30-06 and .222 rifles.

In east Greenland, young and adult harp seals, hooded seals as well as bearded seals and ringed seals are encountered and hunted year-round. From January until April, ringed seals are caught from the sea ice using nets. From May until December the seals are hunted by means of vessels. The hunting equipment used depends on the size of the seal. For larger seals Sako .222 rifles are used and for smaller seals .22 Magnum rifles are used.

<u>Discussion</u>
Greenlandic hunters have noted a more frequent occurrence of seals with patchy hair or without hair in their catch. This is also seen occasionally in Atlantic and Arctic Canada. The reasons for this are not known, and further research is needed.

Bjørne Kvernmo, Norway: East and West Ice commercial hunt
Today Norwegian sealing for harp and hooded seals is much less active than it used to be. In the last few years, only about three or four vessels have participated, with two-three going to the West Ice and one going to the East Ice. These are ocean going fishing vessels that participate in other fisheries at other times of the year. Each vessel has a crew of 13 - 15, as well as an inspector appointed by the Norwegian authorities. Each ship takes 2,000 to 5,000 seals in a trip. In recent years the emphasis has been on taking hooded seal pups (bluebacks) as these have the most valuable pelts.

The vessels cruise through the ice fields, with gunners stationed at the bow shooting seals. Seals are shot at a range of 30 to 70 m. Under Norwegian regulations (Appendix 2), after being shot the seal must be struck with a club or hakapik, then bled. The seals are retrieved directly from the sealing vessel, or small boats are used. In slack ice conditions, shooting is sometimes conducted from small boats as well.

The minimum power of the rifles to be used for shooting adult seals and seal pups is restricted by Norwegian law (Appendix 2, p. 89). The most common rifle for shooting seal pups is the calibre .222, while the 6.5 mm calibre is used for shooting adult seals.

Expanding bullets (i.e. not full metal jacket) are used. Guns with 5 shot magazines are preferred. All shooters use rifles with telescopic sights, and the rifles are sighted in on a daily basis.

Sealers are required to take a one-day training course annually.

In general sealing in faraway waters is a complex and demanding operation that requires extensive planning and preparation. The weather is very unpredictable and harsh in the sealing areas. Safety considerations for the sealers and crew are very important.

Discussion
Norwegian hunters have found that the use of sound suppressors (silencers) on rifles enables them to take more adult seals from a patch, as the other seals don't become so alarmed at the sound of the shots.

Andreas Dunkley, Norway: Norwegian coastal seal hunt
The non-commercial hunt for coastal seals is concentrated on grey (*Halichoerus grypus*) and harbour seals, but ringed and harp seals are also sometimes taken.

Hunting is conducted from small boats so calm weather is necessary. Normally the shooter is set on land in an area where seals are known to be present. Seals are rarely shot from a boat. Ideally seals are shot when they are hauled out on land. If seals are shot in the water, this is done in areas of shallow water, so they can be retrieved if they sink. The shooting range is usually between 20 and 100 m.

The minimum size of rifles used in the hunt is restricted under Norwegian regulations (see Appendix 2, p. 91). The use of expanding bullets is mandatory. Expanding bullets tend to disintegrate when they hit the water, reducing danger from ricochet. Many hunters use a bipod when shooting. Some hunters use a silencer, which reduces recoil and muzzle flash, and is safer for the hunter. Other important hunting equipment includes binoculars, a rangefinder, a gaff, a hook and line to retrieve sunken seals, and an underwater viewing apparatus to find sunken seals.

The seal is usually shot in the head, resulting in a quick kill. Animals tend to float in the winter months but some sink even then: for this reason it is best to shoot seals only in shallow water and have the equipment necessary to retrieve them.

All hunters are required to take a shooting test before participating in the seal hunt.

Pétur Guðmundsson and Árni Snæbjörnsson, Iceland
Only the harbour seal and grey seal are hunted in Iceland. The harbour seal breeds in the spring from May to July with its maximum breeding activity in the end of May and beginning of June. On the south coast the common seal breeds on sand dunes up in the glacier rivers and on the bare sandy beach, but on the west and the north coast on very small rocky islands. The grey seal starts breeding in late September with its maximum activity in October/November and continues until February/March. Because of the

breeding time the harbour seal is called the spring seal in Iceland and the grey seal the autumn seal.

Seal hunting in Iceland is focussed almost entirely on seal pups, mainly for the skin; but the meat, the blubber (fat) and the flippers played an important role for human consumption in the past. Pups are taken when they are a few weeks old, just towards the end of lactation. Annual takes range from 200 – 400 harbour seal pups and somewhat fewer grey seal pups. Harvests have declined in recent years because of the low market price of the skins. For a very long time before 1980 the catch was 4000 – 6000 harbour seal pups and 500 - 1000 grey seal pups per year. Seal hunting has a long tradition that goes back to when the island was first colonised. It is still the case that a land owner has the right to the seals on his land; therefore virtually all seal hunting is carried out by farmers on their own land, or with the land owner's permission. Seal farmers in Iceland have established the Seal Farmers Society with a membership of 100.

In Iceland the hunting methods have developed according to different circumstances from farm to farm, being different in the glacial rivers of the south coast during the spring, compared to the methods used on the rocky islands on the NW-coast during the autumn. Hunters choose a suitable hunting method according to the circumstances.

Net hunting is the most common method for hunting the harbour seal pup. The hunting takes place in the spring. To maximise the success of the hunt, it is necessary to be quiet around the whelping areas; therefore shooting is an unsuitable method. The nets are placed close to the small rocky islands or across creeks and channels. The bottom part of each net is made as heavy as necessary to keep it as close to the bottom as possible, to prevent the pup from lifting the net to the surface for air. This minimises the time it takes for the seal to drown. Every pup entangled in the net is caught, none escape wounded, and none suffer pain from their wounds. In the glacier rivers on the south coast, nets are pulled upstream between the riverbanks to catch pups. Then the pups are landed and put to death using a seal club or a rifle of .22 calibre.

The grey seal pups are almost entirely caught in the whelping areas, using either a seal club or a rifle of .22 calibre from a very short distance. For hunting of adult grey seals a rifle of calibre .222-.243 is used.

All seal pups skins are utilised. Harbour seal pup skins are tanned for fur coats and jackets and some of them are sold dry for export. The grey seal pups skins are tanned for the leather industry, and this is a very strong leather material. Icelanders have for centuries utilised the seal products completely, i.e. the skin, the meat, the blubber and the flippers. The meat is used fresh, salted or smoked. The blubber was used as a source of light, animal fodder or for human consumption. The very old tradition of singeing and pickling the flippers still exists. After 1980 the popularity of the seal products declined, but in the last few years it is increasing again.

Bjarni Mikkelsen, Faroe Islands

Seal hunting may have had a long tradition in the Faroe Islands, in parallel with the tradition of utilising the whale resources around the islands. The hunt is fairly well described in historical records going back to the seventeenth century. Two seal species formerly bred in the islands and were hunted - the harbour seal and the grey seal. By the mid-eighteenth century the harbour seal became extinct, probably due to overexploitation. The grey seal hunt continued for another hundred years.

The main hunting season was during the breeding season when seals were on land. For harbour seals, this was May-June, on sandy shores and skerries in more sheltered areas. Grey seals were hunted during the whelping season in September-October, in caves and on rocky shores. The hunters approached the breeding sites by boat. In caves they sometimes had to use flares to illuminate the cave. Reaching shallow waters, the men jumped on land and equipped with wooden clubs they killed all adult seals present with a strike to the head. Afterward all pups were killed. Outside of the breeding season, a few seals were taken in special large mesh-sized seal nets put out in near-shore waters. Later, with the introduction of weapons, seals were also shot in shallow waters, mainly in the summer period.

With the termination of a four-year bounty hunt in 1967, reducing the grey seal stock significantly, and new weapons legislation in 1969, banning the possession and use of rifles as a hunting weapon, traditional seal hunting virtually ceased in the Faroe Islands.

Fish farms were introduced in the Faroes in the early 1980's. The farmers experienced problems with grey seals interacting with cages and disturbing the fish. They were given permission to possess rifles, with a minimum calibre of 6.5 mm, using hollow point bullets, and to shoot seals approaching the farm. The farmers shoot mainly from land, aiming at the head of the seal. A high portion, perhaps 70-90%, of grey seals killed in the water sink, even in the winter. The farmers have experienced problems with bullets ricocheting off the sea, posing a potential danger to people residing near the fish farms. Some farmers have started using shotguns and cartridges loaded with pellets to shoot the seals, which is illegal.

Farmers are not required to keep hunting logbooks or to retrieve the shot animals, even for scientific purposes. There is no longer any tradition to utilise seal meat and blubber or the fur in the Faroe Islands.

Åke Granstrøm: Sweden and Finland

Harbour, ringed and grey seals are found in Swedish and Finish Baltic waters. Of these only the grey and ringed seals are hunted at present. The grey and ringed seal populations are now recovering after commercial over-harvesting in the first half of the 20th century, and a period of low reproductive success apparently caused by pollutants. Seal hunting was stopped entirely in Sweden in 1975 and in Finland in 1982, and only recently restarted in 2001 and 1997 respectively. There is an increasing problem with interactions between seals and commercial fisheries in both countries.

Seal hunting is strictly regulated in both countries (see Appendix 2, pp. 92 - 93). The hunting season for grey seals lasts from 16 April to 31 December, while that for ringed seals in Finland is divided into 2 periods from 16 April to 31 May and from 1 September to 15 October. There are quotas for both species. Hunting is forbidden in seal reserves, which include all the major resting-places for seals in the Baltic. Hunting from boats is not permitted. The minimum power of rifles to be used for seal hunting is also specified in the regulations.

During the spring period seals are hunted on the ice. Grey seals are usually found near the edge of the ice pack. The seals lie right next to the water, so the shot must be instantly lethal so the seal will not be lost. Hence they are always shot in the head.

During the open water season, hunting usually takes place around islands and skerries frequented by seals. Once seals are spotted, the hunter is landed close enough to get a shot at the seal. If the seal is shot while it is in the water it must be retrieved very quickly or it will sink. Hence hunters usually operate in teams, with a boat ready to go out and retrieve the seal immediately after it is shot. Seals sink quickly in the Baltic because the salinity of the water is very low. Also the water is not very clear, which makes retrieval of sunken seals difficult. Therefore hunters prefer areas of shallow water where sunken seals can be retrieved more easily.

The struck and loss rate was relatively high (42%) in Sweden in 2001, the first year the hunt was resumed. However the situation has improved and the struck and loss rate was only 5% in 2003. The full quotas have not been taken in either country, but seal hunting is becoming more popular.

Discussion

It was noted that pollution has been a problem in the Baltic and that there is some evidence that it has affected the reproductive rates of seals in the past. However the situation has improved in recent years, and seal populations are generally increasing. Hunters utilise the meat but not the blubber of seals.

5. SUMMARY OF WORKSHOP

Glenn Williams summarised some of the presentations and discussions during the Workshop. He noted that seal and walrus hunting are conducted in widely differing environments and under variable regulatory regimes. The equipment used is often restricted by the regulatory framework but is also adapted to the local conditions. Hunters from different areas have much to learn from one another, and should be open to new ideas, equipment and techniques, and willing to change their hunting methods if better methods are available. Hunters from different areas need to cooperate with one another to preserve their way of life. Hunters should have reason to be proud of what they do, and this requires that they be well educated and use the best available equipment and techniques.

Glenn Williams noted the following themes had been raised in the discussions, and suggested that they should be integrated into the recommendations from the

Workshop:

- Hunters should aim for full utilisation of their catch;
- Hunters should acknowledge the importance of conservation and consider themselves as conservationists;
- Hunters do not agree that the results of some studies that show very high struck and loss rates for seal and walrus hunts can be applied to all hunts. Further research on struck and loss rates is required.
- Hunters need to find practical and effective measures to reduce struck and loss rates in some hunts;
- There is a need for more effective hunter training in some areas;
- There is a need for more research on the effectiveness of various rifles and bullet types for killing seals and walrus.

6. RECOMMENDATIONS

A Drafting Group composed of Glenn Williams, Mark Small, Niels Lange Nielsen, Siri K. Knudsen, Åke Granstrøm, Charles Brower, Daniel Pike and Grete Hovelsrud-Broda developed a set of draft recommendations based on the presentations and the discussions at the Workshop. These draft recommendations were then presented to the workshop participants and discussed one by one, revised if necessary, and adopted by consensus. These recommendations are for implementation by management authorities, hunters and researchers. In each case the hunts to which the recommendation most applies are identified.

Hunter training

The Workshop recognised the continuing importance of hunter training for the improvement of hunter safety, reducing unnecessary suffering to animals, minimising struck and lost animals, maximising utilisation of the harvest, and equipment selection, manufacture and maintenance. Hunter training should be a priority for all hunts.

- The Workshop recommended training for inexperienced hunters in particular and that such training should be a continuous process for all hunters in general.
- The Workshop recommended that information is provided to hunters on new and improved equipment that is presently available.

Struck and Lost Estimates

Workshop presentations and discussions demonstrated a lack of accurate and reliable estimates of "struck and lost" (S/L) for seal and walrus hunts. The Workshop recognised that reliable estimates of S/L are urgently required to allow better conservation and management and enable us to target hunts where S/L can be reduced. It was also recognised that reducing S/L benefits hunters because of potential higher catches, less unnecessary suffering to animals and a better public image. Struck and loss estimates are a priority for open water seal and walrus hunts.

- The Workshop recommended that studies of S/L should be done in cooperation between researchers and hunters.
- The Workshop recommended the methods, techniques and equipment to reduce

S/L should be developed and applied at the local level to ensure that these are appropriate to local conditions.

Minimise Animal Suffering

- The Workshop recommended that the hunters should make every effort to reduce unnecessary suffering by hunted animals, by minimising killing times and avoiding letting injured animals escape. Such efforts should have priority for all hunts.

Technical Innovation

The Workshop noted a lack of technical innovation in developing new equipment and hunting techniques to improve hunting efficiency and reduce "struck and lost".

- The Workshop recommended that development and research be undertaken in this area. Open water hunting for large seals and walrus was identified as a priority area.

Calibre and Bullets

The Workshop recognised that there is a need to establish minimum requirements for firearms and ammunition for seal and walrus hunts. It was further recognised that specific recommendations on selection of calibre and bullet types for different species and hunts are difficult to make because little information is available. These observations and recommendations apply to all hunts.

- The Workshop therefore recommended that objective studies on terminal ballistics of various calibre and bullet types in seal and walrus hunting are carried out.
- It was recommended that these studies be done in cooperation with the hunters.
- There is a need to consider what types of firearms and ammunition are presently available in remote communities and the Workshop urged the stores to make available the ammunition determined to be appropriate for the various hunts.

Full Utilisation

The Workshop agreed that the fullest possible utilisation benefits hunters because of more returns from the harvest, preservation of traditional skills and a better public image. This applies to all hunts. The Workshop recommended the following:

- That all hunting should occur within safe conservation limits.
- That all hunts should work towards the fullest possible utilisation of harvested animals.
- That new uses and markets for seal and walrus products should be pursued.

Hunter Safety

The Workshop recognised that the safety of the hunters should be a priority in all hunts.

- The Workshop recommended that the safety of the hunters must be considered in any regulatory measures or technical innovations to equipment and techniques.

- In particular the Workshop recommended special attention to: hearing loss due to noise and the need for ear protection, bullet ricochet endangering people and property and protective gear for extreme cold and harsh conditions.

WORKSHOP CLOSURE

The Chairman thanked the technical staff and all delegates for making the meeting a success. The Report from the workshop will be sent out to all attendants and presented to the Council of NAMMCO at their next meeting in March 2005. The Report will also be published in the NAMMCO Annual Report for 2004.

Appendix 1

PROGRAMME

TUESDAY 7 SEPTEMBER	
0800-	Registration at the North Atlantic House
0900-0930	OPENING SESSION Welcome by Jústines Olsen**,** Chair of the NAMMCO Committee on Hunting Methods Introductory remarks by Egil Ole Øen, Chair of the Workshop
0930-1100	SESSION I Physical features, biology and behaviour of seals and walrus. The anatomy and behaviour of significance for the choice of equipment and methods used in the hunt Presenters: Seals: Siri K. Knudsen, Norway Walrus: Joel Garlich-Miller, Alaska, USA Discussion
1030-1100	*Coffee break*
1100-1500	SESSION II Weapons and other hunting equipment: ballistics and effects **Presenters:** 1100-1130 Egil Ole Øen, Norway Siri K. Knudsen, Norway *Lunch* Pierre-Yves Daoust, Canada Discussion
1445- 1500	Alaska Native Harbour Seal Commission: John Boone, Alaska, USA *Coffee break*
1530-1800	VIDEO presentations of hunting activities from different regions
1800-	*Reception hosted by the Representations of the Faroe Islands and Greenland in Denmark in the North Atlantic House*
WEDNESDAY 8 SEPTEMBER	
0900-1800	SESSION III Descriptions of seal and walrus hunting
0900-1130	Walrus hunting Chukotka, Russian Federation: Vladilen Kavry Alaska, USA: Charles Brower/Charlie Johnson Canada: Glenn Williams
1030-1100	*Coffee break*
1100-1130	Greenland: Leif Fontaine Discussion
1130-1800	Seal hunting Chukotka, Russian Federation: Vladilen Kavry Chuktoka, Russian Federation: Rules and Regulations: Edward Zdor Alaska, USA: Other seals: John K. Boone
1230-1400	*Lunch* Canada: East Coast seal hunt: Mark Small

	Canada: Arctic seal hunts: Glenn Williams
	Greenland: Jakob Petersen
	Norway: East – and West Ice seal hunt: Bjørne Kvernmo
1530-1600	*Coffee break*
1600-1700	Norway: Coastal seal hunt: Andreas Dunkley
	Iceland: Pétur Guðmundsson and Árni Snæbjörnsson
	Faroe Islands: Bjarni Mikkelsen
	Sweden and Finland: Åke Granstrøm
1700-1800	Discussion and short summary of Workshop Sessions I, II, and III

THURSDAY 9 SEPTEMBER

0900-1030	SESSION IV Evaluation
	Comparison of methods and efficiency.
	Open forum discussion.
1030-1100	*Coffee break*
1100-1230	SESSION V Recommendations
	Workshop summary and recommendations
	Formulations of recommendations on best practice, minimum requirements, enhancements and technical innovations for weapons and ammunition.
1230-1300:	WORKSHOP CONCLUSIONS
	Chair and Co-chair will present their concluding remarks.
	The meeting adjourns.

Appendix 2

REGULATIONS GOVERNING SEAL AND WALRUS HUNTING

The following is a summary of regulations governing the hunting methods used for seals and walrus in several countries. Only regulations concerning hunting methods are included, not regulations concerning licensing, quotas, seasons, areas, etc. Some of the material was translated from Danish, Swedish and Norwegian by NAMMCO Staff and are not official translations.

FAROE ISLANDS

There is only one regulation governing the hunting of seals in the Faroe Islands. It is a part of the Animal Protection Regulations.

Parliamentary law No. 9 of March 9th 1985 on protection of animals, with amendments, latest from May 30th 1990.

§ 3. It is not allowed:
9.2 to shoot seals and other large sea animals with a shotgun.

GREENLAND

Regulations on the protection and hunting of walrus
Hunting methods and disposal of catch
§ 5. The minimum calibre of rifle to be used in hunting walrus is 7.62 mm (30.06), but rifles of calibre 5.64 mm (.222) can be used for killing harpooned or otherwise secured walrus.
Stk. 2. The use of explosives, harpoon cannons, shotguns and rifles (.22 Rimfire rifles) for walrus hunting is forbidden.
Stk. 3. Walrus that are shot and are in the water shall be harpooned before they are killed. The harpoon shall be secured to one or more floats so that hunting loss is avoided.

Seals
There are presently no regulations concerning hunting methods for seals.

ICELAND

There are presently no regulations that apply specifically to hunting methods for seals in Iceland. However, the 15. article of the law No 15/1994: "law on animal protection" (Lög um Dýravernd) deals with the hunting of all animals. : "*Hunting of animals shall be carried out in a procedure that causes the minimum pain to the animal. Hunters are obliged to do everything in their power to kill animals they have wounded.*

NORWAY

Regulations on seal hunting in the West Ice and East Ice (i.e. harp and hooded seals)

§ 1 Main rule for the hunt

Hunters must show the highest respect and use hunting methods that avoid unnecessary suffering for animals. Injured animals shall be killed as soon as possible.

§ 4 Requirements for weapons and ammunition

Only rifles shooting ammunition with expanding bullets and an impact energy of at least 2,700 joules (275 kilogram-meter) for 9 gram bullets and 2,200 joules (225 kilogram-meter) for 10 gram bullets at a distance of 100 meters shall be used for shooting adult seals.

Only rifles shooting ammunition with expanding bullets and an impact energy of at least 981 joule (100 kilogram-meter) at a distance of 100 meters shall be used for shooting seal pups.

A rifle and ammunition approved for adult seals shall at all times be available at shooting locations on board during seal hunting.

Hunting rifles must be inspected and approved by a gunsmith before sailing and sighted in with the ammunition that will be used during the hunt.

§ 5 Specifications for the hakapik and the club-hook

1. The hakapik shall have a wooden shaft made of birch that is from 110 to 150 cm in length and with a diameter of 3 to 5 cm. The hakapik shall have an iron shoe that weighs at least 400 grams and is furnished with a slightly bent tip from 12 to 18 cm in length. The butt end of the iron shoe can have a hammer that shall not be more than 4 cm long. The iron shoe shall be firmly attached to the shaft. The tip of the hakapik shall be kept sharp at all times.
2. The club hook shall be 50 cm long, ½ inch thick and weigh at least 1,000 grams, of which the welded weight attached to the hook shall weigh at least 250 grams.
3. The design and construction of the hakapik and club shall be in accordance with the Seal Hunt Committee's prescription of 4 November 1970 and the drawing from the same date.

§ 6 Hunting restrictions

1. It is forbidden to hunt:

a) seal species other than harp and hooded seals;

b) adult hooded seal females and adult harp seals in whelping patches;

c) seals that are in the water.

2. It is forbidden to shoot seals under conditions such that they cannot be struck with the hakapik or club and bled on the ice. Exceptions to this are during hunting of seal pups when the conditions in § 10 are filled, and during the shooting of individual seals from the ship (*plukkfangst*) when the conditions in § 7 fifth part are filled.

§ 7 Killing procedures
Killing shall proceed such that the animal does not suffer unnecessarily.

Adult animals shall be shot. Pups shall be shot or struck with the hakapik or club.

Animals that are shot shall be struck with the hakapik as soon as possible. For pups the club can also be used.

When using the hakapik or club the seal shall be struck on the skull. The seal shall first be struck with the tool's butt end or hammer so that the skull is crushed. After that the tool's tip shall be struck deep into the brain. With animals that are shot and lying still, it is sufficient to use the tool's point only.

Seals shall be bled on the ice immediately after the hakapik or club are used. During the shooting of individual seals from the ship (*plukkfangst*), bleeding can take place on board, if the animal is taken on board immediately and the conditions otherwise allow this.

Seals shall be bled by making a cut from the underside of the jaw to the end of the breast bone, then cutting the blood vessels to the foreflippers.

§ 8 Regulations for shooting seals from the ice and from a hunting boat.
Seals shot from the ice or from a hunting boat shall be struck with the hakapik and bled as soon as the ongoing hunt makes it possible.
During such hunting there shall at all times be at least one person assigned to each shooter to club and bleed animals that are shot.

§ 9 Fastening lines to seals
It is forbidden to fasten a line to animals on the ice before the animals have been struck with the hakapik or club and bled. An exception can be made for individual seals that are shot from the sealing vessel and that are obviously dead.

§ 10 Hooking of seals
It is forbidden to take seals that have not been bled on board using a hook.
Pups that are shot can be taken on board using a hook if they are undoubtedly dead and the ice conditions make it inadvisable to walk on the ice.

§ 11 Forbidden hunting methods
It is forbidden to
a) hunt or kill seals with the use of lines, nets or any form of trap
b) use a firearm with an unrifled barrel
c) use the hakapik on adult animals that have not been shot
d) use the club on adult animals
e) strike animals with the hakapik or club anywhere but on the skull
f) kill seals in artificial light.

§ 12 Use of airplanes

It is forbidden to use an aeroplane or helicopter for seal hunting. An aeroplane or helicopter can be used from land to scout the hunting areas.

§ 13 Exceptions from the regulations in emergency situations

The hunting regulations do not apply in cases where it is necessary

a) to kill animals that are injured

b) with respect to the safety of the hunters and the hunting vessel.

Regulations for the management of seals on the Norwegian coast

§ 10 Killing methods

Hunters must show the greatest respect and use humane killing methods to avoid unnecessary suffering for the animals.

The following apply to the killing of seals:

- Only rifles shooting ammunition with expanding bullets and an impact energy of at least 2,700 joules (275 kilogram-meter) for 9 gram bullets and 2,200 joules (225 kilogram-meter) for 10 gram bullets at a distance of 100 meters shall be used for shooting seals.
- It is forbidden to hunt or kill seals with the use of lines, nets or any form of trap. It is forbidden to use a firearm with an unrifled barrel or to use a hakapik or club-hook to kill seals.

CANADA

In Canada the management of marine mammals is a federal responsibility. Below are excerpts from the Marine Mammal Regulations of the Fisheries Act that concern hunting methods for seals and walrus.

Prohibitions

7. No person shall disturb a marine mammal except when fishing for marine mammals under the authority of these Regulations.

8. No person shall attempt to kill a marine mammal except in a manner that is designed to kill it quickly.

9. No person shall fish for a marine mammal without having on hand the equipment that is necessary to retrieve it.

10. (1) No person who kills or wounds a marine mammal shall

(*a*) fail to make a reasonable effort to retrieve it without delay; or

(*b*) subject to section 33.1, abandon or discard it.

(2) No person who kills a cetacean or walrus shall waste any edible part of it.

SOR/2003-103, s. 3.

Part III Walrus

25. No person shall fish for walrus with a firearm unless the person uses

(a) a rifle and bullets that are not full metal-jacketed that produce a muzzle energy of not less than 1,500 foot pounds; or

(b) a shotgun and rifled slugs that produce a muzzle energy of not less than 1,500 foot pounds.

Part IV Seals - Prohibitions

28.

(1) No person shall fish for seals, for personal or commercial use, in any of Sealing Areas 4 to 33 except with

(a) a round club made of hardwood that measures not less than 60 cm and not more than 1 m in length and that, for at least half of its length, beginning at one end, measures not less than 5 cm and not more than 7.6 cm in diameter;

(b) an instrument known as a hakapik, consisting of a metal ferrule that weighs at least 340 g with a slightly bent spike not more than 14 cm in length on one side of the ferrule and a blunt projection not more than 1.3 cm in length on the opposite side of the ferrule and that is attached to a wooden handle that measures not less than 105 cm and not more than 153 cm in length and not less than 3 cm and not more than 5.1 cm in diameter;

(c) a rifle and bullets that are not full metal-jacketed that produce a muzzle velocity of not less than 1,800 feet per second and a muzzle energy of not less than 1,100 foot pounds; or

(d) a shotgun of not less than 20 gauge and rifled slugs.

(2) Every person who strikes a seal with a club or hakapik shall strike the seal on the forehead until its skull has been crushed and shall manually check the skull, or administer a blinking reflex test, to confirm that the seal is dead before proceeding to strike another seal.

(3) If a firearm is used to fish for a seal, the person who shoots that seal or retrieves it shall administer a blinking reflex test as soon as possible after it is shot to confirm that it is dead.

(4) Every person who administers a blinking reflex test on a seal that elicits a blink shall immediately strike the seal with a club or hakapik on the forehead until its skull has been crushed, and the blinking reflex test confirms that the seal is dead. SOR/2003-103, s. 6.

29. No person shall start to skin or bleed a seal until a blinking reflex test has been administered, and it confirms that the seal is dead. SOR/2003-103, s. 7.

SWEDEN

Shooting places

The main rule is that the hunting must be done from shore. When the weather is calm (windspeed <3m/s or <6 knots), and there are no waves, the hunting may be done from the ice or from a boat that is anchored (*fast angjord*) in the ice.

Hunting from a shooting tower or other similar construction is permitted as long as the construction is permanently placed or built on the seafloor or a similar construction with a size and anchored in such a way such that the hunting takes place as if it was on shore.

These rules applied for the 2003 season and may be changed. You may find the relevant laws and regulations on the WebPages of the “Naturvårdsverkets”, “Länsstyrelsens” or “Jägareförbundet”.

Notification and samples
When a seal has been shot this must be reported to “Kustbevakningen” before 21:00 at the latest on the same day that the hunt took place.

For the hunter to keep the seal it is necessary to take and send in samples from different parts of the seal’s body.

“Naturvårdsverket” decides which samples are necessary on an annual basis.

Hunting equipment
In the seal hunt one is only allowed to use a rifle (Class 1 Swedish). This requires ammunition with bullet weight of at least 9 grams and impact energy at a distance of 100 meters from the target with at least 2700 joules (J). The Ammunition must be loaded with a bullet that expands when hitting the seal (leaded bullet, plastic or full metal jacket).

FINLAND

Hunting methods
The impact energy of the bullet from a rifled barrel used to hunt seals must, from a distance of 100 meter from the target, be at least 800 joules and the bullet must have a weight of at least 3.2 grams. A full metal jacket bullet is not allowed JF16§. A shotgun loaded with shotgun shells is not allowed. JF18§. Traps that capture living animals may be used in the seal hunt JF 11§.

All permanently settled persons in Finland have the right to hunt within the common (*allment*) water-areas of the sea JF7§. The police, border patrols, costumes and the inspectors from the different hunting associations (*jaktvårdsföreningarnas jaktövervakare*) shall within their respective areas of responsibility ensure that the law of the hunt is being respected JF88§.

A grey seal or a “vikare” caught dead in fishing equipment in the sea belongs to the owner of the fishing equipment JF83§.

Samples
Samples from hunted seals must be sent to the ”game and fisheries research” (*vilt och fiskeriforskningen*).

ALASKA

While there are no explicit regulations under the Marine Mammal Protection Act (MMPA) regarding methods and means for the subsistence hunting of marine mammals, the law does prohibit taking marine mammals in a "wasteful manner." *Wasteful manner* is defined in the Code of Federal Regulations as: “Any taking or method of taking which is likely to result in the killing or injuring of marine mammals beyond those needed for subsistence purposes or for the making of authentic native articles of handicrafts and clothing or which results in the waste of a substantial portion of the marine mammal and includes without limitation the employment of a method of taking which is not likely to assure the capture or killing of a marine mammal, or which is not immediately followed by a reasonable effort to retrieve the marine mammal."

This definition provides restrictions on subsistence hunters with respect to minimum salvage requirements as well as hunting methods. Hunters can/have been cited for violations of the MMPA when they do not meet minimum salvage requirements (for example salvaging just the heads or tusks), or when they fail to make a reasonable effort to retrieve animals (for example shooting into a group of walrus in the water). Because of the lack of explicit guidelines regarding what constitutes a "wasteful take", potential violations must be investigated on a case by case basis.

The MMPA is due for re-authorisation. Under the current law, the subsistence harvest of marine mammals can only be regulated when a population becomes depleted. Over the past few years, the U.S. Fish and Wildlife Service and other government agencies have been working with the Alaska Native community to develop proposed changes to the MMPA that would allow for the regulation of subsistence harvest of marine mammals prior to depletion. Under the proposal, Native organisations could initiate and develop their own harvest management regimes. Upon adoption by the managing Federal agency, assistance in implementing and enforcing management provisions would become available. The proposal provides new responsibilities and a meaningful role for the Native community in resource management.

RUSSIAN FEDERATION

Legislation of the Russian Federation on marine mammal harvest, submitted by the Association of Traditional Marine Mammal Hunters of Chukotka (ATMMHC)

Structure of the Russian legislation

I Federal legislation

1. Constitution – the basic law
2. Federal acts
3. Presidential decrees and governmental resolutions
4. Resolutions and instructions of the ministries and agencies
5. GOSTs (national standards) and regulations

II Regional legislation

1. The Okrug law
2. Resolutions and orders of the Government of the Chukotsky Autonomous Okrug

The Constitution on marine mammal harvest

Article 72 1) Protection of the traditional living habitat and of the traditional way of life of the small ethnic communities

The Wildlife Federal Act

- Chapter I. General provisions (pp.1-10)

- Chapter II. Governmental management in the sphere of protection and use of the wildlife species (pp.11-17)
- Chapter III. Protection of the wildlife species and their habitat (pp.18-29)
- Chapter IV. Right and social protection of the officials authorized to prosecute protection of the wildlife species and their habitat (pp. 30-32)
- Chapter V. Wildlife Use (pp.33-47)
- Chapter VI. The traditional methods of protection and use of the wildlife species (pp. 48-49)
- Chapter VII. The economic regulation of protection and use of the wildlife species (pp.50-54)
- Chapter VIII. Responsibility for violation of the legislation of the Russian Federation on protection and use of the wildlife (pp.55-59)
- Chapter IX. International conventions (p. 60)
- Chapter X. Promulgation of the present Federal Act (p. 61)

Decrees and resolutions of the RF Government

Decree # 1644-r of November 12, 2003, Moscow

To approve the enclosed Total Allowed Catches of the Aquatic Biological Resources for the year 2004 in the internal fresh waters, the internal marine waters, in the national waters, on the continental shelf and in the exclusive economic zone of the Russian Federation, in the Azov and the Caspian Seas and in the lower reaches of the rivers flowing into the seas as well as in the Amur River.

M.Kasianov. Prime Minister of the Russian Federation

Comment: The Total Allowed Catch Limits on white whales, killer whales, bottle-nosed dolphins, pilot whales, walruses, Caspian and bearded seals (in the Barents, the Kara and the White Seas) are designated for the subsistent needs of the small indigenous peoples of the North, Siberia and Far East of the Russian Federation, for scientific, cultural and educative purposes.

The normative acts of the Federal Government, ministries etc.

- Resolution of the Council of Ministers of the Russian Federation # 728 of July 26, 1993 “Amateur and Sport Hunting in the Russian Federation”
- Resolution of the Government of the Russian Federation # 1574 of December 27, 1996 “The Procedure of Issuance of the Long-Term Licenses for the Use of the Wildlife Species”
- Order of the Russian Federation Ministry of Natural Resources # 134 of July 14, 1993 “Protection and Regulation of the Wildlife Resources Use”
- Order of the Russian Federation Ministry of Agriculture # 569 of June 26, 2000 “Approval of the Provisions on the Order of Issuance of the Long-Term Licenses” (with alterations of March 29, 2001)

GOSTs (national standards) and regulations

- GOST 17.1.2.04-77 Environmental protection. Hydrosphere. Environmental indicators and the regulations on evaluation of the fishery water bodies
- The regulations on harvest of the marine plants and the water invertebrates in the USSR basins. Approved by the order of the USSR Ministry of Fisheries # 17 of January 17, 1966 (with alterations and addenda)
- The regulations on fishing in the internal basins of the Far East. Approved by the order of the USSR Ministry of Fisheries # 524 of November 24, 1980 (with alterations and addenda)
- Standard regulations of the amateur and the sport fishing. Approved by the order of the USSR Ministry of Fisheries # 187 of April 13, 1983 (with alterations and addenda)
- The regulations on fishery, protection and use of the living resources of the economic zone of the USSR in the Black Sea for the Soviet fishing organizations and the fishing vessels. Approved by the order of the USSR Ministry of Fisheries # 321 of June 18, 1986 (with alterations and addenda)
- The regulations on fishery, protection and use of the living resources of the economic zone of the USSR in the Baltic Sea for the Soviet fishing organizations and the fishing vessels. Approved by the order of the USSR Ministry of Fisheries # 322 of June 18, 1986 (with alterations and addenda)
- The regulations on protection and harvest of marine mammals. Approved by the order of the USSR Ministry of Fisheries # 349 of June 30, 1986 (with alterations and addenda)
- The regulations on fishery, protection and use of the living resources of the economic zone of the USSR in the Barents Sea for the Soviet fishing organizations and the fishing vessels. Approved by the order of the USSR Ministry of Fisheries # 356 of July 1, 1986 (with alterations and addenda)
- The regulations on fishery in the economic zone, the national waters and on the continental shelf of the USSR in the Pacific and the Arctic Oceans for the Soviet fishing vessels, organizations and citizens. Approved by the order of the USSR Ministry of Fisheries # 458 of November 17, 1989 (with alterations and addenda)
- The basin (regional) regulations on fishery in the fishery waters

The regulations on protection and harvest of marine mammals is the basic specialised document regulating the harvest. The structure of the document:

- The area covered by the regulations
- General provisions
- Protection, regulation and control over the stock condition
- Responsibilities of the catchers
- Limitations
- The fishing areas
- The Far East Catch Basin
- The Northern Catch Basin
- The Caspian Catch Basin

- The Baikal Catch Basin
- Responsibility for the violation of the regulations

The regional legislation as a basic assistance to the aboriginal marine mammal harvest

- The Chukotsky Autonomous Okrug Act on the Government Regulation of the Marine Mammal Harvest in the Chukotsky Autonomous Okrug.
- The Programme of Stabilization and Development of the Agroindustrial Sector of the Chukotsky Autonomous Okrug for the years 2003-2005.

Appendix 3

SCIENTIFIC PRESENTATIONS ON PHYSICAL FEATURES, BIOLOGY AND BEHAVIOUR OF SEALS AND WALRUS, AND WEAPONS AND OTHER HUNTING EQUIPMENT: BALLISTICS AND EFFECTS

- Seals: Dr Siri K. Knudsen
- Walrus: Joel Garlich-Miller
- Ballistics: Dr Egil Ole Øen
- Terminal ballistics: Dr Siri K. Knudsen
- Animal welfare and the Canadien Harp Seal Hunt: Dr Pierre-Yves Daoust

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BIOLOGY, BEHAVIOUR AND PHYSIOLOGY OF SIGNIFICANCE FOR METHODS AND EQUIPMENT USED IN SEAL HUNTING

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Section of Arctic Veterinary Medicine

World-wide there are 33 different species of seals. Seals in the broad sense are often referred to as "pinnipeds" which consists of three sub-families: (1) the Family *Odobenidae* that only contains the walrus; (2) the Family *Otariidae*, which consists of the seal lions and the fur seals. The 14 species in this family all have ears with a visible external ear flap and the otariids are therefore often referred to as "eared seals"; (3) the Family *Phocidae* contains 18 species. These are often referred to as true seals or "earless seals" because the outer opening of the ear possesses no flap visible on the surface.

In the following a more detailed description of the anatomy of important organs and organ systems in pinnipeds will be given as well as an overview of some specific behavioural features of seals that are of particular relevance for the hunt.

Anatomically, pinnipeds are built like any other mammal: their skeleton is comprised of the same bone parts and the internal organs are the same and have the same relative position in the body.

Skeletal and muscular system. Locomotion.

All pinnipeds have much shorter limbs compared to terrestrial mammals of the same size. Phocids and otariids swim differently, which is reflected by some anatomical differences. The otariids use their fore flippers when swimming, very much in the same manner as a penguin. Consequently, otariids have their main muscle mass around their shoulders and the neck is very massive. The hind flippers of otariids usually play no part in sustained swimming and simply trail behind. The phocids move quite differently. They swim with their hind flippers, looking more or less like a fish, with the fore flippers held quite passively against their body sides. Therefore, phocids have a less defined neck than otariids.

The aquatic adaptations of the limbs of pinnipeds have lead to their having limited mobility on land. Otariids are, however, more agile when ashore and can walk by moving their fore flippers alternately. The phocids, on the contrary, crawl on their bellies when they are on land, heaving themselves forward in a "humping" way. However, the phocids can travel much more economically on ice. This is important to take into consideration when seals that are lying near the ice edge are shot: If the animal is wounded, and not dead, it can move quite quickly into the sea.

Seals, as other diving mammals, have increased storage capacity of oxygen in their musculature, which means that muscular movement can persist long after the animal is dead. It may be observed as general muscular tremors in the flesh during skinning and slaughter. However, the movements can also be very violent and give the impression that the animal is still alive. In fact, movements mimmicking voluntary movements, including withdrawal of the head, back arching and gaping, may be observed in seals for a long time after their brains have been destroyed. This phenomenon, which is called reflex activity, is closely related to the central nervous system, and will be dealt with in some more detail under the nervous system.

The skeleton of all seals consists of the skull, the spinal vertebrae, four limbs and the ribs. They have the standard mammalian seven cervical vertebraes and 13 ribs, and all seals have the full complement of five fingers or toes in each limb.

The vertebral column, whose main tasks are to protect the spinal cord and assist locomotion, also reflects the different way of swimming between species. Otariids, that use the front end of their body, have strong and well-developed bone processes on the cervical and thoracical parts of the vertebrae. Phocids, which use their back part, have strong transverse bone process in the lumbar region of the vertebrae.

The skull of pinnipeds is characterised by a short snout and large orbits (the hole in the skull where the eyes are placed). During hunting, seals are usually either shot or culled in the head, with the brain being the main target. Consequently, for hunters this area is the most important. As in all other animals, the location of the brain in the skull is behind the eyes. The brain is enclosed and protected by the parts of the skull bones that are called *the cranium*, which in pinnipeds is large and rounded. The thickness of the cranium varies in different parts of the skull and this may inflict on both bullet ballistics and the effect of for instance the hakapik. It is generally thickest over the frontal and basal parts of the brain, where it may be several centimetres thick. It becomes thinner at the upper hind part and laterally. The thickness also varies to some extent among different species, but most importantly it varies between animals of different size. Generally large adults, especially males, have the thickest skull, and deep-diving seals tend to have somewhat thicker skull bones than shallow-diving ones. The skull of young pups has a softer structure and is more fragile than in adults.

Body wall

The integument of seals is comprised of the skin and blubber. The skin bears the hair follicles and is well supplied with blood vessels. The skin can be of considerable thickness, especially in adult males. Moulting, which is annual in adult seals, have significant influence on the animals behaviour. During this process, the blood supply to the skin has to be greatly increased and this inevitably means that heat losses are increased as well. Consequently, the animals spend more time out of the water at the moult.

The fur of seals plays little role in insulation. This is provided by the blubber. Its thickness depends on the age, size and nutritional status of the seal. Seals commonly may have in excess of 7-10cm of blubber on their bodies when well fed. It is not continuous over the whole body surface as it is lacking over the head and flippers. Consequently, blubber thickness is of lesser significance than skull bone thickness, when it comes to shooting or clubbing of seals. However, during the hunt the blubber thickness has significance with respect to how the animal will behave after it is dead. Well-fed animals will usually float when they are dead, while thinner animals most often will sink, in many cases within the course of a few seconds.

The nervous system

The nerve system of pinnipeds is built and functions in the same manner as in other mammals and it consists of a central part, which is the brain and spinal cord, and a peripheral part which is the nerves and nerve cells in the rest of the body. In seals, as in other animals, the nervous system is in principle built like a telecommunication network. The brain is the centre; the spinal cord is the main cable; the nerves out to the body acts like the distributing cables, and the periphery nerve cells act like the telephone with incoming and outgoing information.

The spinal cord is enclosed by the spinal vertebrae. The spinal cord of phocids is relatively shorter than that of otariids. The brain, which is enclosed in the cranium, is gross anatomically built similar to other mammalians. It has two large hemispheres (termed cerebrum), a cerebellum and the brain stem. The brain can be regarded as the true centre of the body responsible for survival, consciousness and the maintenance of physiological conditions. By consciousness we mean awareness of the world around and of the own body. Thus, someone who is unconscious will not perceive pain. Generally it can be said that during seal hunting the same applies as for other mammals: in order to render the animal instantaneously unconscious some specific brain areas have to be put out of function, which includes the cerebral cortex, deep central parts of the cerebrum and/or the brain stem, which contain the centres for consciousness and control units for respiration and heart activity.

It is the brain and spinal cord that are responsible for the reflexes and involuntary reactions in dead animals which I described earlier. Such movements are very commonly registered when animals are killed or slaughtered using physical methods. A reflex can be defined as a stereotyped response mediated by the nervous system. Most of such reflexes do not require cerebral coordination and thus they can be elicited in the insensible animal. The basis for this process is very complex and it would take too long to go into detail. Roughly it can be said, though, that reflex activity in an unconscious animal is a result of the spinal cord losing its chief commander, namely the brain. The brain acts in both inhibitory and facilitatory ways on the spinal cord. When the higher control centres have been put out of function, the spinal cord starts to “work on its one” resulting in uncontrolled movements of for instance the limbs.

The circulatory system

The major tasks of the heart and blood vessels are to transport oxygen rich blood from the lungs to all organs and tissues in the body - a job carried out by the arteries - and to remove carbon dioxide from these tissues and transport it through the veins to the lungs where it is breathed out. It is the heart, which really is only a muscle that is the motor in this system. It pumps blood through arterial blood vessels to the peripheral parts of the body. The blood is then returned to the right side of the heart via the veins and pumped by the right side of the heart into the lungs. The arterial part is a high-pressure system, while the venous system is a low-pressure system. The term “blood pressure” applies to the arterial blood pressure. It fluctuates with each heart beat (or pulse) between a maximum value when the heart contracts and a minimum value when the heart relaxes. Optimal regulation of the blood pressure is essential. Too low blood pressure results in shock and eventually death. Shock is a state of acute inadequacy of the blood supply to the vital organs, i.e. the brain and heart. During hunting irreversible shock may occur if the heart or major blood vessels are injured or massive bleeding occurs for instance in the lungs. After severe injury the blood pressure will drop almost immediately and the animal will be unconscious, not immediately, but very rapidly. This may, however, be time enough for an animal that for instance is lying near the ice edge to haul itself into the water and sink.

Physiologically, it is the circulatory system of seals that is most different compared to terrestrial animals. These adaptations are of course related to diving. One of the diving champions among pinnipeds, the Antarctic Weddell seal (*Eptonychotes weddelli*), can stay submerged for more than one hour and reach dephts beyond 600m. The basic problem facing air-breathing animals during submersion is the ever-decreasing arterial oxygen tension and an ever-increasing arterial carbon dioxide tension. The solution in pinnipeds to overcome this is to bring in as much oxygen as they can before diving, economise with from the very moment of submersion. Seals have impressive oxygen stores. In addition to the earlier mentioned adaptation of the musculature, also the oxygen carrying capacity of the blood is also increased and they have larger blood volume than their non-diving equivalents. However, the true prerequisite for prolonged submersion is another circulatory adjustment. During dives the heart beats considerably slower and the oxygen rich blood is portioned out to only a few high-priority tissues, i.e. the heart and brain, at the expense of others that are closed off to subsist on local oxygen stores.

The heart of pinnipeds is of normal mammalian construction, though it tends to be broader and flatter than the hearts of terrestrial mammals. It consists of four separate chambers (left/right fore-chamber and left/right ventricles). The left side is responsible of pumping oxygen rich blood out to the body and is therefore larger than the right side of the heart. Like in other mammals the heart is placed behind and below the shoulder blade, and takes up much of the space in the lower part of the thoracic cavity from about the third to the 5-6th rib. Also the heart musculature has higher oxygen storage capacity than in terrestrial mammals. This is important to be aware of for hunters, as the heart can carry on beating a long time after the animal is in fact dead. In the early 1970s experiments were carried out on seals in which the brain was first destroyed by a blow hook and the animals were thereafter bled. Heart activity was recorded for up to 45 minutes after. For comparison, the same procedure was applied on a domestic calf, in which heart activity was only recorded for 10 minutes after the animal was bled.

As most organs in marine mammals are similar to those of terrestrial mammals, their central blood supplies are also similar. The arterial system of pinnipeds is very much as in dogs. The aorta is the parent of all other arteries in the body except for the pulmonary ones. Just as the aorta leaves the heart it sends of branches that supply the heart itself with blood, the *coronary arteries*. Soon after it makes a U-turn, the so-called *aortic arch*, where one branch travels forward against the head and one travel backward in the thoracical cavity. Most pinnipeds have a distinct dilatation or enlargement of the aortic arch compared to terrestrial animals. The large branch that runs from the arch and up along the neck is paired into two branches. These run on both side of the trachea and higher up they are divided into several arteries that supply the head and brain with blood. In the aortic arch, a large branch is also given off that supplies the forelimbs as well as the cervical vertebra with blood. It is these arteries to the forelimbs that are cut when seals are bled by making incisions in their armpit. It is important also to notice that the cervical vertebral arteries supply the spinal cord and also the brain with blood.

The part of aorta that travels backwards from the aortic arch travels in the roof of the thoracic cavity along the vertebral column. It continues into the abdomen, where it gives off several paired and unpaired branches that supply the abdominal organs with oxygen-rich blood. The caudal part of the aorta splits into arteries that supply the hind-flippers with blood.

Most of the anatomical modifications of the circulatory system that have taken place in pinnipeds as part of the aquatic adaptation are found in the venous part of the circulation. These are present to ensure that the brain functions normally during dives, and they are more developed in phocids. Compared to a dog, they have an extra vein that lies along the frontal part of the spinal cord which ensures that oxygen-poor blood is transported away from the brain. Otherwise the venous system is quite similar to dogs. Veins from the head and forelimbs join into a large vessel, called the *vena cava cranialis*. The venous blood from the back part of the spinal cord travels to the heart via a separate vein. The veins from the rest of the body join into the large *vena cava caudalis*. All these veins enter the right part of the heart, which then pumps this blood to the lungs through the pulmonary arteries. In the lungs the carbon dioxide is diluted out from the blood and breathed out and oxygen is breathed in. The oxygen-rich blood is then transported to the left part of the heart which pumps it into the aorta.

The respiratory system

The respiratory system of seals is similar to other mammals, allthough the lungs tend to be relatively larger than in terrestrial mammals. The nostrils are closed when relaxed and the trachea divides into smaller branches, the bronchi, around the level of the first rib in otariids and much lower - immediately outside the lung - in phocids. The airways in pinnipeds, as in other diving animals, are reinforced to withstand the pressure when diving. The lungs fill up a major part of the thoracical cavity dorsally and laterally to the heart. The lungs receive and send off large blood vessels to the heart and the lung tissue contains many blood vessels. Therefore, lung injuries tend rapidly to be, all though not instantaneously, fatal in seals shot with high velocity projectiles in this area.

Contrary to what one might think, the lungs are not a major oxygen reserve during dives. The pinnipeds, and especially the expert divers, expire before submersion to avoid diver's disease (gas bubbles in the blood vessels). The deep divers therefore seldom utilise the lungs as a source of oxygen.

Abdominal organs
The thorax and abdomen are separated by the diaphragm, a thin muscular wall that is essential for respiration. It is traversed by the *aorta*, the *vena cava caudalis* and the *oesophagus*. Easy-to-find landmarks caudal to the diaphragm include a massive liver and the various components of the gastrointestinal tract. Marine mammal livers are generally not too different from those of other mammals. The liver has a rich blood supply and is located immediately caudal to the diaphragm. The kidneys typically lie against the musculature of the back.

Finally, I will give you a short overview on the seal species that are most topical for this workshop with special emphasis on important anatomical and behavioural differences. A hunter has to be able to differentiate between different species of seals. In many countries there are restrictions and regulations as to which species are allowed to be hunted. Several countries also have defined hunting seasons or areas for different species. Additionally, various seal species behave differently and there are also some anatomical variations, especially with respect to size, that are important to take into consideration when choosing hunting method and equipment. I would like to emphasise the importance of teaching species knowledge to new and inexperienced hunters that are about to start to hunt for seals, either from experienced hunters to youngsters or as part of official training programmes that are offered for new seal hunters in some countries.

Some facts about topical seal species. *(Most of this section is quoted from Bonner, 1994)*
Bearded seal. Large seals. The two genders almost the same size: ♂/♀: 2,5m, 300kg. Adults are greyish-brown, usually darker on the back. They spend the winter mostly in heavy offshore ice. Breeding takes place on the pack ice. Outside the breeding season the bearded seals are normally solitary.
Hooded seal. Large seals, the male noticeably larger than females: ♂: 2,5m, 400kg; ♀: 2m, 300kg. Adult hooded seals are pelagic, deep-diving predators. In the spring the hooded seals gather in loose aggregations on old, heavy ice floes to breed. The pups are born from mid-March to early April. Adults are silvery grey with black spots especially on the back and flanks. The adult male has a characteristic inflatable appendage on the nose, the hood, which is formed from an enlargement of the nasal

cavity. When inflated (especially when the animal is excited near another male) the nostrils are closed and the hood forms a vast sac about twice the size of a football. Besides the hood, males can extrude an extraordinary membranous balloon from one nostril (usually the left). When the balloon is inflated, the seal can make a loud "pinging" noise by shaking it violently from side to side. This aggressive play is performed by the bulls to establish dominance and impress the females.

Grey seal. Relatively large seal. ♂: 2m, 300-400kg, ♀: 1,8m, 200kg. Besides the difference in size between the two genders, there are differences in shape too. The shoulders of the adult bulls are very massive and the skin in this region and over the chest is thrown into heavily scarred folds and wrinkles. The female has the usual streamlined profile. The snout of the adult male is elongated with a convex outline giving it an appearance like a horse head. The body colour of the adults may vary from entirely black to almost creamy-white. Pups are born in a silky white fur which is moulted by the end of the lactation period, which lasts about 15-20 days. Pupping sites are usually on isolated skerries or uninhabited islands. In Canada, and also in the Baltic, spring-breeding seals may give birth on sea ice as well.

Harbour seals. Medium sized. ♂: 1,5m, 100kg; ♀:1,2m, 70kg. The colour pattern of is very variable, but usually they are darker on the back and lighter below, with a mottle of dark spots on the silvery or creamy-grey belly and flanks. On the back the dark spots coalesce to produce a dark reticulation. Pups are usually born in the adult-pattern coat, but occasionally they can have a natal white coat (but this is usually shed in the uterus before birth). Harbour seals give birth on rocks or sandbanks.

Spotted seal. Relatively small seal. ♂: 1,7m, 100kg; ♀: 1,5m, 80kg. A seal of the pack-ice. The coat has a background of silvery grey, which weathers to a brownish-yellow, peppered with black spots which may coalesce on the back to produce a black mantle. The pups are born in a greyish-white natal coat which is moulted to reveal the adult pelage. Pups are born on the ice floes in late March and April. Spotted seal usually remain over the continental shelf and they are not deep divers, feeding in relatively shallow waters. During summer and autumn, the seals move to the coast and concentrate near rivers where salmon are assembling before spawning.

Harp seal (Medium sized. ♂/♀: 1,7m, 130kg). The harp seals have a very distinct body colour pattern. The adult males are light silvery grey over most of their bodies, but there is a black mask to the face and a black patch over the shoulders, which extends down and backwards over the flanks (harp-shaped or horse-shoe like). In the female, the dark markings are paler and tend to be more broken up. Juveniles are grey with black spots and mottlings. Pups are born in a dense white natal coat. Although there are some variations in timing, the Harp seals generally move southwards before the freezing pack ice. After winter feeding, the females assemble on the ice in the traditional whelping areas. The whelping time varies between mid-February to April. After weaning and mating, the adult seals assemble on ice to the north of the whelping patches to moult. After moulting, the seals follow the melting ice edge northwards to their summer feeding grounds. The pups follow the adults after they are finished moulting. By September, the seals begin a new cycle and move southwards again.

Ribbon seal. Medium sized seal. ♂/♀: 1,6m, 95kg. The adult male is a dark chocolate brown with broad white bands around the neck, the hindquarters and the insertion of each fore flipper. As in the Harp seal the females are paler and the markings are less distinct. Pups are born on relatively heavy ice floes from April to early May in a white natal coat and after moulting they become blue-grey on their backs and silvery beneath.

Ringed seal. Small seal. ♂: 1,5m, 80kg; ♀: 1,3m, 60kg. The coat has a light grey background spotted with black. The spots are often surrounded with lighter ring markings. The belly may be free of spots. Most Ringed seal pups are born in a silky white natal coat. The Ringed seal is an ice-breeding seal and most pregnant females make a snow lair in the fast ice. Having excavated a lair, an access hole is kept open through the ice to the water beneath. The pups are usually born in early April.

Northern fur seal. Males are much larger, as in most other otariids. ♂: 2m from nose to tail, 250 kg; females: 1,2m and 40 kg. Brown in colour. Often called “the bear-like animal”. Breed on land.

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WALRUS BIOLOGY AND BEHAVIOR

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Species Description and Distribution

Although there were once many walrus-like creatures that roamed our prehistoric oceans, today the walrus family *Odobenidae* is represented by a single modern species

Odobenus rosmarus. Two sub-species of walrus are generally recognised: the Atlantic walrus (*O. r. rosmarus*) and the Pacific walrus (*O. r. divergens*). These two sub-species occur in geographically isolated populations and have evolved into slightly different forms. Pacific walrus are somewhat larger in body size and skull dimensions than Atlantic walrus and have proportionally larger tusks.

Walruses have a discontinuous, although nearly circumpolar distribution around the perimeter of the Arctic Ocean and the contiguous sub-arctic seas. Their distribution appears to be constrained by water depth and by severe ice conditions. Although they are capable of diving to deeper depths, walruses for the most part are found in waters of 100 meters or less, probably because of the higher productivity of their benthic foods in shallower waters.

Atlantic walrus ranges from the central Canadian Arctic, eastward to the Kara Sea. Several more or less discrete stocks of Atlantic walruses are recognised in Canada, Greenland, Norway and Russia. The Pacific subspecies is represented by a single stock of animals that inhabits the continental shelf waters of the Bering and Chukchi seas.

Habitat

Walruses generally haul out on ice in preference to land. Floating pack ice serves as a substrate for resting and giving birth. Walruses generally require ice thickness of 60 cm or more to support their body weight. Although walruses can break through ice up to 20 cm thick, they usually occupy areas with natural openings such as leads and polynas and are not found in areas of extensive, unbroken ice. Thus, their concentrations in winter are in areas of divergent ice flow or along the margins of persistent polynas.

When suitable pack ice is not available, walruses will haul out on land. Isolated sites such as islands, points and headlands are most frequently occupied. Walruses tend to choose traditional haulout locations and exhibit some degree of fidelity to these sites. Isolation and protection from strong winds and surf seem to be common features of traditional haulout locations. Social factors, learned behaviour, and proximity to their prey base probably also influence the location of preferred haulout sites.

Growth and Body Size

Walrus are large, sexually dimorphic pinnipeds. Adult males are approximately 20 % longer and 50% heavier than females. Males also tend to have more massive skulls and tusks.

At birth, calves of both sexes weigh approximately 50-60 kg. Walrus calves are capable of entering the water shortly after birth, but tend to haulout frequently, until their swimming ability and blubber layer are well developed.

After the first few years of life, the growth rate of female walruses declines rapidly, and they reach a maximum body size by approximately 10 years of age. Adult females can reach lengths of up to 3 meters and weigh up to 1,100 kg. Male walrus tend to grow faster and for a longer period of time than females. They usually do not reach a full adult body size until they are 15-16 years of age. Adult males can reach lengths of 3.5 meters and can weigh more than 2,000 kg.

Reproduction

Walruses are long-lived animals with very low rates of reproduction. Although some females reach sexual maturity at 4-5 years of age, they usually do not reach their full reproductive potential until they are nine or ten years old. Male walruses tend to become fertile at 5-7 years of age; however it is unlikely that they are able to successfully compete for mates until they reach full physical maturity.

The walrus has the lowest reproductive rate of any seal species. Pregnancy lasts through the next breeding season, lowering the minimum interval between successful births to two years. In compensation for their low reproductive rate, walrus enjoy relatively low rates of natural mortality. Walrus calves accompany their mother from birth and are usually not weaned for two years or more. The prolonged period of care allows walrus calves to achieve an advanced developmental state prior to weaning, which ultimately leaves them well equipped to forage and escape predators.

Food

Walruses are highly specialised benthic feeders. Bivalve mollusks (clams) are their most common food, however other invertebrates such sea cucumbers, crabs, and segmented worms are also frequently found in their stomachs. Although captive walrus appear to do quite well on a diet of oily fish, in the wild, walruses rarely eat fish. Native hunters frequently report incidences of walruses preying on seals and seabirds. The significance of seals and birds in the diet of walruses is poorly understood, but may vary with location and population status.

Anatomical Characteristics

Walrus have evolved many specialised adaptations for exploiting benthic foods in an ice covered habitat.

The shape and size of the skull is quite different from other seals. The skull is large and blocky, nearly rectangular in shape. The front of the skull is greatly enlarged to accommodate the massive tusks. Males, which have relatively larger tusks than females also tend to have much broader skulls. The walrus skull has a large mastoid process for the attachment of powerful neck muscles necessary for hauling a massive body out of the water. There are no super-orbital processes which leave the dorsally situated eyes vulnerable to injury – hunters frequently report walrus with missing or damaged eyes. The lower jaw is also massive. It houses a large and powerful tongue capable of generating enormous suction. The size and weight of the skull and tusks are undoubtedly helpful in maintaining an inverted position while foraging on the ocean bottom. Their mass also contributes to a general lack of buoyancy; most walrus killed in the water sink to the bottom. In comparison with the well-armoured features of its face and jaw, the walls of the cranium are relatively thin. The cranium is the usual target of hunters seeking to kill a walrus instantly.

Walrus skin is extremely thick and tough. Many hunting communities in Alaska and Chukotka still use walrus skin to cover their wood framed boats. Skin thickness increases with age, reaching up to 3 cm in adults. On the neck and shoulders of adult males, the skin is much thicker and is frequently raised up into bosses up to 8 cm.

Walruses have a dense vascularized layer of blubber directly below the skin. Blubber serves as an efficient insulation layer in the cold marine environment, and plays an important role in energy storage. Blubber is a dynamic tissue and its thickness can vary greatly depending upon the nutritional state and life history stage of the animal. Hunters report that males tend to be fattest during the early winter months prior to the breeding season, while females tend to maximise their blubber reserves while pregnant as they approach full term.

Walrus have many of the typical circulatory adaptations characteristic of diving mammals. They have an enormous blood volume; up to 2-3 times larger than a terrestrial animal of comparable size. The walrus heart is large, broad and flat. The heart of an adult male walrus can weigh more than 4 kg. The ascending *aorta* is greatly enlarged forming an elastic aortic-bulb that helps maintain blood flow between heartbeats while diving. There is a large extra-dural vein within the vertebral canal above the spinal cord which receives blood from the brain, back and pelvis. Walruses also have a large venous sinus in the liver that can hold up to 1/5th the total blood volume during a dive.

Sensory Systems
Walrus sensory systems are adapted for foraging on the ocean floor.

In comparison with other seals, the visual acuity of walruses is not particularly well developed. Their eyes are located towards the top of the head, at a dorso-lateral angle, resulting in poor peripheral vision. Because of their broad skull and snout, walruses also have a blind spot directly in front of their face. Their vision appears to be better suited to benthic foraging: they lack a dorsal arch over their orbital cavity, allowing them to look upward and forward as they forage along the ocean bottom. Their retinal anatomy suggests colour vision, and aboriginal hunters report that walruses are often wary of bold bright colours.

Walrus frequently feed at night and in turbid murky water, suggesting that the tactile sensitivity of their whiskers may be more important than vision in locating food items. Walruses have approximately 450 whiskers served by well-developed sensory and motor nerves. While most seals use their whiskers to detect vibrations in the water, walrus whiskers are more adapted to locate and manipulate prey items in front of their face. Research on captive animals has shown that walruses are capable of distinguishing between different shaped items less than .5 cm in size. The long lateral whiskers are apparently used to locate prey items while the shorter ones in the middle of the snout are used to assess finer details.

Walruses appear to have a fairly well developed sense of smell. They are often observed sniffing each other, suggesting that scent may be important in identifying individuals. Hunters also report that walrus frequently react to the smell of fire or exhaust.

Walrus lack external ear flaps, and have a limited capacity to locate sources of airborne sounds. When diving, walrus close their auditory canals and sound is conducted via the vascular lining of the ear tube. The upper frequency of limit for underwater hearing is approximately 16 kHz.

Behavioural Characteristics

During migrations, walrus can travel several hundred kilometres in a matter of days. When travelling, walrus usually make a series of shallow short dives, usually 1-2 minutes in duration.

Telemetry studies have shown that while foraging, walrus dive to the bottom nearly continuously. Foraging bouts can last for several days. Most foraging dives to the bottom last between 5-10 minutes, with a relatively short (1-2 minute) surface interval.

Walruses are highly specialised predators of clams and other benthic invertebrates. They use their sensitive whiskers to locate prey items in the sediments of the sea floor. With head down and whiskers in contact with the bottom, the walrus proceeds forward, propelling itself by sculling with the hind flippers. They use their fore-flippers, nose, jets of water and suction to dislodge their prey from the sediments. Prey are manipulated by the lips and grasped with the aid of roughly textured gums. The soft parts of molluscs are removed from the shells by suction and the shells are then ejected. Invertebrates without shells are usually swallowed whole without chewing.

Direct observations of walrus foraging indicate that walrus can locate and consume up to 60 clams during each dive to the bottom. The aerobic dive limit for walruses has been estimated at approximately 10 minutes, although they have been known to dive for more than 25 minutes. That maximum depth recorded for a diving walrus was 113m.

Walrus swim in a manner comparable to phocid seals. They use their hind flippers to propel themselves while the fore-flippers are used primarily as rudders to change direction. Their normal cruising speed is approximately 7-10 km/hr, but they can exhibit short bursts of speed up to 35 km/hr.

Social Behaviour

Walrus are extremely social and gregarious animals. They tend to travel in groups and haulout onto ice or land in groups. On land or ice, in any season walrus tend to lie in close physical contact with each other. Youngsters often lie on top of the adults. The size of the hauled out groups can range from a few animals, up to several thousand individuals. When disturbed, stampedes of walrus off a haulout may cause injuries and mortalities. The risk of stampede related injuries increases with the number of animals hauled out. Calves and young animals at the perimeter of these herds are particularly vulnerable to trampling injuries.

The mother-calf bond is extremely strong. A mother walrus is very solicitous and protective of her newborn calf, and watches over it and protects it with vigour. The calf normally remains in her charge for at least 2 yrs, sometimes longer if not supplanted by a new calf.

After separation from their mother, young females tend to remain with groups of adult females, while young males gradually separate from the females and begin to associate with groups of other young males and older bulls. Individual social status appears to be based on a combination of body size, tusk size, and aggressiveness. Individual animals do not necessarily associate with the same group of animals and must continually reaffirm their social status in each new aggregation.

Breeding occurs primarily during the winter, in polynas or other areas of broken ice. Potent males follow herds of females and take up positions when they haul out on ice. Adult males compete for choice areas near the females, and perform elaborate visual and acoustical displays in the water. Sub-dominant males remain on the periphery of these aggregations and apparently do not display. Individual females leave the resting herd to join a courting male in the water where copulation occurs.

There are many anecdotal accounts of walruses attacking hunting boats, or marauding polar bear and killer whales with their tusks. In most cases these relate to wounded animals or females protecting their young. When threatened, walrus frequently form groups in the water and attempt to intimidate the perceived threat by huffing; barking and displaying their tusks.

Hunting Methods

Before the introduction of whaleboats and rifles, walrus were hunted by harpoon and lance. Walrus were stalked at land haulouts or along the flow edge; or by approaching them in kayaks while they hauled out onto ice pans. The large size of the walrus and the logistics associated with butchering and transporting the meat made it necessary for several hunters to work co-operatively. Variations of these traditional hunting practices are still utilised by aboriginal hunters around the Arctic.

The introduction of motorised boats and firearms revolutionised walrus hunting making it far less dangerous and far more productive. Modern hunters usually prefer to target walruses hauled out onto large flat ice pans since they can be easily approached, killed and butchered. Typically walrus herds are approached slowly from down-wind to avoid detection by sound or smell. Resting walrus can often be approached to a very close range if care is taken. When multiple animals within a herd are targeted, hunters normally begin shooting at the same time.

The central nervous system (brain) is normally targeted with the objective of killing the animal outright, on the ice, in place for butchering. Animals are usually killed using high-powered rifles. Some hunters prefer full metal-jacketed bullets for maximum penetration of defensive bones.

There is considerably more work and risk involved in taking animals in the water. A walrus in the water must first be wounded, usually by several shots to the body when it surfaces for air. The lungs and spinal cord are frequently targeted. Injured animals must then be harpooned before a killing shot is made because they generally sink upon death. Care must be taken approaching a wounded walrus in the water; they can be dangerous and have been known to attack and damage boats.

Harvest Trends and Conservation Issues

There have been tremendous advancements in walrus hunting technology in recent years. Powerful long-range boats and global positioning technology have opened up much of the sea-ice habitat occupied by walruses to hunting. Although evolutions in hunting practices have greatly enhanced the ability of hunters to catch walruses, they also raise the potential danger of over-exploitation.

Because walrus have such low rates of recruitment, walrus populations have only a limited capacity to absorb hunting pressure, or to recover from depletions. In addition to hunting practices and means, hunters and resource managers also need to be concerned that hunting practices and patterns remain sustainable.

The use of firearms in walrus hunting has made it easier to kill walruses quickly and humanely from greater distances, but has also lead to a large increase in the proportion of animals killed but not retrieved. Accounts of struck and loss rates for modern walrus hunting practices range from less than 10 percent to more than 50%. Reducing the proportion of animals struck and lost is probably the easiest way to reduce the overall hunting mortality affecting walrus populations.

Because walrus usually sink upon death, some level of hunting loss is unavoidable; however, loss rates can be minimised through appropriate target selection and by utilising suitable hunting practices and gear.

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BALLISTICS

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Ballistics

Ballistics is the science of the motion; the propulsion and the impact of a projectile. Although closely interrelated, ballistics is commonly divided in three branches:

a) *Internal ballistics* ("interior ballistics"): events taking place within the gun
b) *External ballistics* ("exterior ballistics"): the flight of the projectile
c) *Terminal ballistics* ("target ballistics"): the projectile behaviour at target.

Calibre

When speaking about ballistics, one cannot avoid speaking about the calibre, which has great impact on all the three categories of ballistics. The term calibre is used to designate the diameter of the slug or weapon bore. It is measured in millimetres or thousands of an inch.

There is no single designation or international standard to express the calibre concept. It is rather a "jungle" of concepts to walk into. Europeans manufacturers use the metric terminology like 7,62 mm, while US manufactured ammunition of the same size is commonly measured in fractions of an inch like .30 inch. But some US manufacturers also use the metric terminology, but they are not using the decimal comma as in Europe (7,62), but a decimal point (7.62) to qualify calibre numbers.

For cartridges (shells) corresponding to the 7,62 or .30 calibre rifles the cartridges' designations are commonly shown to comprise two figures: the first refers to the calibre and the second to the year of the introduction of the original powder charge. For example, a cartridge designated .30-06 means a .30 calibre bullet introduced in the year of 1906. But that calibre is exactly the same as the European calibre designation with the metric system where the figures are 7,62 x 63, where the first figure refers to the calibre in millimetre and the second to cartridge length in millimetre. The US calibre designation of .308 Win is corresponding to the European 7,62 x 51 (mm) or 7,62 NATO. Another common and popular European ammunition is the 6,5 x 55 (mm) (Swedish Mauser), which is practically the same as the calibre designation .257.

In the US system the second number can also designate the propellant load, the number of grains of gunpowder, in the cartridge as in the calibre designations .30-30 and .30-40. Occasionally, the second number will indicate the muzzle velocity of the projectile. Some of the calibre designations can also include the name of the manufacturer or person who developed the cartridge like .30 Remington, .30-30 Winchester, .30-40 Krag, .30-06 Springfield, .300 H&H Magnum, .300 Savage, .300 Weatherby Magnum, .308 Norma Magnum, .308 Winchester, .270 Win.

The weight of a bullet is designated in grams (g) or grains (gr) (0,0648 grams). Hunting bullets may range in weight from about 3,2– 32,5 g (50 to 500 gr).

Internal ballistics
Internal ballistics ("interior ballistics") covers the events that take place within the gun from the moment the primer ignites to the moment the bullet leaves the barrel. This is a complex system that involves the case and the primer characteristics; the propellant characteristics, its quantity and burning rate; bullet characteristics like size, shape, weight, and its seating in the case, *etc*.; barrel characteristics like bore friction, barrel twist and length, *etc.*

A *cartridge* (shell) is composed of four basic components: *primer*, *case*, *powder* and *bullet*. When struck, the primer at the cartridge base provides the "spark" that ignites the powder charge (propellant). When powder ignites it releases heat and gases resulting in the propulsion of the bullet that leaves the cartridge and will be pushed down the barrel of the firearm at high speed. The barrel grooves (rifles) impart rotation or spin along the bullet's longitudinal axis to stabilise it in its flight.

Modern *propellants* (powders) are solid chemical compounds that, when confined in a cartridge case, burn at a rapid but predictable rate, producing heat and gases that builds up an internal pressure in the cartridge and barrel of several thousands atmospheres. There are over 100 different component powders available. They are highly specialised and often classified after their morphology, or shape, which can be flakes, sheets, cylindrical sticks and balls.

Modern powders (smokeless powders) are *nitro-cellulose-based* propellants. They are classified as flammable solids. These propellants burn at a very rapid rate, although the shooter hears a single loud explosion. The release of energy through burning is called *deflagration*. The rate of energy release is the *burning rate* of the propellant. They can be classified as *fast-burning* and *slow-burning* powders. When nitro-cellulose is used alone, the propellant is referred to as "single-base". When mixed with *nitro-glycerine*, the energy increases and those with a mixing of nitro-cellulose and nitro-glycerine is called "double-base".

Burning rate and energy caused by the powder deflagration are influenced by temperature and consequently it also influences the velocity, range and performance of the projectile. Propellant loads that are made for safe and effective use at 0°C (32°F) may prove excessive if fired at 30°C (100°F). Likewise a load developed at 30°C will likely show a velocity loss of 5-10% when fired at 0°C.

Black powder is now rarely used for hunting purposes except in some types of whaling activities. Black powder was for centuries the only available ballistic propellant and with few, but important modifications it has remained almost unchanged since it was developed. It has its disadvantages. It is a slow burning powder where less than half of the powder converts to gas and the remaining solid residues create the thick white smoke along with heavy barrel fouling that will produce rust if not eliminated by hot water washing. The only way to increase velocity when using black powder is to increase the charge weight, which limits its use in firearms using cartridges. Black powder is also very sensitive to friction and electricity. Several accidents have occurred during production and the use of black powder and it is now classified as explosive and storage and sale is entirely banned in some communities. The black powder is therefore replaced with the much safer substitute – Pyrodex - where possible.

The projectile, *bullet,* is intended to efficiently deliver ballistic performance to the target. The choice of bullet depends on the rifle, the cartridge, the target and presumptive shooting range. A small game hunter requires different ballistic performance than a walrus and moose hunter. Shooting at long ranges of several hundred meters (yards) requires different ballistic performance than the shooting at short ranges. With such wide variety of bullet types and forms for the different hunts, the hunters might wonder which bullets to choose for the particular hunt. However, without going into details, for the hunting of terrestrial games and seals, some type of expanding bullets will be preferred. But, for hunting and euthanasia of some species of whales and some African games, solids or full-jacketed bullets are preferred.

External ballistics

External ballistics ("exterior ballistics") is the science of the flight of a bullet or a missile of any kind between the barrel muzzle and the target. External ballistic studies and predicts the projectile's *trajectory* or *path* relative to some frame of reference. It is used to set up firing tables, which information includes the bullet path (the vertical distance that the projectile rises or falls relative to the line of sight), its remaining velocity at any distance, and the time of flight at different ranges. By knowing the full trajectory of the bullet, the shooter can predict where the bullet will strike and decide how to "zero" the firearm for best results. By knowing the remaining velocity (and energy) of a known projectile at any point along its path, the shooter can estimate its energy and thus its effectiveness at any distance.

Velocity is the speed of the bullet. Distance measured in meters and time in seconds, results in velocity in meters per second (m/s) or using feet; feet per second (ft/sec). The formula for calculating velocity is:

Velocity (v) = distance (s)/time (t), $v=s/t$.

The velocity affect the bullet's flight (external ballistics) and degree of penetration, expansion and deformation in the target (terminal ballistics). Many factors may influence on the bullet's velocity. Type of propellant, weight, barrel's length, air temperature, but also the composition and design of bullets influence the velocity at which they are propelled. Low-velocity projectiles travel slower than 300 m/s (1000 ft/sec), medium –velocity bullets between 300 m/s and 600 m/s (1000 – 2000 ft/sec) and high velocity projectiles faster than 600 m/s. However, the figure of 750 m/s (2500 ft/sec) and above is generally selected as the designated speed of high-velocity projectiles. Most hunting rifles fire bullets in the medium to high-velocity range. At low velocities, a bullet may expand very little while at higher velocities, the same bullet may expand normally or break it up completely. Bullets that are designed for low-velocities should therefore not be utilised for high-velocities and *vice versa*.

Most bullets are composed of 90% lead, with 10% antimony used as a hardener. Some are composed of zinc, magnesium, plastic and other materials. Some bullets, such as the common .22 calibre cartridge, are not jacketed, but have an outer metallic coat. Medium and high-velocity bullets are manufactured in two basic designs: bullets with an outer full metal jacket, which passes unchanged through the target and expanding bullets where the jacket is open in the front and exposes the core. The outer metal jacket may be composed of different hard metals like steel, copper, brass and alloys of copper and zinc (gilding metal) with a higher melting point than the lead alloy core (copper, cupronickel, brass, soft steel). The jacket restricts the bullet from deformation during passage through the barrel as a result of heat, friction, and pressures generated with high velocities and subsequent deformation on impact.

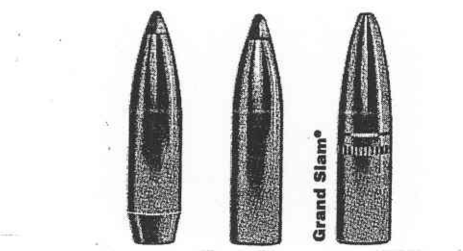

Fig. 1. From left: a) Soft point, boat tail b) Soft point, flat tail c) Full jacket. Illustration from Speer Reloading Manual No. 13.

The bullet trajectory is a product of the forces acting on it during flight. Forces include those pertaining to the Earth and its rotational motion (gravity, centrifugal forces, etc), and aerodynamic forces (drag) produced by the resistance of the air to projectile motion.

Published firing tables have bee evaluated for long-angle fire with no wind and standard atmospheric conditions (altitude: sea level, temp: 15ºC (59º F), pressure: 750 mm Hg (29.53 inches Hg), relative humidity: 78%, air density at sea level) and with gravitational forces constant along the bullet trajectory. If the environment changes (pressure, temp, etc) it will influence the trajectory. The atmospheric pressure and air density changes with the altitude and very dry air generates higher drag on the bullet than humid air. Very low temperatures of the cartridge can influence dramatically on the muzzle velocity of the projectile.

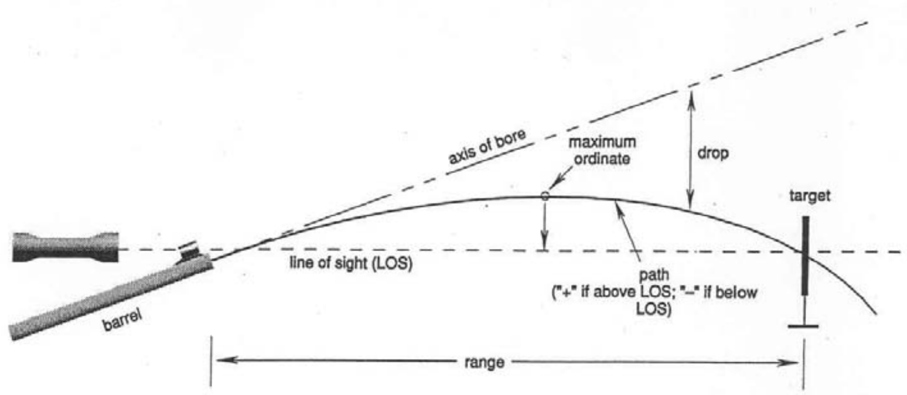

Diagram illustrating trajectory elements and references

Fig 2. Illustrations from Speer Reloading Manual No. 13.

Because firing tables results from horizontal firing tests, their values cannot be directed used when estimating shooting that includes an elevation angle. Since the muzzle is inclined at some angle, the initial velocity of the bullet now has a component in the vertical direction. In flat firings the bullet drop is always perpendicular to the firing direction, which is not the case for angle shooting. Therefore, for both uphill and downhill shooting, the bullet impact will be higher than expected for level shooting at the same distance. Thus the shooter will have to aim lower in such conditions.

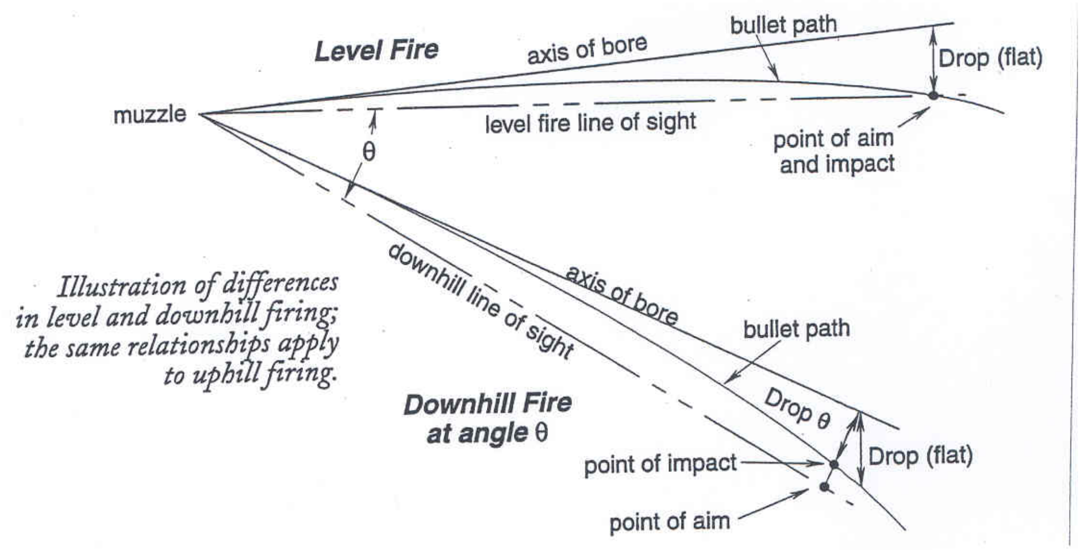

Fig. 3. Illustration from Speer Reloading Manual No. 13.

Air resistance depends on several factors like the projectile's shape and diameter, its muzzle velocity and air density. Higher bullet velocity relative to that of the air, produces greater drag. This is expressed by the concept of *ballistic coefficient,* BC, which simply expresses the bullet's ability to cut through the air. The higher the BC, the more easily the bullet slips through the air. BC is defined as the weight (w) of bullet divided by the square of its calibre (d) and by a factor related to the shape of the bullet (i): $BC = w/id^2$. For example the BC for a boat tail bullet is higher than the BC for a flat tail bullet with the same point shape and weight.

Wind affects bullet flight. Head wind gives an increased drag, while tail wind gives less drag on the bullet. Side wind results in drifting of the bullet from the line of the bore.

Terminal ballistics

Terminal ballistics ("target ballistics") is the science of the stopping process of the projectile at the target. Penetration, wounding effect, energy dissipation, projectile formation and stability are important processes covered by this branch. This effect is of particular interest for hunters and will be detailed in separate lectures in this workshop. In this presentation some basic and general principles of terminal effects will be mentioned.

The seriousness of bullet wounds is often considered to be limited to the tissues in the direct path of the projectile. However, the wounding potential of projectiles is a very complex subject and it is important to remember that deaths in humans and in animals have indeed occurred from hits in a vital structure, even with comparatively “benign” air gun pellets.

Energy is the ability to do work. The energy of an object in motion is called *kinetic energy* (E or KE). It is commonly expressed in kilogram-meters (kgm), foot-pounds or in Joules. The basic formula for calculating the energy of a moving object like a bullet is: $E = mv^2/2$ or $E = pv^2/2g$ where m is bullet mass, v bullet velocity, p bullet weight in grams or grains and g gravitation. It can be read from this formula that changes in velocity, v, have great impact on the energy as it changes with the square of the velocity. A drop or increase in velocity will therefore, considerably influence the bullet’s performance. In some countries therefore a minimum amount of muzzle velocity and energy is specified for big game hunting.

The performance of penetration of the bullet is important because the bullet must usually get well inside the animal to disrupt the function of its vital organs. A bullet that fails to penetrate the fur, skin, muscle, and bone necessary to reach vital organs is unlikely to bring an animal down. The bullets *sectional density* (SD) is very important for its penetration abilities. It is defined as ratio of weight to the square of the bullet diameter: $SD = w/d^2$. When comparing different hunting bullets, it is important to remember that SD stays the same for all bullets of the same weight in the same calibre and that shape does not affect the SD.

Jacketed bullets generally promote greater penetration into the target than bullets that expand and/or flatten or mushroom on impact, thus increasing the resistance during penetration and passage. For expanding bullets the expansion is affected by the type of tissues penetrated, thickness and strength of the jacket, hardness of the core, and the amount of core exposed. A hollow-point, soft-tip bullet can expand two to threefold. Too rapid deceleration and instability of the expanding bullet as it passes through the target may promote bullet fragmentation and enhance tissue destruction. A partial jacket is therefore sometimes included to protect the soft lead from deformation and fouling during its passage through the barrel and provide controlled expansion and penetration in the target.

SHOTGUNS

Shotgun calibres are measured according to their gauge and are capable of firing pellets of variable diameters. Shotguns differ from handguns and rifles both by design and function. Shotguns are smooth-bore, long-barrelled guns designed primarily for killing fast moving game birds and small animals. The shot charge consists of a large number of small spheres or pellets that forms a pattern that depends on the distance and “choke” of the barrel. Their use should be limited to close range because of the small mass and low velocity of the projectiles and in the game field 25-35 meter (30-40 yards) is the effective range for most shotguns. From a ballistic standpoint, shotguns are decidedly inferior to a single projectile, high velocity rifle.

MISFIRES

(Most of this section is quoted from Speer Reloading Manual Rifle & Pistol Number 13)

Handloading problems

The most common cause of misfires in reloaded ammunition is the failure of the re-loader to fully seat the primer in the case. When a primer is not fully seated, some of the force of the firing pin must be used to drive the primer deeper into the pocket.

Misfires for re-loaders can also be caused by other reasons such as:

- excessive headspace where the cartridge is too far forward in chamber and the firing pin cannot make solid contact
- incorrect cartridge
- lack of propellant
- contamination of primer or ammunition with oil or water

Gun problems

- Broken or damaged firing pin
- Inadequate firing pin spring
- Grease or dirt in the firing pin mechanism that slows down the pin fall
- Build up of powder residue or grease in the chamber
- Excessive headspace

When bolt hard to open

Hard bolt lift is a signal of DANGER. It can be due to several factors. However, for safety's sake it should always be considered to be a sign of excessive pressure and danger and firing should cease until the cause is diagnosed and corrected.

Unusual sounds and/or recoil

- A soft report or lack of recoil can indicate a squib load and the danger of a bullet being lodged in the barrel. Check for obstruction!
- A faint hissing sound following a shot, or hear a sound like the opening of a beverage can when you open the bolt, you almost certainly have a bullet stuck in the bore. Check for obstruction!
- Double sounds or a detectable delay between pulling the trigger and the cartridge firing are signs of poor ignition.

Poor accuracy

- Improper ammunition
- Inconsistent positioning of gun in the rest
- Poor attachment of sights
- Guard screws in the stock are not secure
- Bore unclean and fouled with powder residuals, lead or jacket material
- Wood stock warping due to moisture absorption
- Excessive lubricant
- Wind and/or cold

Slam-fires

A slam-fire is the discharging of a cartridge in the firearm by the closing of the bolt without the pull of the trigger. In most cases this is a phenomenon associated with military style semi-automatic rifles. It can be caused by a high primer or by a heavy un-sprung firing pin.

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Terminal ballistics

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Section of Arctic Veterinary Medicine

Some definitions

Terminal ballistics describes the effect a projectile has while striking the body as well as the counter-effects produced upon the projectile. This lecture will focus on the interaction between the projectile and the tissue.

When a projectile strikes a medium, a so called “bullet-body interaction” occurs. This interaction leads to transfer of energy from the projectile to the medium which leads to a degree of destruction of the involved medium. *Wound ballistics* is the study of the terminal ballistics of both bullet (and its fragments) in living tissue. *Ballistic wounds* are penetrating injuries caused by projectiles.

Energy transfer

The energy that a projectile transfers as it penetrates tissue is associated with several direct and indirect phenomena:

- The tissue that comes in direct contact with the projectile is *cut*. During the several hundred microseconds that it takes for a typical rifle bullet to penetrate tissue, a region of very high pressure develops at the bullet’s leading edge in which the tissue is disrupted.
- Transfer of energy from the projectile to the tissue causes low frequency, high-displacement transverse waves (*shear waves*), which cause the tissue surrounding the bullet’s trajectory to be stretched aside so that a temporary void is created. This is called the *temporary cavity*. In living tissue, the temporary cavity is often irregular and asymmetrical. The dimension of the temporary cavity will vary between different bullet types and also with the structure of different body tissue. After the temporary cavity has reached its maximum size, it starts to collapse and finally the *permanent cavity* is formed, which is identical with the observed final

wound canal. The permanent cavity often contains foreign material, like bone parts, hair and for expanding bullets also bullet fragments.

With respect to shooting of pinnipeds with rifles, it is these two first mechanisms of energy transfer and injury creation that are the most important. However, the projectile also transfers energy to the tissue through two other mechanisms:

- Transferring energy from the projectile also causes high frequency, low-displacement longitudinal waves (*shock waves*).
- Some energy is also transferred from the projectile to the target in the form of *heat*.

Ballistic wounds of the skull and brain

Generally, shots fired at the brain will in many cases be grossly destructive and cause very severe bleedings and tissue damage. The brain is particularly vulnerable to ballistic injury, as it is enclosed in the heavy bones of the skull and the tissue therefore has little room for expansion. When a rifle bullet hits the skull, the pressure inside will increase dramatically. High pressure within the skull is amongst other things often associated with bleeding in the brain tissue and meninges, which may be extensive if the pressure delivered is high. The brain stem is the area that is most sensitive to increased intracranial pressure. Additionally, the brain tissue possesses little elasticity and ballistic wounds to the brain are therefore often of an "explosive" character. If the pressure at impact is high, the brain can be blown away and pressed through natural openings like the sinuses or foramen magnum. The cranium itself can also crack and fractures and bone splints can cause secondary damage to the brain. A projectile, if powerful enough, does not have to hit the brain directly to cause devastating injury. Shock waves created from an impact site close to the brain, for instance the upper cervical spine, may be sufficient to cause bleeding and tissue disruption in higher and vital areas in the central nervous system.

A series of pictures were shown from experimental trials conducted by a group of researchers (Thali *et al*. 2002, 2003) to characterise the progressive formation of trauma caused by different bullet types in different areas of the skull, including head through-and-through gunshot and glancing/tangential gunshot using expanding and full-metal jacketed ammunition.

Ballistic wound to the chest

The major organs in the chest (lungs, heart and major vessels) tolerate ballistic injury differently. The lung tissue has very low density compared to other organs in the body and it is relatively elastic and therefore tolerates more stretch compared to for instance the brain. This does not mean, however, that the temporary cavitation cannot be a destructive process in the lungs. Projectiles with high-energy transfer are more than capable of causing severe damage to this tissue.

Wounds to the heart are frequently as destructive as wounds to the skull. The catastrophic injuries often encountered after wounding of the heart, in particular with high-velocity weapons, is mainly due to temporary cavitation occurring in a fluid-filled and minimally elastic organ. The large vessels, like the *aorta* and main pulmonary vessels, are susceptible to the same damages as the heart.

Abdomen and soft tissue

Generally, hits in organs in the abdominal cavity are very seldom rapidly fatal. The internal organs of the abdomen can be divided into dense organs (liver, kidney, spleen) and hollow organs (gastrointestinal tract, bladder). The dense organs are highly vascular (rich in blood) and friable (lacks elasticity and tear easily upon stretching) and the formation of the temporary cavitation will result in severe tissue disruption in these organs. The permanent cavity in these organs will often be of almost the same size as the temporary cavity. The gas or fluid filled organs in the abdomen are totally different as these tissues are relatively tolerant to stretching.

Hits in the musculature are never fatal. If a marine mammal is hit in the musculature and then dives, bleeding will stop quite rapidly due to diving adaptations in the circulatory system.

Practical hunting situations

At the end of the lectures a serious of pictures of harp seals on the ice were shown to indicate where and how to shoot the animals in order to render the animal instantaneously unconscious with one rifle shoot. Points were also made on how to prevent the wounding of animals during such circumstances.

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ANIMAL WELFARE AND THE CANADIAN HARP SEAL HUNT

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The annual harp seal (*Pagophilus groenlandicus*) hunt on the Atlantic coast of Canada is the largest seal hunt in the world. Most of this hunt occurs in the Gulf of St. Lawrence (hereafter referred to as the Gulf, with a current quota of 98,000 animals) and at the Front (northeast of Newfoundland, with a current quota of 247,000 animals). The Northwest Atlantic population of harp seals is currently estimated at 5.2 million animals, based on an estimated total annual production of 997,000 pups. This herd is the object of regular counts by scientists of the Canadian Department of Fisheries and Oceans (DFO) (Stenson *et al.*, 2003). Its current replacement yield (number of animals that can be taken in a given year without reducing the total population in the next year) is 255,000 animals (Hammill and Stenson, 2003). DFO's 2003-05 Management plan allows for a harvest of 975,000 seals over three years, with an anticipated reduction of the population to 4.7 million animals by 2006 (Anonymous, 2003).

This is a competitive form of hunt and, in recent years, quotas have been reached within less than a week in the Gulf and also at the Front. Despite the very large number of seals taken, animal welfare issues surrounding the hunt have always been the topic dominating the attention of the news media and the public. It was on the basis of these issues that, in the early 1980s, the European Economic Community decided to ban the importation of harp seal products from Canada, thus leading to the collapse of the hunt. Therefore, if only for pragmatic reasons, animal welfare issues cannot be ignored anymore by people exploiting wild animal resources. Moreover, humane practices are perfectly compatible with, and actually optimise, the harvest of pelts of good quality.

The harvest of whitecoats (newborn harp seals), which fuelled the opposition to the harp seal hunt by animal welfare groups and the general public in the 1970s, has been prohibited in Canada since the mid 1980s. Beaters now represent 90% of the commercial harp seal harvest in Canadian waters. These animals are 3-4 weeks old or older and weigh on average 30 kg; they have been weaned at about 12 days of age and have lost their white coat, but continue to spend the majority of their time resting on ice floes. Slightly older animals are targeted at the Front than in the Gulf and are thought to provide pelts of better quality.

Hunting methods used at the hunt are greatly influenced by ice conditions. Cold winters in the Gulf promote the formation of large ice floes on which it is easy to move on foot or even by snowmobile or all-terrain vehicle. Under these conditions, the hakapik (a wooden club, 105-153 cm long, with a metal ferrule with a slightly bent spike on one side and a blunt projection on the opposite side used to strike the seal's skull) is preferred to the rifle. Its proper use can be easily mastered; it can quickly kill the target animals and does not damage their pelt; and the cost of ammunition is avoided. Conversely, mild winters in the Gulf result in small ice floes on which beaters are less easily accessible and from which they can more readily escape into the water when approached; small ice floes also predominate at the Front, which is in more open sea. Under these conditions, rifles are the more efficient weapon.

Animal welfare issues at the hunt revolve primarily around the proportion of animals that are supposedly not killed instantaneously and thus may subsequently be hooked, bled or even skinned when still conscious. Understanding how pain can be prevented and how irreversible loss of consciousness or death can be achieved requires a few basic principles of anatomy and physiology. Pain is perceived as a result of nerve impulses from the periphery reaching the cerebral cortex (Lemke, 2004). Therefore, the integrity of the cerebral cortex, involving both cerebral hemispheres, is required for pain sensation. The base of the brain (brain stem) contains vital centres (control of respiration and blood circulation), and its destruction ensures that the animal is dead. It is therefore conceivable that a seal with both cerebral hemispheres destroyed but with an intact brain stem would still be alive but unconscious and unable to perceive stimuli, including pain. It is also possible for a seal to lose consciousness only temporarily as a result of concussion from a blow to its head, without there being significant damage to its brain. In this context, the Marine Mammal Regulations of the Fisheries Act of Canada (Marine Mammal Regulations, 1993) ask that the sealer verify that the animal is dead by confirming that it has lost its blinking reflex at the touch of its cornea. Loss of this blinking reflex may indicate death or, perhaps, only a deep level of unconsciousness which is not necessarily irreversible. For this reason, immediate and rapid bleeding of the animal is important in order to ensure that it will never regain consciousness. This practise is also important for the preservation of the quality of the pelt.

Scenes that are typically used in the media to illustrate the alleged cruelty of the hunt are those showing a sealer clubbing a seal with a hakapik. Yet, this author believes that proper use of the hakapik is an efficient and quick method of killing beaters. The top of the skull of young harp seals (up to at least 1 year of age) is very thin and can be easily crushed by one or a few blows from this weapon. A single blow may crush only one side of the skull and, according to some, can potentially leave the other side of the brain intact and available to perceive pain. However, the resulting concussion should be sufficient to cause at least temporary loss of consciousness. If so, immediate and rapid bleeding of the animal is again important to ensure that it will never regain consciousness. It also appears that, in many instances in which the top of the skull is only partially fractured, portions of the base of the brain case are fractured as well, thus presumably causing major damage to the brain stem, a vital component of the brain (Daoust et al., 2002). Nonetheless, a minimum of three blows to the top of the skull is recommended, in order to ensure its complete destruction and, thus, that of both cerebral hemispheres. This can then be easily and rapidly verified by palpation of the top of the skull (through skin and blubber). Although this author endorses the use of the hakapik for killing beaters, the same does not necessarily apply to adult harp seals or to young seals of other species, because of the normal increase in thickness of the brain case of animals with age and of wide variations in the configuration of the skull among different species of seals.

The Marine Mammal Regulations (1993) specify the minimum muzzle velocity (1,800 feet per second) and energy (1,100 foot-pounds) of the ammunition that can be used at the harp seal hunt. However, some hunters/sealers argue that these rifle regulations may have been designed to hunt adult harp seals, that these types of ammunition are unnecessarily powerful to kill beaters, and that less powerful ammunition such as a .22-caliber Rimfire Magnum cartridge: 1) has sufficient power to kill beaters when the shot is aimed at their brain case, 2) causes less damage to the pelt, 3) is safer for use on the ice because of its shorter range, and 3) is less expensive. A recently completed study of .22 Magnum ammunition, using intact heads of beaters under controlled conditions, suggested that, based on the damage caused to the skull of these heads, this type of ammunition is sufficiently powerful to kill beaters in a humane manner when they are hit directly in the brain case from a distance of 40 m or less (Daoust and Cattet, unpublished data). However, as compared to ammunition of higher power, it may be more likely to injure a beater than to kill it instantaneously when hit elsewhere than in its brain case. Other factors, such as human safety and the hunter's marksmanship, also need to be considered in the decision to allow or not the use of .22 Magnum ammunition. However, from an animal welfare perspective, a precautionary approach would suggest that this type of ammunition be not allowed during the harp seal hunt. Field observations are needed to complement this study.

The swimming reflex is a stereotypic movement of a recently killed harp seal which is the counterpart of the paddling movements of livestock animals killed at the slaughter house with a stun gun. It is characterised by vigorous lateral movements of the caudal part of the body, with no movement (such as lifting) of the head and little or no movement of the front flippers. The presence of this reflex has often been used by animal welfare groups as an indication that the seals are still alive after having been struck with a hakapik or shot. Its physiological basis is not clearly understood, and its occurrence and severity in any animal are difficult to predict (Daoust et al., 2002). More specifically, it is not clear to what extent, if any, this swimming reflex (or the paddling reflex in livestock) correlates with the degree of damage to the brain. This stereotypic movement may last considerably longer in seals than in terrestrial animals because of the unique adaptation of their musculature to diving, particularly a much larger store of oxygen in muscle tissue associated with the higher concentration of myoglobin. Complete immobility of the seal immediately following a blow to its head with a hakapik should actually alert the sealer to the possibility that the animal is still conscious, especially if this immobility is accompanied by contraction of the body. This fear-induced paralysis is a typical behaviour of harp seals (Lydersen and Kovacs, 1995), and such immobile seals might be interpreted as dead by inexperienced sealers and, therefore, might still be conscious when hooked, bled or skinned.

In conclusion, this author believes that the killing methods used at the harp seal hunt are appropriate for the species and age group harvested, when properly applied. The hakapik may actually be the better weapon, as it is less likely than the rifle to result in loss of struck animals that will subsequently die from their wounds. Based on his field observations and those of colleagues, it is estimated that 2% of the beaters are not killed properly and suffer for an inordinate amount of time. This value compares to a figure of 40% claimed by some animal welfare groups (IFAW, 2004). Nonetheless, a value of 2% applied to such a large hunt amounts to at least a few thousand animals. In order to improve further the quality of the hunt from an animal welfare perspective, this author proposes the following recommendations: 1) with the hakapik, the top of the seal's skull should be struck with a minimum of three strong blows; 2) with the rifle, ammunition of lower power than is currently indicated in the Marine Mammal Regulations (1993) should not be allowed (although this recommendation needs to be supported by field observations); 3) in every instance, the seal's skull should be palpated to ensure that it is completely crushed or the absence of a blinking reflex should be verified before the animal is hooked, bled or skinned; 4) mandatory training sessions for the sealers should be provided to ensure that newcomers to the hunt have appropriate skills, but also, and as importantly, to try to instil in the sealing community at large the importance of respect for, and humane treatment of, the animals hunted, because, ultimately, the quality of any hunt depends at least as much on the ethics and ability of the hunter as on the killing potential of the weapon used; 5) there should be continuous monitoring of the hunt by independent observers, in order to encourage compliance with proper hunting practices; and 6) the quota should revert to that of the replacement yield soon after 2005; this should ensure a sustainable harvest in the long term, and a less hurried hunt may also be a more careful hunt.

Acknowledgements
I thank Fisheries and Oceans Canada and the Canadian Veterinary Medical Association for their logistical and professional support. I also thank the many sealers in whose company I worked and with whom I talked for their trust.

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SECTION 2 – MANAGEMENT COMMITTEE

2.1
REPORT OF THE MANAGEMENT COMMITTEE
Tromsø, Norway, 3 March 2005

1. - 3. OPENING PROCEDURES

The Chair of the Management Committee, Halvard P. Johansen, welcomed delegations and observers to the meeting. See Section 5.1 for the list of Participants to the meeting. The agenda, as contained in Appendix 1, was adopted. Documents available to the meeting are listed in Appendix 2. The Secretariat was appointed as rapporteur for the meeting.

4. NATIONAL PROGRESS REPORTS

National Progress Reports for the year 2003 were available from the Faroe Islands, Greenland, Iceland and Norway (see Section 4 of this volume). In addition a Progress Report was provided by Canada to the NAMMCO Scientific Committee and brought to the Management Committee as an information item. The Management Committee expressed its appreciation to Canada for providing the report.

The Committee was pleased to receive a verbal presentation from Russia. This detailed ongoing research on harp seals in the Barents and White seas involving aerial remote sensing surveys in the White Sea for pups in March and ground searches using calibrated squares on ice during the hunting season. In addition biological sampling on 500 adult females and 500 pups was carried out. In 2004 there had been no harp seals taken, but catches in 2005 will follow ICES recommendations. All results will be presented to the ICES Working Group in St Johns during fall 2005. Ship and aerial surveys for cetaceans including dolphins and killer whales in the Barents Sea have been ongoing for 3 years. Additionally annual ecosystem surveys have been carried out in the north Barents and Norwegian seas relating marine mammals and fish, facilitated by good research relations with Norwegian colleagues.

5. STATUS OF PAST PROPOSALS FOR CONSERVATION AND MANAGEMENT

The Committee considered document NAMMCO/14/MC/3 (Appendix 3, p. 147) which was a record of past proposals for conservation and management put forward by the Management Committee. The Chair asked the Committee to comment on any regulatory or other measures that had been taken in response to these proposals.

5.1 Atlantic walrus
Greenland announced that they plan introducing quotas for walrus, possibly in 2005. Greenland is awaiting the findings of the Scientific Committee in their assessment of walrus.

5.2 Ringed seal
There was nothing to report under this item.

5.3 Harp seal

5.3.1 Northwest Atlantic

The observer from Canada informed the Committee that 2005 was the last year of the 3-year management plan for harp seals, and that quotas in the new plan for the period starting in 2006 will be based on the results of a survey conducted in 2004. Greenland once again noted that this was a stock shared between Canada and Greenland and that the stock should be managed jointly. To this end Greenland will seek to organise a bilateral in 2005.

5.3.2 White/Barents Sea

Norway reported on a joint venture project between Russian and Norwegian commercial interests to conduct sealing in the White Sea using small vessels, as is done in Canada. The project will be carried out in 2005 or 2006.

5.3.3 Greenland Sea

There was nothing to report under this item.

5.4 Hooded seal

Norway informed the Committee that a hooded seal survey covering all stocks will be carried out jointly with Canada and Greenland in 2005.

5.5 Grey seal

In 2004 the Management Committee recommended that both Iceland and Norway should define clear management objectives for grey seals.

Iceland reported that the management objective for grey seals would be to maintain the stock size close to the current level, and that protective measures would be taken should further declines continue. A precondition to this objective will be careful monitoring of the stock size.

Norway reported that a management plan for grey seals is presently under development. Recent catches have been lower than the quota levels in most areas.

5.6 Northern bottlenose whales

There was nothing to report under this item.

5.7 Long-finned pilot whales

There was nothing to report under this item.

5.8 Minke whales – Central North Atlantic

There was nothing to report under this item.

5.9 Beluga - West Greenland

Greenland informed the Committee that a quota of 320 had been introduced in West Greenland and Qaanaaq year-round from 1st July 2004. After implementation the catch was lower than the quota level, mainly due to poor weather conditions.

5.10 Narwhal - West Greenland

Greenland informed the Committee that quotas of 200 in West Greenland and 100 in Qaanaaq had been introduced in 2004. After implementation the catch was lower than the quota level.

For both narwhal and beluga (see 5.9) the Management Committee, while commending Greenland for taking action on this difficult management issue, noted the concern of the Scientific Committee that the established quotas were above the levels recommended. The Management Committee looked forward to receiving more information next year and noted that the effects of the new quota implementation should be followed closely.

5.11 Fin whales - East Greenland - Iceland stock area

There was nothing to report under this item.

5.12 Incorporation of users' knowledge in the deliberations of the Scientific Committee

See agenda item 11, p. 141.

6. STATUS OF PAST REQUESTS TO THE SCIENTIFIC COMMITTEE

The Chair drew the attention of the Committee to the updated summary of requests by the NAMMCO Council to the Scientific Committee, and responses by the Scientific Committee (Appendix 4). In addition the Chairman of the Scientific Committee updated the Management Committee on the status of outstanding requests from the 2004 meeting of the Scientific Committee:

White-beaked, white-sided and bottlenose dolphins

There was still insufficient information to move forward on this request for an assessment. This may become feasible once feeding, genetic and life history studies have been completed in Iceland, the Faroes and Norway, and when new abundance estimates become available from the SCANS II, NASS and other sightings surveys. Such an assessment could probably be conducted by 2008 at the earliest.

Humpback whales

In 2004, the Scientific Committee was requested to assess the sustainable yield levels for humpback whales, particularly those feeding in West Greenlandic waters. The Scientific Committee found that there was insufficient information available from West Greenland to proceed with an assessment at this time.The existing abundance estimate is more than 10 years old and a new estimate may become available from recent surveys off West Greenland. Even so, the uncertainty in the new estimate is likely to be high. Due to the effects of environmental and demographic stochasticity in populations of only a few hundred individuals, the models that the Scientific Committee usually apply to assess sustainability would require modification to be applied to humpback whales in West Greenland.

Greenland noted that there was a growing problem with entanglement of humpback and that some by-catch had occurred over the past few years. Greenlandic hunters and fishers have noted an increase in the population of humpback whales off West Greenland. Greenland therefore considered that the requested assessment should be carried out as soon as is feasible.

Killer whales
In 2004 the Management Committee requested the Scientific Committee to review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, with an emphasis on West Greenland. The Scientific Committee found that there was not enough information to support a meaningful assessment at this time, particularly for the West Greenland area, and developed research recommendations to improve the knowledge base on killer whales for all areas.

The Chairman of the Management Committee requested the Secretariat to continue to update the status of past requests to the Scientific Committee, as this was very useful.

7. NEW PROPOSALS FOR CONSERVATION AND MANAGEMENT, REQUESTS FOR ADVICE FROM THE SCIENTIFIC COMMITTEE AND RECOMMENDATIONS FOR SCIENTIFIC RESEARCH

7.1 Economic aspects of marine mammal - fisheries interactions

7.1.1 Recommendations for scientific research

The Management Committee endorsed the recommendations for scientific research by the Scientific Committee, contained in Section 3.1 of this volume, and the plan to continue the work in 2006 if sufficient new information becomes available. The Management Committee noted the conclusion of the Scientific Committee that progress in the assessment of multi-species interactions will not be made unless significant additional resources are dedicated to it. Norway informed the Committee that consideration was now being given to furthering the multi-species modelling work for the Barents Sea. Iceland noted that the Icelandic Research Programme is addressing one of the major knowledge gaps in this area, the diet of minke whales around Iceland. The programme has been delayed but it is expected to be completed in 2006. Once these data become available the Icelandic modelling work can proceed.

The Management Committee emphasised the importance of this work and urged members to proceed with the research required to complete it.

7.2 Harp and hooded seals

7.2.1 New requests for advice

Harp seals
The Management Committee noted the conclusion of the Scientific Committee that the likely effect of the harvest levels outlined in the Canadian Management plan was a slight drop in total abundance in the short term (3-5 years), and an accelerating decline if these harvest levels are maintained over a longer period (*ca*. 10 years), and that the availability of seals to Greenlandic hunters would likely decrease as the total population decreased. The Management Committee therefore recommended that the

Scientific Committee evaluate how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland.

The Management Committee recalled its request to the Scientific Committee from 2004, that advice on catch quotas should be provided in the light of potential ecosystem management requirements. For the Greenland Sea and Barents/White Sea stocks of harp seals, advice should be provided on catch quotas that would result in varying degrees of stock reduction over a defined period of time. The Management Committee therefore requested the Scientific Committee to specify harvest levels for these 2 stocks that would result in a population reduction of 20% over a period of 20 years. It was recognised that the terms of reference of the ICES/NAFO Working Group would have to be revised if the advice is to be provided through that group.

In 2004 the Scientific Committee requested that the Council consider the feasibility of NAMMCO assuming a more formal involvement with ICES and NAFO in the Working Group on Harp and Hooded Seals. The Observer from ICES suggested that a more formalised relationship could be realized either by revising the terms of reference of the Working Group such that NAMMCO is a formal partner, or by establishing a Memorandum of Understanding between NAMMCO and ICES. These options are discussed by the Council under Item 8 (p.37).

7.3 Grey seals

There were no new requests or proposals under this item.

7.4 Walrus

The Scientific Committee Working Group on Walrus met in January 2005 to deal with the request for advice posed by the Council in 2004. The Scientific Committee will report on this item at their next meeting in 2005.

7.5 Harbour porpoise

7.5.1 Recommendations for scientific research

The Management Committee endorsed the recommendations of the Scientific Committee pertaining to harbour porpoises around Iceland, that in order to estimate the sustainability of the ongoing by-catch, better estimates of the present by-catch levels are required as well as an estimate of absolute abundance for the area. Aerial surveys will be carried out over the next two years as part of the Icelandic Research Programme, and it was recommended that the feasibility of modifying these surveys to generate valid estimates of absolute abundance for this species be investigated.

7.6 Beluga - West Greenland

It was considered that the collaboration with the JCNB at the scientific level has been productive and the plan of the Scientific Committee to hold a joint meeting with the JCNB Scientific Working Group in 2005 was endorsed.

7.6.1 Recommendations for scientific research

Noting the importance of the West Greenland index survey series to the continued assessment of both West Greenland narwhal and beluga, the Management Committee supported the recommendation of the Scientific Committee that this survey series be continued.

7.7 Narwhal - West Greenland

7.7.1 New requests for advice

The Management Committee requested that the Scientific Committee carry out an assessment of East Greenland narwhal, and provide an estimate of sustainable yield for the stock. The management objective in this case is to maintain the stock at a stable level. If the assessment cannot be completed with available information, the Scientific Committee should provide a list of research that would be required to complete the assessment.

7.7.2 Recommendations for scientific research

Noting the importance of the West Greenland index survey series to the continued assessment of both West Greenland narwhal and beluga, the Management Committee supported the recommendation of the Scientific Committee that this survey series be continued.

7.8 Fin whales

7.8.1 Recommendations for scientific research

The Management Committee supported the recommendations of the Scientific Committee for research on fin whales contained in Section 3.1, and emphasized that the assessment of fin whale stocks could not be continued until these tasks were carried out.

As in 2004 it was noted that questions of stock identity and relationships to other stocks are of highest priority. The IWC Scientific Committee is carrying out a pre-implementation assessment of fin whales, beginning in 2005 with the development of stock hypotheses. Noting that the IWC Scientific Committee had suggested that the pre-implementation assessment could benefit from co-ordination between the 2 committees, the Management Committee supported the recommendation of the Scientific Committee to investigate the option of holding a joint intercessional workshop to address the issue of stock structure, if it is not fully resolved at the IWC Scientific Committee meeting in May 2005. It was emphasised however that any such co-ordination should not compromise the independence of the NAMMCO Scientific Committee's continuing assessment of North Atlantic fin whales.

7.9 Minke whales

There were no new requests or proposals under this item.

7.10 White-beaked, white-sided and bottlenose dolphins

There were no new requests or proposals under this item.

7.11 Humpback whales

7.11.1 New requests for advice

In 2004 the Management Committee requested the Scientific Committee to assess the sustainable yield levels for humpback whales, particularly those feeding in West Greenlandic waters. Mainly because of a lack of current information on abundance, the Scientific Committee was unable to complete the Assessment for West Greenland. The Scientific Committee noted that they would be able to estimate sustainable yield levels for humpback whales in the Northeast Atlantic.

The Scientific Committee is requested to continue its assessment of humpback whale stocks in the North Atlantic. For West Greenland, the Scientific Committee should assess the long-term effects of annual removals of 0, 2, 5, 10 and 20 whales. For the Northeast Atlantic the Scientific Committee should provide estimates of sustainable yield for the stocks. In all cases the management objective would be to maintain the stocks at a stable level. The Scientific Committee should identify information gaps that must be filled in order to complete the assessments.

7.11.2 Recommendations for scientific research

For West Greenland the most urgent requirement is for a new estimate of abundance. In this regard it was noted that a survey was completed in 2004, and that a new estimate should be available sometime in 2005.

7.12 Killer whales

7.12.1 Recommendations for scientific research

The Management Committee noted the conclusion of the Scientific Committee that there was not enough information to carry out the assessment that was requested in 2004 at this time, particularly for the West Greenland area, and requested the Scientific Committee to review new information on killer whales annually with the aim of completing the assessment once sufficient information becomes available for a particular area. The Management Committee supported the recommendations for scientific research contained in Section 3.1.

7.13 North Atlantic Sightings Surveys

7.13.1 Recommendations for scientific research

The Management Committee accepted the recommendation of the Scientific Committee that, for various reasons, 2007 would be the optimal year to carry out the next NASS, rather than 2006 as originally planned. The Management Committee also noted the efforts of the Scientific Committee to expand the NASS to include involvement from countries in the Western and Eastern Atlantic, and recommended that this effort be continued.

Harbour seal

7.14.1 New requests for advice

Harbour seal abundance has fluctuated in the Northeast Atlantic in recent years due to local outbreaks of viral distemper. Usually these outbreaks have been followed by rapid recoveries, and harbour seal abundance may have increased in many areas. In some areas, harbour seals are harvested and/or taken incidentally by fisheries and aquaculture operations (*e.g.* Greenland, Norway and Iceland). They also have significant direct and indirect interactions with fisheries in many areas. For these reasons, the Scientific Committee is requested to:

- Review and assess the status of harbour seals throughout the North Atlantic;
- Review and evaluate the applied survey methods;
- Assess stock delineation using available data on genetics, spatial and temporal distribution and other sources;
- Review available information about harbour seal ecology;
- Identify interactions with fisheries and aquaculture.

It was anticipated that this request could be addressed by the Scientific Committee in 2006.

8. REPORT OF THE WORKING GROUP ON BY-CATCH

The Working Group held a meeting on 28 February 2005, and the Report from the meeting is contained in Section 2.2.

New regulatory measures in the European Union
The Working Group was informed of new regulatory measures which had taken effect in the European Union (EU) in July 2004. The measures include a phase-out of the use of drift nets in the Baltic Sea, mandatory use of acoustic deterrent devices (pingers) in EU fisheries deploying gillnets and entangling nets, and the use of on-board observers for certain "high risk" fisheries. The requirement for pingers will apply only to vessels greater than 12 m in length.

Progress in monitoring marine mammal by-catches by NAMMCO Member Countries
The Working Group reviewed the progress of member countries in establishing systems to effectively monitor by-catch. There have been no changes in the past year in the by-catch monitoring systems in the Faroe Islands, Greenland and Iceland. In Norway the reporting of marine mammal by-catch in fishery logbooks has been mandatory since 2003 on vessels larger than 21 m. However there is no system in place to collect and analyse the data from the logbooks, so the effectiveness of the programme is not known. In 2004 fisheries observers on larger offshore fishing vessels were instructed to also report by-catches of marine mammals. An evaluation of the effectiveness of this system is in progress. In 2004 the Institute of Marine Research began a pilot project in which a limited number of coastal gillnetters were contracted to provide detailed records of their fishing effort, target species catches, and by-catches of marine mammals. The effectiveness of this procedure has been evaluated and the programme will be expanded in 2005.

Evaluation of the Icelandic by-catch monitoring programme
In 2004 the Management Committee requested the Scientific Committee to carry out an evaluation of the data collection and estimation procedures used in the Icelandic by-catch monitoring programme. The evaluation focused on the methods used and the reliability of the by-catch estimates rather than on the significance of the estimates themselves. The Scientific Committee carried out the evaluation at their 12th meeting as reported in Section 3.1.

The recommendations of the Scientific Committee were supported by the Working Group. The importance of including a level of precision in by-catch estimates was especially emphasised. In this regard it will be necessary to establish target levels of precision that are required for management, as this will facilitate the process of designing an effective by-catch monitoring programme. It was also noted that any self reporting is dependent on the willingness of fishermen to participate.

It was concluded that the system used in Iceland of monitoring marine mammal by-catch through fishery logbooks could be a useful model for other countries to use as a starting point. To be effective, the system would have to be modified such that the presence or absence of by-catch is recorded for every gear cast. It was recognised that this would require changes in logbook format which might be problematic for practical reasons in some cases. It was also recognised that such a system was likely to result in negatively biased estimates in most cases due to non-reporting and potentially to deliberate misreporting. Therefore, in high risk fisheries or for species of special conservation concern for which very precise and unbiased estimates are required, a logbook system might have to be augmented by an observer programme with a targeted level of estimation precision.

Evaluation of the potential risk of marine mammal by-catch in the fishery within the NAMMCO area

In 2004 the Management Committee recommended that member countries should prepare working documents outlining the existing knowledge about marine mammal by-catch in their jurisdiction, for the consideration of the Working Group.

In the Faroe Islands, there are a wide variety of fishing gears used and a high degree of overlap between fisheries and the distributions of many species of whales and seals. In contrast to most other areas however there is no inshore, shallow water gillnet fishery in the Faroes. Although no formal by-catch reporting system exists, incidental reports of marine mammal by-catch are very infrequent. The Working Group agreed that the lack of an inshore gillnet fishery was certainly the reason why by-catch appeared to be an infrequent phenomenon in the Faroes. However it was noted that by-catch of harbour porpoises and dolphins is high in some pelagic trawl fisheries in other areas. Given the lack of a formal reporting system and the fact that many of these fisheries are prosecuted by foreign fleets from which even incidental reports of by-catch could not be expected, the Working Group could not rule out the possibility that by-catch in pelagic trawl and possibly other fisheries was significant in the Faroes.

In Greenland the offshore fisheries are monitored by observers with an approximate coverage of 50%, and reporting of marine mammal by catch is mandatory. There are no reports of marine mammal by-catch from these fisheries. A wide variety of inshore fisheries are also prosecuted, however by-catch reporting is not mandatory for these fisheries and it is assumed that if by-catch occurs it is reported through the general harvest monitoring programme. In such cases it would not be distinguishable as by-catch. The Working Group required more information on the size and spatial distribution of Greenlandic fisheries, and their overlap with marine mammal distributions, in order to evaluate the potential for by-catch in Greenland. This applies particularly to fisheries in nearshore waters.

In Iceland, there are a wide variety of fishing gears used and a high degree of overlap between fisheries and the distributions of many species of whales and seals. The largest overlap in fishing effort and mammal distribution occurs on the coastal shelf leading to the highest potentials for by-catch in these fisheries. The highest risk for by-catch is probably in the coastal and near shore gillnet fishery. Some interactions may also occur in the capelin and herring fisheries.

The Working Group agreed that the inshore gillnet fisheries for lumpfish, cod and flatfish were the most likely to result in by-catch in Icelandic waters. Thus it was recommended that by-catch monitoring be focussed on these fisheries in the near term.

Norway did not provide information to be evaluated by the Working Group.

Reporting of by-catch to NAMMCO

This year, for the first time, all countries used the new National Progress Report format to report by-catch. The Faroe Islands and Greenland reported some by-catch but did not provide details about the fishery in which these animals were caught. Norway provided a brief description of ongoing programmes to monitor by-catch, but did not provide any estimates from these programmes. Reporting from Iceland followed fully the National Progress Report format.

The Working Group provided recommendations to improve the monitoring of by-catch in NAMMCO member countries (see Section 2.2). The Management Committee noted that the Working Group was not able to complete its assessment of the potential for marine mammal by-catch in NAMMCO member countries because Norway did not provide the requested information and the information from Greenland was incomplete. Both Norway and Greenland agreed to provide the requested information for the next meeting of the Working Group. The Committee therefore agreed to postpone a full consideration of the recommendations put forward by the Working Group until the next annual meeting.

Given that the Working Group on By-catch was established in 1997 with a very broad mandate, the Management Committee considered it timely to focus the work of the Working Group with renewed terms of reference:

The Working Group on By-catch will focus on improving the systems for collecting data on by-catch in NAMMCO member countries. Specifically the Working Group will:

- Compile information on existing by-catch data collection systems in NAMMCO member countries and other jurisdictions;
- Monitor the activities of other International Government Organizations in this field;
- Evaluate the effectiveness of by-catch data collection programmes in NAMMCO member countries, and make recommendations for their improvement;

- Monitor the quality of by-catch reporting by NAMMCO member countries to NAMMCO.

9. REPORT OF THE SUB-COMMITTEE ON INSPECTION AND OBSERVATION

The Chair of the Sub-committee on Inspection and Observation, Egil Ole Øen, presented the report from the meeting held 14 January 2004 (see Section 2.3, p. 199). Following a recommendation from the Sub-Committee, the Management Committee at its last meeting in 2004 asked the Secretariat to review and recommend improvements to the implementation of the Scheme. The review was presented to the Sub-Committee at its meeting in January. The review considered only the implementation process and not the actual text of the Provisions and the Guidelines.

The Scheme came into force in 1998 and hence has been operative for seven seasons. NAMMCO has had observers in Greenland, the Faroe Islands and Norway. Until 2001 observations were land based, but have since then also been conducted out at sea. The last year's observation activities have focused on one region and/or one activity. No violations of national or hunting related regulations have occurred during the period the observation scheme has been in operation. The review outlined the major characteristics of the hunts that have an impact on the implementation of the observation scheme in Greenland, the Faroe Islands and Norway.

The Sub-Committee emphasised the following general comments and areas where there was potential for improvement of the Scheme:

- Hunting activities are more easily accessible in Norway and the Faroe Islands as compared to Greenland, due to the latter's opportunistic character, less organised and scattered hunting areas.
- The success of the Scheme is not measured by a high number of actual hunting observations during a period, although this is desirable, but the fact that an observer is present and able to conduct his or her job without interference of any sort
- The member countries were urged to follow the prescribed procedures governing nomination and appointment of observers, and to nominate more than one observer candidate.
- As a rule the observer should not come from the country in which he/she is conducting observations. With respect to communication and language this poses a special challenge with respect to observations in Greenland as the majority of the hunters in Greenland do not speak English and may not have a good understanding of a Nordic language. The implication of this is that the observer should be accompanied by an interpreter or the national "jagtbetjent".
- To have updated information on hunting statistics, time frames, quotas, the most optimum areas of observation, names of contact persons *etc.* available to the Secretariat is very important for the smooth running of the Scheme. By focusing on one region at a time the Secretariat has gained valuable information on how the different hunts are being organised in the different countries. It was recommended

that this practice should be continued.

- With the exception of the courses held in Norway for inspectors in connection with sealing and, up until now, whaling, there exist no organised training courses for observers. It is the Secretariat's responsibility to ensure that every observer has all the relevant documentation regarding regulations and laws governing marine mammal hunting in the respective countries and the Provisions of the Joint NAMMCO Control Scheme. As part of the preparation the Secretariat has made a practice of arranging a meeting at the outset of the observation period between the observer and relevant persons in the country in question to discuss the national laws and regulations and laws and other connected matters. It was recommended that this practice be continued.
- The budget of NOK 200 000 will never allow for more than partial coverage. In order to observe all marine mammal hunting activities throughout the whole season the budget would have to be much higher.

In conclusion the Sub-Committee agreed that the implementation of the Inspection and Observation Scheme seems to be functioning well, given the human and financial resources at hand. The importance of having observer candidates skilled in languages and with an understanding of the situation, to which she or he will be exposed, *i.e.* long periods of waiting in unfamiliar surroundings, was emphasised.

Dr Øen also provided a short report on the status of the automated monitoring "Blue Box" programme for Norwegian minke whaling. The "Blue Box" is a tamper-proof automated computing system designed to independently monitor and log the activities associated with data on certain events on board provided by different sensors, including an independent GPS, shock transducers, strain transducers and heel sensors located in different places on a vessel that independently or in sum indicate that a whale has been shot and taken on board. The system is designed for continuous operation and logging of data for a minimum of 4 months. Prototypes have been tested for 3 seasons. Based on the data and results from the 2004 season, the system has been upgraded, and for the 2005 season the plan is to install a "Blue Box" on all whaling vessels. National inspectors will still be present on some boats in 2005 to monitor its function and from 2006 it is anticipated that the system will be fully operational, and national inspectors will only make random inspections on board vessels.

Implementation of the "Blue Box" system will ease some of the unnecessary and unintended restrictions of the current monitoring system. It will allow the hunt to return to the traditional opportunistic "good weather" pattern, without the restrictions inherent in having to have an inspector always on call. It takes no space, it does not sleep, eat, and does not socialise with anyone. The system, when fully implemented, will probably save an estimated 6 million NOK every year.

The Management Committee commended the Sub-committee for their thorough evaluation of the Observation Scheme, and noted that it continues to function as the only operating scheme of its kind for marine mammals. In light of the recommendations of the Sub-committee, member countries were encouraged to submit proposals for amendments to the Scheme to the Management Committee.

The Management Committee thanked the outgoing chair Dr Øen for his able chairmanship both in this Sub-committee and its predecessor, and noted that Greenland would take over the chairmanship.

10. IMPLEMENTATION OF THE JOINT NAMMCO CONTROL SCHEME

10.1 NAMMCO International Observation Scheme 2004

The Chair referred to the Report of the NAMMCO International Observation Scheme under the Joint Control Scheme for the Hunting of Marine Mammals, prepared by the Secretariat. Charlotte Winsnes, presented the report to the Management Committee. For the 2004 season, observations were focused on whaling and sealing activities in Greenland. Effective observation days were 60 not including days of travel to and from Greenland. The observers were stationed in 3 different regions, one in South-West Greenland mainly in Qaqortoq and Narsaq, one in Nuuk and one in Sisimiut. The last one also travelled to Illulisat and Maniitsoq. All observers carried out both land based and on board observations of whaling and sealing activities. However, due to weather conditions, technical difficulties and other reasons, observations were predominantly land based.

All the observers found that they could carry out their observations in accordance with the provisions of the Scheme. No violations were reported, and reports have been submitted to the Secretariat.

Ms Winsnes noted that it has proven beneficial to focus on one region per year. In Greenland the observer's opportunities to observe the actual hunting activities are limited due to the hunt's opportunistic character.

10.2 NAMMCO International Observation Scheme 2005

The Management Committee agreed that observations in 2005 would focus on sealing activities in Norway and Iceland.

10.3 Other matters

In response to a query from Greenland, Norway indicated that hunters and inspectors from other jurisdictions would be welcome to participate in training courses offered in Norway.

11. USER KNOWLEDGE IN MANAGEMENT DECISION-MAKING

11.1 Report of the Working Group on User Knowledge in Management

The Working Group was established in 2003 as a follow up of the NAMMCO Conference on User Knowledge in Management Decision-Making held in January 2003. The Working Group has not held any meetings since the last meeting of the Management Committee in March 2004, but will resume its work in 2005, after the publication of the proceedings from the Conference.

12. ENHANCING ECOSYSTEM BASED MANAGEMENT

The Management Committee recalled that an *ad hoc* Working Group on enhancing ecosystem based management had been established in 2003 with the following terms of reference, to:

1. Identify the challenges faced in adapting marine management systems to ecosystem-based approaches,
2. Investigate the progress that has been done in other *fora* in implementing ecosystem-based management
3. Recommend what kind of principles and measures can be applied to the situation faced by NAMMCO members and neighbouring countries.

The *ad hoc* WG met in Copenhagen in December 2003 and reported to the Management Committee at its last meeting (NAMMCO/13/MC/9).

The MC noted that it had not been possible for the *ad hoc* Working Group to meet and continue its work during 2004 as was decided at the last meeting of the Management Committee. The *ad hoc* Working Group had been tasked at that meeting to develop a case study focussing on harp seals in the North Atlantic from an ecosystem perspective.

In discussing how best to proceed in developing a clearer focus within NAMMCO on ecosystem based management, the MC agreed that before deciding on the further development of a particular case study, it would be beneficial to examine more closely the broader context in which ecosystem based approaches to management of marine resources, including marine mammals, are being applied across the North Atlantic. Such an examination was carried out at the first meeting of the *ad hoc* Working Group, but it was felt that a continuation of these discussions in a larger forum with a broader range of participants would help to better examine the basis for a common understanding of this approach in the NAMMCO context. In addition it was felt that there was a need to identify more clearly in a dedicated forum the gaps in scientific knowledge on the interactions between marine mammals and fisheries resources, and the implications of these gaps for the application of ecosystembased management. The Management Committee underlined that management of marine mammals should be seen in the light of the management of marine resources in general.

The Management Committee decided that the *ad hoc* Working group should meet again prior to the next annual meeting of NAMMCO. In order to be able to address in more detail the Terms of Reference developed for the WG in 2003, the aim of the next meeting would be to:

- review the development of multi-species models for marine resource management which include marine mammals, the extent to which these can be applied in management today, and the gaps and work required to further develop these models for management purposes. This review will have as its basis the work carried out to date through the NAMMCO scientific committee and any other relevant information provided by participating countries;

- examine the management objectives and experiences in relation to the application of ecosystem based management across the North Atlantic where marine mammal utilisation occurs;
- report back to the Management Committee at its next meeting, with recommendations for how best to advance NAMMCO's focus on ecosystem based management.

The Management Committee noted the importance of ensuring the participation of relevant marine scientists, managers and policy makers, and users of the resources in the next meeting of the *ad hoc* Working Group. The Management Committee also welcomed and encouraged the continued active participation of Canada and the Russian Federation in these discussions, as well as the participation of other interested Observer Governments and relevant intergovernmental organisations.

13. ANY OTHER BUSINESS

Ms Mona Gilstad gave a presentation on the project "SEAL – our common resource". The project was initiated in 2004 and is funded mainly by the European Union. The project goals are:

- to promote ecologically safe maintenance of the existing seal stocks for the benefit of the coastal population of the Kvarken Mittskandia area;
- to promote cooperation between Nordic countries, businesses, organisations and authorities responsible for seal-related issues;
- to create a framework for the usage of a valuable renewable resource;
- to educate seal hunters, restaurant chefs, craftsmen and others to use seal as a resource.

Included in the project are the production of information materials and the holding of training courses on hunting methods, seal product utilisation and cooking. Also there is an effort to promote the development and marketing of seal products. It is expected that the project will continue through 2006. More information is available at www.nordicseal.org.

14. ADOPTION OF REPORT

The final report of the meeting was approved by correspondence on 1 April 2005.

Appendix 1

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2. Adoption of agenda
3. Appointment of rapporteur
4. National Progress Reports
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    - 5.2 Ringed seal
    - 5.3 Harp seal
        - 5.3.1 Northwest Atlantic
        - 5.3.2 White/Barents Sea
        - 5.3.3 Greenland Sea
    - 5.4 Hooded seal
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    - 5.5 Grey seal
    - 5.6 Northern bottlenose whales
    - 5.7 Long-finned pilot whales
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    - 5.9 Beluga - West Greenland
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    - 5.11 Fin whales - East Greenland - Iceland stock area
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    - 7.1 Economic aspects of marine mammal - fisheries interactions
        - 7.1.1 Proposals for conservation and management
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    - 7.2 Harp and hooded seals
        - 7.2.1 Proposals for conservation and management
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7.6 Beluga - West Greenland
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7.9.2 New requests for advice
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7.10 White-beaked, white-sided and bottlenose dolphins
7.10.1 Proposals for conservation and management
7.10.2 New requests for advice
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7.11 Humpback whales
7.11.1 Proposals for conservation and management
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7.12 Killer whales
7.12.1 Proposals for conservation and management
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7.13.1 Proposals for conservation and management
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7.14 Others
8. Report of the Working Group on By-catch
9. Report of the Sub-Committee on Inspection and Observation
10. Implementation of the Joint NAMMCO Control Scheme
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10.3 Other matters
11. User Knowledge in Management Decision-Making
11.1 Report of the Working Group on User Knowledge in Management
12. Report of the *ad hoc* Working Group on Enhancing Ecosystem Based Management
13. Any other business
14. Adoption of report

Appendix 2

LIST OF DOCUMENTS

NAMMCO/14/MC/1	List of documents
NAMMCO/14/MC/2	Agenda
NAMMCO/14/MC/3	Status of past proposals for conservation and management
NAMMCO/14/MC/4	Status of past requests by NAMMCO Council to the Scientific Committee, and responses by the Scientific Committee
NAMMCO/14/MC/5	Report of the Management Working Group on By-catch
NAMMCO/14/MC/6	Report of the Sub-Committee on Inspection and Observation
NAMMCO/14/MC/7	Report of the NAMMCO International Observation Scheme 2004

National Progress Reports

NAMMCO/14/MC/NPR-F	Faroe Islands - Progress Report on Marine Mammals in 2003
NAMMCO/14/MC/NPR-G	Greenland - Progress Report on Marine Mammals in 2003
NAMMCO/14/MC/NPR-I	Iceland - Progress Report on Marine Mammals in 2003
NAMMCO/14/MC/NPR-N	Norway - Progress Report on Marine Mammals in 2003

Council documents

NAMMCO/14/5	Report of the Scientific Committee, 27 – 29 October 2004

Appendix 3

LIST OF PAST PROPOSALS FOR CONSERVATION AND MANAGEMENT

(Up to and including NAMMCO/14 - 2005)

PINNIPEDS

1. Atlantic walruses

Proposal for conservation and management:

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 recognising the overall 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 co-operatively with Greenland to assist in the achievement of these objectives (*NAMMCO Annual Report 1995*: 49).

Management measures/response by member countries:

- Greenland provided the Management Committee with information on further measures recently implemented through legislation by the Greenland authorities for the conservation of the West Greenland stock. These regulations include: the restriction of walrus hunting to people with valid professional hunting licences only; a year-round ban on walrus hunting south of 66° N; limitations on the means of transport used in connection with walrus hunting to dog sleds and vessels of 19.99 GRT/31.99 GT or less; and the sale of walrus products limited to direct sales at open markets or for personal use only. Municipal authorities now also have the possibility of implementing further restrictions if circumstances require. (*NAMMCO/8*)
- Greenland noted that in addition to the regulatory measures that were taken in 1999, it had been decided to introduce quotas on walrus. A new regulatory proposal has been drafted and public hearings will be held in the near future. The final regulatory proposal will take these hearings into account. (*NAMMCO/11*)
- Greenland informed the Committee that the regulatory initiative to introduce quotas and other hunting regulations for this species had been delayed, and comprehensive public hearings have been conducted. The draft regulations have now been submitted to the Council of Hunters. It is expected that a final decision on the initiative will be taken later in 2003 (*NAMMCO/12*).
- Greenland informed the Committee that a regulatory initiative that will restrict walrus hunting to those holding valid hunting licences, and allow for the introduction of quotas and other hunting regulations for this species was now in progress, and that public hearings were being conducted. The regulation will go to

the Greenlandic government for approval this year (*NAMMCO/13*).

- Greenland announced that they plan introducing quotas for walrus, possibly in 2005. Greenland is awaiting the findings of the Scientific Committee in their assessment of walrus (*NAMMCO/14*)

2. Ringed seals

2.1 Proposal for conservation and management

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 (*NAMMCO/6*).

Management measures/response by member countries:

None.

2.2 Proposal for conservation and management

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/6).*

Management measures/response by member countries:

The Greenland government is presently undertaking a regulatory initiative which will deal with hunting of all seals in Greenland, rather than just harbour seals as at present (*NAMMCO/11*).

3. Harp seals in the Northwest Atlantic

3.1 Proposal for conservation and management

The Management Committee requests that the Scientific Committee annually discusses the scientific information available on harp and hooded seals and advice on catch quotas for these species given by the ICES/NAFO Working Group on Harp and Hooded Seals. The advice by the Scientific Committee on catch quotas should not only be given as advice on replacement yields, but also levels of harvest that would be helpful in light of ecosystem management requirements.
For the Barents/White Sea and Greenland Sea stocks, in addition to the advice on replacement yields, advice should be provided on the levels of harvest that would result in varying degrees of stock reduction over a 10 year period (*NAMMCO/13*).

Management measures/response by member countries:

None

3.1 Northwest Atlantic

3.1.1 Proposal for conservation and management

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 /6*). Noting that Canada has instituted a multi-year management plan with a 3-year allowable catch of harp seals totalling 975,000 (not including the catch by Greenland), the Management Committee requested the Scientific Committee to provide advice on the likely impact on stock size, age composition, and catches in West Greenland and Canada under the conditions of this plan *(NAMMCO/13)*.

Management measures/response by member countries:

None.

3.1.2 Proposal for conservation and management

The Management Committee noted that combined estimated catches of harp seals in Canada and Greenland are in the order of 300,000 and that these catches are near or at, the established replacement yields (*NAMMCO/8*).

Management measures/response by member countries:

Canada brought to the attention of the Committee the recently completed Report of the Eminent Panel on Seal Management, which contains a full review of research and management of seals in Canada, with a primary focus on Northwest Atlantic harp and hooded seals. The Report is available at the following web site: http://www.dfo-mpo.gc.ca/seal-phoque/reports/index.htm. Canada also noted that an abundance survey of the Northwest Atlantic harp seals had been completed in 1999, and that published results were now available. (*NAMMCO/11*) Greenland commented that sustainable catches may be obtained at other catch levels than those that provide replacement yields. (*NAMMCO/11*) The Observer for Canada presented information on a multi-year management plan for the Atlantic seal hunt, which was announced in February 2003. For harp seals total allowable catch is set at 975,000 over a 3-year period. If the full quota were taken and Greenlandic harvests were as forecast, the total take should result in a slight population reduction over the period, while still maintaining the population well above the conservation reference points adopted. (*NAMMCO/12*) Greenland informed the Management Committee that bilateral discussions with Canada on the Canadian Management Plan had taken place over the past year *(NAMMCO/13)*

3.2 White/Barents Sea

Proposal for conservation and management

The Management Committee noted the stock status and catch options presented by the Scientific Committee, and concluded that the catch level in 1998 was well below the

calculated replacement yield. Catches at the same level in the future may result in population increase. From a resource management point of view, future quota levels approaching the replacement yield are advised. (*NAMMCO/9*)

Management measures/response by member countries:

Norway informed the Committee that measures were being considered to improve the efficiency of the seal harvest in this area. The possibility of introducing smaller vessels into the seal hunt is being pursued. The long-term goal will be to reduce the need for subsidising the hunt and increase the take of seals from this stock *(NAMMCO/13)*.

3.3 Greenland Sea

Proposal for conservation and management

The Management Committee noted the stock status and catch options presented by the Scientific Committee, and concluded that the catch level in 1998 was well below the calculated replacement yield. Catches at the same level in the future may result in population increase. From a resource management point of view, future quota levels approaching the replacement yield are advised. (*NAMMCO/6*)

Management measures/response by member countries:

Norway informed the Committee that, similar to the situation for the White/Barents Sea stock, efforts are being made to improve the efficiency of harvesting. Recent harvests have been a small fraction of available quotas. Again the long-term goal will be to reduce the need for subsidising the hunt and increase the take of seals from this stock *(NAMMCO/13)*.

4. Hooded seals

4.1 *Northwest Atlantic*

4.1.1 *Proposal for conservation and management*

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/6*)

Management measures/response by member countries:

None.

4.1.2 *Proposal for conservation and management*

The Management Committee noted that the total catch of hooded seals in the Northwest Atlantic in 1996 slightly exceeded the replacement yield while in 1997 the total number of seals taken was much lower. (*NAMMCO/8*)

Management measures/response by member countries:

Greenland noted that this stock was shared with Canada and that the two countries hold regular bilateral discussions on management of this stock, including an exchange of information on harvest statistics, utilisation and stock assessment. (*NAMMCO/11*)

4.2 Greenland Sea

Proposal for conservation and management

The Management Committee noted the stock status and catch options presented by the Scientific Committee, and concluded that the catch level in 1998 was well below the calculated replacement yield. Catches at the same level in the future may result in population increase. From a resource management point of view, future quota levels approaching the replacement yield are advised. (*NAMMCO/9*)

Management measures/response by member countries:

While supporting the past conclusion of the Management Committee that catch levels for this stock are below replacement yield, Norway noted that the abundance estimate for this stock is dated and that it hoped that new information should soon be available from surveys planned for 2002. (*NAMMCO/11*)
Norway informed the Committee that quotas in this area have been reduced on the advice of the ICES/NAFO Working Group on Harp and Hooded Seals, mainly because there is no recent abundance estimate for the stock. Consequently it is expected that the quota may be fully utilised this year *(NAMMCO/13)*.

5. Grey Seal

Proposal for conservation and management

The Management Committee noted the concern expressed by the Scientific Committee with regard to the observed decline in the grey seal stock around Iceland, where harvesting has been above sustainable levels for more than 10 years, with the apparent objective of reducing the size of the stock. The Management Committee agreed to recommend that Iceland should define clear management objectives for this stock.
The Management Committee noted the conclusion of the Scientific Committee that the new quota levels implemented for Norwegian grey seals would, if filled, almost certainly lead to a rapid reduction in population in the area. The Management Committee agreed to recommend that Norway should define clear management objectives for this stock.
For the Faroe Islands, the Management Committee supported the recommendation of the Scientific Committee to obtain better information on the level of catch *(NAMMCO/13)*.

Management measures/response by member countries:

Iceland reported that the management objective for grey seals would be to maintain the stock size close to the current level, and that protective measures would be taken should further declines continue. A precondition to this objective will be careful monitoring of the stock size (*NAMMCO/14*)
Norway reported that a management plan for grey seals is presently under development (*NAMMCO/14*)

CETACEANS

6. Northern bottlenose whales

Proposal for conservation and management

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/5*)

Management measures/response by member countries:

None.

7. Long-finned pilot whales

Proposal for conservation and management

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, 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. (*NAMMCO/7*)

Management measures/response by member countries:

In 1997 the Management Committee concluded that the Faroese drive hunt of pilot whales is sustainable. There have been no changes in annual take, new abundance estimates or other information that warrant any change in this conclusion. (*NAMMCO/11*)

8. Minke Whales - Central North Atlantic

8.1 Proposal for conservation and management

The Management Committee accepted that for the Central Stock Area the minke whales are close to their carrying capacity and that removals and catches of 292 animals per year (corresponding to a mean of the catches between 1980-1984) are sustainable. The Management Committee noted the conservative nature of the advice from the Scientific Committee. (*NAMMCO/8)*

Management measures/response by member countries:

None.

8.2 Proposal for conservation and management

The Management Committee took note of the conclusions of the Scientific Committee with regard to the Central Atlantic Stock, which, under all scenarios considered, a catch of 200 minke whales per year would maintain the mature component of the population above 80% of its pre-exploitation level over that period. Similarly, a catch of 400 per year would maintain the population above 70% of this level. This constitutes precautionary advice, as these results hold even for the most pessimistic combination of the lowest MSYR and current abundance, and the highest extent of past catches considered plausible. The advice applies to either the CIC Small Area (coastal Iceland), or to the Central Stock as a whole (*NAMMCO/13).*

Management measures/response by member countries:

None.

9. Beluga - West Greenland

9.1 Proposal for conservation and management

Maniitsoq – Disko The Management Committee noted that a series of surveys conducted since 1981 indicate a decline of more than 60% in abundance in the area Maniitsoq to Disko. It further noted that with the present harvest levels (estimated at 400/yr) the aggregation of belugas in this area is likely declining due to overexploitation.

Avanersuaq – Upernavik The present harvest in the area Avanersuaq - Upernavik is estimated to be more than 100/yr. The Management Committee noted that since this beluga occurrence must be considered part of those wintering in the area from Maniitsoq to Disko, it is considered to be declining due to overexploitation.

Finally the Management Committee noted the conclusion by the Scientific Committee that with the observed decline a reduction in harvesting in both areas seems necessary to halt or reverse the trend. *(NAMMCO/9)*

Management measures/response by member countries:

Greenland stated that this issue again will be thoroughly discussed with the hunters, and that the Greenland Government does share the concerns expressed. (*NAMMCO/10*)

Greenland informed the Committee that in November 2000 the government made a decision to introduce harvest quotas for beluga and narwhal. Public hearings on a draft regulatory proposal were held in spring 2001. The results of these hearings are being taken into account in the drafting of a revised regulatory proposal, and a final set of regulations is expected to be introduced sometime in 2002. (*NAMMCO/11*)

Greenland informed the Committee that the regulatory initiative to introduce quotas and other hunting regulations for this species had been delayed, and comprehensive public hearings have been conducted. The draft regulations have now been submitted to the Council of Hunters. It is expected that a final decision on the initiative will be taken later in 2003. (*NAMMCO/12*)

9.2 Proposal for conservation and management

It was accepted that the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB) would provide management advice for this stock, which is shared by Canada and Greenland. The Management Committee therefore recommended that closer links be developed between NAMMCO and the JCNB on this and other issues of mutual concern. Greenland stated that this issue again will be thoroughly discussed with the hunters, and that the Greenland Government does share the concerns expressed. *(NAMMCO/10)*

Management measures/response by member countries:

None

9.3 Proposal for conservation and management

In 2000 the Management Committee accepted that the Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB) would provide management advice for this stock, which is shared by Canada and Greenland. The Management Committee noted with pleasure that a joint meeting of the NAMMCO Scientific Working Group on the Population Status of North Atlantic Narwhal and Beluga and the JCNB Scientific Working Group had been held in May 2001, and recommended that this cooperation at the scientific level should continue. The Management Committee also reiterated its recommendation that closer links be developed between NAMMCO and the JCNB on this and other issues of mutual concern. *(NAMMCO/11)*

Management measures/response by member countries:

Greenland informed the Committee that a regulatory framework allowing the government to set quotas and other limitations on hunting has now been passed. The new regulations provide protection for calves and females with calves and limit the size of vessels that are involved in beluga and narwhal hunting as well as hunting methods. The Municipalities will have the power to limit or prohibit the use of nets for narwhal/beluga harvesting. It is expected that quotas will be introduced for beluga and narwhal by July 2004. The municipalities will be involved in the allocation of the quotas (NAMMCO/13).

Greenland informed the Committee that a quota of 320 had been introduced in West Greenland and Qaanaaq year-round from 1st July 2004. (*NAMMCO/14*)

10. Narwhal - West Greenland

10.1 Proposal for conservation and management

Avanersuaq The Management Committee noted that the present exploitation level in Avanersuaq of 150/yr seems to be sustainable, assuming that the same whales are not harvested in other areas

Melville Bay – Upernavik The Management Committee noted that the Scientific Committee could give no status for the Melville Bay – Upernavik summering stock.

Uummannaq The Management Committee noted that the substantial catches (several hundreds) in some years do cause concern for the status of this aggregation. The Management Committee further noted that the abundance of narwhal in this area should be estimated.
Disko Bay The Management Committee noted that present catches in this area are probably sustainable.
Catch Statistics The Management Committee noted that for both narwhal and beluga it is mandatory for future management that more reliable catch statistics (including loss rates) are collected from Canada and Greenland. (*NAMMCO/9*)

Management measures/response by member countries:

As for beluga, harvest quotas will be introduced for West Greenland narwhal in the near future. (*NAMMCO/11*)
Greenland informed the Committee that the regulatory initiative to introduce quotas and other hunting regulations for this species had been delayed, and comprehensive public hearings have been conducted. The draft regulations have now been submitted to the Council of Hunters. It is expected that a final decision on the initiative will be taken later in 2003. *(NAMMCO/12*)

10.2 Proposal for conservation and management

The Management Committee accepted that the JCNB would provide management advice for this stock, which is shared by Canada and Greenland. The Management Committee therefore recommended that closer links be developed with the JCNB on this and other issues of mutual concern. *(NAMMCO/10)*

Management measures/response by member countries:

Greenland informed the Committee that the new regulations mentioned under 5.8 for beluga will also apply to narwhal, and that quotas will be introduced in July 2004 (*NAMMCO 13*)

10.3 Proposal for conservation and management

The Management Committee noted the conclusions of the Scientific Committee, that the West Greenland Narwhal have been depleted, and that a substantial reduction in harvest levels will be required to reverse the declining trend. These are preliminary conclusions, and more research and assessment work will be required. Nevertheless the Management Committee expressed its grave concern over the status of the West Greenland Narwhal, and noted that the JCNB, which provides management advice for this stock, would be considering this information in the near future. The Management Committee also noted that it will be important for NAMMCO to monitor the situation closely and update the assessment as soon as more information is available. *(NAMMCO 13)*

Management measures/response by member countries:

Greenland informed the Committee that quotas of 200 in West Greenland and 100 in Qaanaaq had been introduced in 2004 (*NAMMCO/14*)

11. North Atlantic fin whales

11.1 Proposal for conservation and management

The Management Committee accepted that for fin whales in the East Greenland – Iceland (EGI) stock area, removals of 200 animals per year would be unlikely to bring the population down below 70% of its pre-exploitation level in the next 10 years, even under the least optimistic scenarios. However, catches at this level should be spread throughout the EGI stock area, roughly in proportion to the abundance of fin whales observed in the NASS surveys. Furthermore, the Management Committee stressed that the utilisation of this stock should be followed by regular monitoring of the trend in the stock size.

The Management Committee also noted the conservative nature of the advice from the Scientific Committee on which the conclusion of the Management Committee was *based. (NAMMCO/9)*

<u>East Greenland-Iceland Stock</u>

The Management Committee noted the conclusion of the Scientific Committee that projections under constant catch levels suggest that the inshore substock will maintain its present abundance (which is above MSY level) under an annual catch of about 150 whales. It is important to note that this result is based upon the assumption that catches are confined to the “inshore” substock, *i.e.* to the grounds from which fin whales have been taken traditionally. If catches were spread more widely, so that the “offshore” substock was also harvested, the level of overall sustainable annual catch possible would be higher than 150 whales. *(NAMMCO 13)*

<u>Faroe Islands</u>

The Management Committee noted that the conclusion of the Scientific Committee had not changed from the previous assessment, that the uncertainties about stock identity are so great as to preclude carrying out a reliable assessment of the status of fin whales in Faroese waters, and thus the Scientific Committee was not in a position to provide advice on the effects of various catches. It may also be necessary to obtain clearer guidance on the management objectives for harvesting from what is likely to be a recovering stock before specific advice can be given. *(NAMMCO/13)*

Management measures/response by member countries:

None

12. Incorporation of the users’ knowledge in the deliberations of the Scientific Committee

12.1 Proposal for conservation and management

The Management Committee endorsed the proposals and viewpoints contained in section 6 in the Scientific Committee report, and suggested that the “Draft Minke Whale Stock Status Report” (*NAMMCO/9/7*) could usefully serve as a pilot project for cooperation with the hunters. (*NAMMCO/9*)

Management measures/response by member countries:

Status Reports under development.

12.2 Proposal for conservation and management

The Management Committee had previously asked the Secretariat to proceed with a proposal by the Scientific Committee to use stock status reports as a starting point for discussions with resource users to incorporate their knowledge in advice to Council, and to use the stock status report on minke whales as a pilot project. However, in 2000 the Management Committee recommended that a proposal for a conference on incorporating user knowledge and scientific knowledge into management advice should proceed, and asked the Conference Advisory Group to plan this conference to evaluate whether and how the previous proposal for incorporating user knowledge into the Scientific Committee's deliberations could be incorporated into the Conference. (*NAMMCO/11*)

Management measures/response by member countries:

Greenland informed the Committee that a person had been hired at the Greenland Institute of Natural Resources to deal with these issues, and that this employee is also on the Advisory Board of the Conference. (*NAMMCO/11*)

LIST OF REFERENCES

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Appendix 4

SUMMARY OF REQUESTS BY NAMMCO COUNCIL TO THE SCIENTIFIC COMMITTEE, AND RESPONSES BY THE SCIENTIFIC COMMITTEE

The following provides a summary of all requests by NAMMCO Council to the Scientific Committee **(**including NAMMCO/14 - 2005), and notes the response of the Scientific Committee (SC) to these requests. Requests forwarded from NAC (North Atlantic Committee for Cooperation on Research on Marine Mammals) to ICES (International Council for the Exploration of the Sea) prior to NAMMCO's establishment, and which were carried over to NAMMCO in 1992, are included. Unless otherwise stated the status of the request and response is ongoing.

1. ROLE OF MARINE MAMMALS IN THE ECOSYSTEM

Marine mammal - fish interaction:

Code/Meeting: 1.1/ NAMMCO/1-
Request:

To provide an overview of the current state of knowledge of the dependence of marine mammals on the fish and shrimp stocks and the interrelations between these compartments

Response of the Scientific Committee:

See 1.2, 1.4, 1.7, 1.9, 1.10.

Code/Meeting: 1.2/NAMMCO/1
Request:

In the multi-species context ... to address specific questions related to the Davis Strait ecosystem such as: • the apparent increase in harp seal stocks; • its influence on the economically important shrimp and cod stocks; • the impact of the fisheries on marine mammals, particularly harp seals; • the southward shift of minke whale distribution in recent years, and • observed changes in oceanographical conditions after the 1970s; • and to the East Greenland-Iceland-Jan Mayen area interactions between capelin stocks, fishery and marine mammals

Response of the Scientific Committee:

• Questions related to harp and hooded seals were forwarded to the ICES/NAFO Joint Working Group on Harp and Hooded Seals (SC/2) • Specific questions related to the Davis Strait ecosystem were not addressed. • See also 1.4, 1.7, 1.9, and 1.10.

Code/Meeting: 1.3/NAMMCO/2
Request:

To assess the impact of marine mammals on the marine ecosystem, with special emphasis on the availability of economically important fish species

Response of the Scientific Committee:

See 1.2, 1.4, 1.7, 1.9, 1.10

Code/Meeting: 1.4/ NAMMCO/6
Request:

The Scientific Committee was requested 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.

Response of the Scientific Committee:

The Scientific Committee established a Working Group on the Role of Minke Whales, Harp Seals and Hooded Seals in the North Atlantic. The Scientific Committee used the report of this Working Group to provide advice to Council, and to recommend further research. (SC/5) Many of the papers presented will be published in Volume 2 of NAMMCO Scientific Publications. (SC/7)

Code/Meeting: 1.5/NAMMCO/7
Request:

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.

Response of the Scientific Committee:

See 1.9, 1.10

Multi-species approaches to management:

Code/Meeting: 1.6/NAMMCO/1
Request:

To consider whether multi-species models for management purposes can be established for the North Atlantic ecosystems and whether such models could include the marine mammals compartment. If such models and the required data are not available then identify the knowledge lacking for such an enterprise to be beneficial to proper scientific management and suggest scientific projects which would be required for obtaining this knowledge.

Response of the Scientific Committee:

See 1.4, 1.7, 1.9, 1.10

Code/Meeting: 1.7/NAMMCO/5
Request:

In 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.

Response of the Scientific Committee:

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

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). (SC/5)

Sealworm infestation:

Code/Meeting: 1.8/NAMMCO/6 – Status: COMPLETED
Request:

Aware 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 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.

Response of the Scientific Committee:

The Scientific Committee established a Working Group on Sealworm Infection to address this question. The Scientific Committee used their report as the basis for providing advice to Council, and developing recommendations for further research. (SC/5) Many of the papers considered by the Working Group are published in *NAMMCO Scientific Publications* Vol. 3 *Sealworms in the North Atlantic: Ecology and population dynamics* (SC/7)

Economic aspects of marine mammal-fisheries interactions:

Code/Meeting: 1.9/NAMMCO/7
Request:

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

Response of the Scientific Committee:

The Scientific Committee established a Working Group on Economic Aspects of Marine Mammal-Fisheries Interactions. The Scientific Committee concluded that inclusion of economic considerations is a valuable addition to multi-species models of interactions between marine mammals and fisheries. The work presented at the Working Group was considered the first step towards more complete analyses of these interactions and it was recommended, in light of the economic impacts, that more complete models should be developed and presented. The Scientific Committee showed a continued interest in the development of the models and it was decided to maintain the Working Group and seek further guidance from the Council on matters of particular interest. (SC/6)

Code/Meeting: 1.10/NAMMCO/8
Request:

The Scientific Committee is requested to investigate the following economic aspects of marine mammal – fisheries interactions:

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

Response of the Scientific Committee:

The Working Group on the Economic Aspects of Marine Mammal - Fisheries Interactions was reactivated to meet this request. It was agreed to separate the request into two sections. At the first Working Group meeting the first two items in the request were addressed. The Working Group used available information to derive estimates of consumption of cod, herring, capelin and shrimp by harp seals, minke whales and *Lagenorhynchus* spp. and bottlenose dolphins in some areas. Multi-species models presently in use or under development in Norway and Iceland offer a means of assessing the impact of marine mammal predation on fish stocks The Scientific Committee therefore recommended that the next logical step in addressing the request should be for NAMMCO to lead or assist in the development of a multi-species-economic model for a candidate area. However, the Scientific Committee reiterated that the estimation and model uncertainties are such that definitive quantification of the economic aspects of marine mammal-fisheries interactions in candidate areas cannot be expected in the near term. (SC/8)

Code/Meeting: 1.11/NAMMCO/10
Request:

Noting the requests for advice from the Council at its 8th meeting in Oslo 1998 (see Annual Report 1998 page 23), the Management Committee recommended that the Scientific Committee continue the assessment of the economic aspects of fishery - marine mammal interactions in the two areas (Barents Sea and Iceland) and with the two species (minke whales and harp seals) that have been identified as feasible for this assessment.

Response of the Scientific Committee:

The Scientific Committee convened a workshop under the theme "Marine Mammals: From feeding behaviour or stomach contents to annual consumption - what are the main uncertainties ", to further investigate the methodological and analytical problems in estimating consumption by marine mammals. (SC/9)

Code/Meeting: 1.12/NAMMCO/11
Request:

The Management Committee noted the conclusion of the Scientific Committee that the estimation and model uncertainties are such that the economic aspects of marine mammal-fishery interactions in candidate areas cannot be quantified without further work. The Management Committee therefore recommended that the Scientific Committee should hold a workshop on ecosystem models aiming for a better understanding of the ecological role of minke whales and harp and hooded seals in the North Atlantic, as proposed in the Scientific Committee report.

Response of the Scientific Committee:

The Scientific Committee convened a workshop, under the theme "Modelling Marine Mammal – Fisheries Interactions in the North Atlantic", to investigate how presently available ecosystem models can be adapted for quantifying marine mammal - fishery interactions. (SC/10)

Code/Meeting: 1.13/NAMMCO/12
Request:

The Management Committee agreed that the Scientific Committee should monitor progress made in multi-species modelling and in the collection of input data and decide when enough progress has been made to warrant further efforts in this area. Future meetings should focus on assessing modelling results from the Scenario Barents Sea model and possibly the GADGET-based template models for other areas, if they are developed. The Scientific Committee should also consider the feasibility of connecting the multi-species models with simple economic models at that time.

Response of the Scientific Committee:

The Scientific Committee convened a Working Group to to review the progress that has been made in the last two years, in 2 specific areas: 1) quantifying the diet and consumption of marine mammals, and 2) the application of multi-species models that include marine mammals to candidate areas of the North Atlantic (SC/12).

2. ENVIRONMENTAL ISSUES

Code/Meeting: 2.1/NAMMCO/1
Request:

To describe the possible pathways of radioactive material from blowouts and leakage in existing nuclear power plants, leakage from dumped material and possible accidents in planned recycling plants in the northern part of Scotland into the food web of the North Atlantic and hence into the top predators like marine mammals.

Response of the Scientific Committee:

Forwarded to ICES.

Code/Meeting: 2.2/NAMMCO/1
Request:

To review the contaminant burdens (especially organochlorines) in marine mammals in the North Atlantic and evaluate the possible sources of these contaminants.

Response of the Scientific Committee:

No response from the Scientific Committee. In 1995, NAMMCO hosted the International Conference on Marine Mammals and the Marine Environment. The Conference covered the following themes: Marine mammals and the marine environment - impacts and management approaches; Contaminants in marine mammals – sources, levels and effects; Coastal communities and marine pollution – social, economic and health considerations; Addressing the questions – problems and future needs. The proceedings were published as a special issue of *The Science of the Total Environment* (186: 1,2).

3. MANAGEMENT PROCEDURES

Code/Meeting: 3.1/NAMMCO/2
Request:

To review the basis for, and develop assessments necessary to provide the scientific foundation for conservation and management of the stocks relevant for management under NAMMCO.

Response of the Scientific Committee:

A Working Group on Management Procedures was established to consider this matter. (SC/2). The Scientific Committee noted that there were many different management needs requiring different management procedures. It was agreed that there was need for more guidance on management objectives before any concrete work can be started on developing appropriate management procedures, and in turn this was likely to be case- (species and/or area) specific. Related to this it was also noted that NAMMCO may prefer to assume an advisory and evaluative role in developing its management. (SC/2)

Code/Meeting: 3.2/NAMMCO/4
Request:

Further development of RMP-like procedures.

Response of the Scientific Committee:

The Scientific Committee decided to develop management procedures on a case-by-case basis: "a more pragmatic approach on an area and species/case-specific basis would be desirable for the development of specific management procedures. It was therefore decided to suggest that requests for advice from the Council be accompanied by specific objectives defined for the case in question". (SC/3)

4. STOCKS/SPECIES

Monitoring marine mammal stock levels and trends in stocks /North Atlantic Sightings Surveys (NASS):

Code/Meeting: 4.1.1/NAMMCO/3
Request:

To plan joint cetacean sighting surveys in the North Atlantic by co-ordinating national research programmes.

Response of the Scientific Committee:

The Scientific Committee agreed to establish a Working Group to plan the sighting survey for the summer of 1995. (SC/2)
The Scientific Committee was pleased to note the good progress that had been made in planning this important joint research, in which the Faroes (1 vessel), Iceland (3 vessels and 1 aircraft) and Norway (11 vessels) had decided to participate. It was noted that Greenland had decided not to conduct surveys as part of these joint efforts. (SC/3)
The Scientific Committee agreed to recommend that a special fund of NOK 800,000 be established from the NAMMCO budget for use in financing various aspects of NASS-95, where required. (SC/3)

Code/Meeting: 4.1.2/NAMMCO/5
Request:

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.

Response of the Scientific Committee:

The Scientific Committee agreed to establish a Working Group on Abundance Estimates. The task of the Working Group on Abundance Estimates would be to review analyses and where relevant also 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. (SC/4)

Code/Meeting: 4.1.3/NAMMCO/6
Request:

The Management Committee noted the successful completion of the North Atlantic Sightings Survey in 1995, and commended the process initiated by the Scientific Committee to conclude the analysis of NASS-95 data. It was expected that the results on abundance will be dealt with by the newly established Scientific Committee Working Group on Abundance Estimates and will be presented at the next annual meeting. It was noted that the Working Group would at least to some extent address last year's request from the Council regarding monitoring of stock levels and trends in stocks. However, it was also noted that one outstanding matter from last year is the request to the Scientific Committee to review results of NASS-95 in the light of recent assessments of North Atlantic whale stocks.
The Council agreed to the suggestion from the Management Committee that this be drawn to the attention of the Scientific Committee to secure a follow-up to last year's request.

Response of the Scientific Committee:

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 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 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, and used them as a basis to provide advice to Council. The Scientific Committee also recommended that the results of NASS-95 be compiled to a future volume of *NAMMCO Scientific Publications*. (SC/5)

Code/Meeting: 4.1.4/NAMMCO/7
Request:

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 prioritise 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.

Response of the Scientific Committee:

See 4.1.3.

Code/Meeting: 4.1.5/NAMMCO/9
Request:

NASS-95: The Management Committee noted particularly that abundance estimates from NASS-95 have not been completed for some species. The Management Committee therefore recommended that the Scientific Committee complete abundance estimates for all species, as part of its efforts to monitor the abundance of all species in the North Atlantic.

Response of the Scientific Committee:

The Scientific Committee noted that abundance estimates for the main target species of NASS-95 (minke whale, fin whale, sei whale, pilot whale) had been completed and accepted by them, however most had not yet been published in the primary scientific literature. The Scientific Committee agreed that further analyses of the abundance of non-target species from the NASS-95 survey should be conducted if they are warranted. However, as the survey was not optimised for these species, it was recognised that the design and conduct of the survey would make this possible to a varying degree, depending on both the species and area in question. In some cases, a general description of the spatial distribution of sightings may be the only analysis warranted. The Scientific Committee agreed to pursue these analyses in the coming year. (SC/8) The Scientific Committee considered new information on the NASS-95 Icelandic aerial and shipboard surveys for minke whales, and a new abundance estimate for humpback whales from the NASS-95 Icelandic shipboard survey. (SC/9)

Code/Meeting: 4.1.6/NAMMCO/9
Request:

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

Response of the Scientific Committee:

The Working Group on Abundance Estimates met in November 2000 to plan for NASS-2001. The survey was conducted in June/July 2001. (SC/9)

Code/Meeting: 4.1.7/NAMMCO/11
Request:

The Management Committee recommended that remaining abundance estimates from the NASS-95 and new estimates from the NASS-2001 surveys should be developed as soon as feasible, with the target species of the surveys being of highest priority. The Management Committee emphasised that this work should be published in a timely manner.

Response of the Scientific Committee:

The Working Group on Abundance Estimates met in March 2002 and developed preliminary abundance estimates for fin whales, minke whales, humpback whales, sperm whales and dolphins. In addition a full evaluation of the 2001 survey was conducted, and recommendations for future surveys were made. (SC/10).
The Working Group on Abundance Estimates met in February 2003 and considered abundance estimates for minke, fin, humpback, blue, pilot and northern bottlenose whales (SC/11)

Code/Meeting: 4.1.8/NAMMCO/13
Request:

The Management Committee welcomed the new abundance estimates for particularly minke and humpback whales in the Central North Atlantic. The NASS have been highly successful in providing important information on the distribution and abundance of cetaceans over a broad area of the North Atlantic. This information becomes more valuable every time a survey is completed, as it provides an indication of trends in abundance over meaningful time periods. The Management Committee therefore requested that the Scientific Committee coordinate the efforts of member countries in planning and conducting a large-scale sightings survey in 2006. In order to ensure as broad a coverage as possible, this should include co-ordination with planned surveys by non-member countries, and inviting other jurisdictions, particularly in the Western Atlantic, to participate in the surveys.

Response of the Scientific Committee:

The next NASS will take place in 2007, and planning will begin in 2006 (SC/12).

Central North Atlantic minke whales:

Code/Meeting: 4.2.1/NAMMCO /7
Request:

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.

Response of the Scientific Committee:

The Scientific Committee agreed to assign the task of assessing the status of the stock to the Working Group on Management Procedures. The Council had requested the Scientific Committee to provide its advice on this matter prior to the next meeting of the Council, however it was the general view of the Committee that it was unlikely that this work could be completed within this time frame. (SC/5)
The Scientific Committee used the report of the Working Group on Management Procedures as the basis for providing advice and research recommendations to Council. The Committee agreed that catches of 292 per year (the mean of the catch between 1980-84) are sustainable for the Central stock, and that catches of 185 whales per year are sustainable for the coastal Iceland(SC/6)

Code/Meeting: 4.2.2/NAMMCO/8
Request:

In order to ascertain the stock structure of minke whales in the North Atlantic, the Scientific Committee is requested to investigate the possibility of supplementing present sampling with existing older material from NAMMCO countries and other countries in joint genetic analyses. If possible, such analyses should be undertaken.

Response of the Scientific Committee:

It was noted that such exchanges of samples are ongoing between Norway and Greenland. Samples collected in the past from Iceland and Norway have already been analysed concurrently, and there are no recent samples from Iceland. The Scientific Committee concluded that available samples are being utilised effectively. (SC/7)

Code/Meeting: 4.2.3/NAMMCO/11
Request:

The Management Committee recommended that the Scientific Committee should complete an assessment of Central Atlantic minke whales once new abundance estimates from NASS-2001 become available.

Response of the Scientific Committee:

The Scientific Committee completed the assessment and provided advice on sustainable catches to the Council (SC/11).

Northern bottlenose whales:

Code/Meeting: 4.3.1/NAMMCO/2
Request:

To undertake an assessment of the status of the northern bottlenose whale (*Hyperoodon ampullatus*) stock in the North Atlantic.

Response of the Scientific Committee:

A Working Group on Northern Bottlenose and Killer Whales was established, and provided a preliminary assessment which was used as the basis of advice and recommendations for further research given by the Scientific Committee. (SC/2)

Code/Meeting: 4.3.2/NAMMCO/4
Request:

To undertake the necessary modelling of the species as suggested under ... items 9.2. and 10.2.2 of ...[the Report of the Third Meeting of the Scientific Committee, 1993]. (SC/3)

Response of the Scientific Committee:

A joint session was held of the Working Group on Northern Bottlenose Whales and the Working Group on Management Procedures in order to consider the request from the Council to undertake the necessary modelling of the population using catch series and abundance estimates. Their report was used as the basis for advice and research recommendations conveyed by the Scientific Committee. (SC/3)

Killer whales:

Code/Meeting: 4.4.1/NAMMCO/2
Request:

To advise on stock identity for management purposes; to assess abundance in each stock area; to assess effects of recent environmental changes, changes in the food supply and interactions with other marine living resources in each stock area.

Response of the Scientific Committee:

A Working Group on Northern Bottlenose and Killer Whales was established by the Scientific Committee, and provided a preliminary assessment. This provided the basis for advice and research recommendations given by the Scientific Committee. (SC/2)
The Chair 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. (SC/5)

Code/Meeting: 4.4.2/NAMMCO/13
Request:

The Management Committee requested the Scientific Committee to review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, and to provide advice on research needs to improve this knowledge. Priority should be given to killer whales in the West Greenland – Eastern Canada area.

Response of the Scientific Committee:

The Scientific Committee concluded that there was not enough information to carry out the assessment at this time, particularly for the West Greenland area. The Scientific Committee will review new information on killer whales annually with the aim of completing the assessment once sufficient information becomes available for a particular area (SC/12).

Long-finned pilot whales:

Code/Meeting: 4.5.1/NAMMCO/1

Request:

To provide an assessment of the state of the pilot whale stock in the north eastern Atlantic, based on the information sampled from the Faroese drive fishery and the NASS sighting surveys.

Response of the Scientific Committee:

The Scientific Committee decided to base its advice on the report of the ICES Study Group on Long-Finned Pilot whales. They concluded that an evaluation of status could not be provided without further work.(SC/2)

Code/Meeting: 4.5.2/NAMMCO/2
Request:

To analyse the effects of the pilot whale drive hunt in the Faroe Islands on North Atlantic pilot whales (*Globicephala melas*), especially whether the numbers taken are consistent with sustainable utilisation.

Response of the Scientific Committee:

This matter was addressed by the Scientific Committee, based on the findings of the ICES Study Group and the review of the results of NASS-95. The Scientific Committee agreed to endorse the list of future research requirements listed by the ICES Study Group in its report, and provided advice on the sustainability of the Faroese catch. (SC/5)

Narwhal and beluga:

Code/Meeting: 4.6.1/NAMMCO/7
Request:

The Scientific Committee was requested to examine the population status of narwhal and beluga (white whales) throughout the North Atlantic.

Response of the Scientific Committee:

The Scientific Committee established a Working Group on the Population Status of Narwhal and Beluga in the North Atlantic, which met in March 1999. The Scientific Committee used the report of the Working Group to evaluate the stock status of the various narwhal and beluga aggregations, and provided recommendations to Council. (SC/7)

Code/Meeting: 4.6.2/NAMMCO/8
Request:

The Management Committee requested advice from the Scientific Committee on the level of sustainable utilisation of West Greenland beluga in different areas and under different management objectives. For narwhal, the Management Committee requested that the Scientific Committee identify the information which is lacking in order to answer the same question proposed with respect to beluga.

Response of the Scientific Committee:

The Scientific Committee reactivated the Working Group on the Population Status of Narwhal and Beluga and used its report as the basis of its recommendations to the Council. The Scientific Committee concluded that the stock is substantially depleted and that present harvests are several times the sustainable yield, and, if continued, will

likely lead to stock extinction within 20 years. The Committee assessed a range of harvest options with the overall objective of arresting the decline of West Greenland Beluga, and provided prioritised research recommendations. (SC/8)
The Scientific Committee noted that developing recommendations on the sustainable harvest of narwhal in Greenland will require significant additional research and cannot be done at present. To this end, the Scientific Committee provided research recommendations to answer questions about catch statistics, stock identity and abundance. (SC/8)

Code/Meeting: 4.6.3/NAMMCO/10
Request:

The Management Committee recommended that the Scientific Committee continue its assessment of West Greenland beluga with reference to the short-term research goals identified. It is anticipated that a joint meeting of the Scientific Working Group of the JCNB and the NAMMCO Scientific Working Group on the Population Status of Narwhal and Beluga in the North Atlantic can be held in spring 2001.

Response of the Scientific Committee:

The Scientific Committee Working Group on the Population Status of Narwhal and Beluga in the North Atlantic met jointly with the Scientific Working Group of the Joint Commission on the Conservation and Management of Narwhal and Beluga (JCNB) to deal with these requests. The Scientific Committee used their report to provide catch options for West Greenland Beluga and research recommendations for West Greenland beluga and narwhal. (SC/9)

Code/Meeting: 4.6.4/NAMMCO/10
Request:

The Management Committee recommended that the Scientific Committee complete an assessment of narwhal in West Greenland when the necessary data are available. Specifically, the Scientific Committee is requested to evaluate the extent of movements of narwhal between Canada and Greenland.

Response of the Scientific Committee:

See 4.6.1. The Scientific Committee used evidence from genetic and contaminant analysis, satellite tagging and hunter knowledge to evaluate the extent of movement between Greenland and Canada. (SC/9)

Code/Meeting: 4.6.5/NAMMCO/11
Request:

The Management Committee recommended that the Scientific Committee should concentrate its assessment efforts on the West Greenland narwhal in the near term.

Response of the Scientific Committee:

The Scientific Committee concluded that West Greenland narwhal were depleted and recommended catch levels for the Inglefield Bredning, Uummannaq, Disko Bay and Melville Bay areas (SC/12)

Code/Meeting: 4.6.6/NAMMCO/12
Request:

The Management Committee noted that a new survey of West Greenland beluga will be conducted in 2004. The Scientific Committee was therefore requested to update the assessment of West Greenland Beluga in light of the new survey results and any other new information. The main management objective is to halt the decline of this stock.

Response of the Scientific Committee:

Survey not successful in 2004. Response pending.

Code/Meeting: 4.6.7/NAMMCO/13

Request:

The Committee noted that a new survey will be carried out in the over-wintering area of the West Greenland beluga in March 2004. If the survey is successful, it will provide an abundance estimate with which to update the assessment of this stock. The Management Committee therefore endorsed the plan of the Scientific Committee to update this assessment in 2005, jointly with the Scientific Working Group of the JCNB.

Response of the Scientific Committee:

The survey was not successful in 2004, and may be attempted again in 2005.

Code/Meeting: 4.6.8/NAMMCO/14

Request:

The Management Committee requested that the Scientific Committee carry out an assessment of East Greenland narwhal, and provide an estimate of sustainable yield for the stock. The management objective in this case is to maintain the stock at a stable level. If the assessment cannot be completed with available information, the Scientific Committee should provide a list of research that would be required to complete the assessment.

Response of the Scientific Committee:

Pending.

Harbour porpoises:

Code/Meeting: 4.7.1/NAMMCO/7

Request:

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.

Response of the Scientific Committee:

The Scientific Committee decided that the matter could best be dealt with by convening an international workshop/symposium on harbour porpoises, which would involve experts working on this species throughout its North Atlantic range. The agenda would include the following themes: distribution, abundance and stock

identity; biological parameters; ecological interactions; pollutants; removals and sustainability of removals. (SC/6)
The Scientific Committee utilised the report of the Symposium to develop its own assessment advice to the Council. Recent abundance estimates are available for only a few places in the North Atlantic. Directed harvesting occurs in some areas, but most removals are through by-catch. In some areas, present removals are not sustainable. The Scientific Committee developed research recommendations to address some of the information needs for management of this species. (SC/8)

Atlantic walrus:

Code/Meeting: 4.8.1/NAMMCO/2
Request:

To advise on stock identity for management purposes; to assess abundance in each stock area; to assess long-term effects on stocks by present removals in each stock area; to assess effects of recent environmental changes (i.e. disturbance, pollution) and changes in the food supply.

Response of the Scientific Committee:

The assessment was postponed pending report of Walrus International Technical and Scientific Committee (WITS). (SC/2) It was decided in late 1994 to request Erik Born of the Greenland Fisheries Research Institute in Copenhagen to coordinate the compilation of a status report on the Atlantic walrus in time for the present Scientific Committee meeting. The result of this collaboration was the report, E.W. Born, I. Gjertz and R.R. Reeves, "Population assessment of Atlantic walrus (*Odobenus rosmarus rosmarus*)" This report was used by the Scientific Committee as the basis of its management and research recommendations to Council. (SC/3)

Code/Meeting: 4.8.2/NAMMCO/13
Request:

The Management Committee noted that the Scientific Committee had last provided an assessment of walrus in 1994. Noting that considerable new information has become available since then, the Management Committee therefore requested the Scientific Committee to provide an updated assessment of walrus, to include stock delineation, abundance, harvest, stock status and priorities for research.

Response of the Scientific Committee:

Pending.

Harp and hooded seals:

Code/Meeting: 4.9.1/NAMMCO/2
Request:

- to assess the stock size, distribution and pup production of harp seals in the Barents Sea and White Sea, and of harp and hooded seals in the Greenland Sea and the Northwest Atlantic;
- to assess sustainable yields at present stock sizes and in the long term under varying options of age composition in the catch;

- to provide advice on catch options in the White Sea/Barents Sea/Greenland Sea and NAFO areas;
- to assess effects of recent environmental changes or changes in the food supply and possible interaction with other living marine resources in the areas.

Response of the Scientific Committee:

- These requests forwarded to Joint ICES/NAFO Working Group on Harp and Hooded Seals. A partial assessment was completed, but more work was required. (SC/2)
- The Scientific Committee considered the report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals which had met in Dartmouth, Canada, 5-9 June 1995. The Scientific Committee endorsed the recommendations in the report and identified further research needs. However the required assessments had not yet been completed. (SC/4).
- The Scientific Committee considered the report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals which had met in Copenhagen in 1997. The Scientific Committee used this report as the basis for its advice to Council, while noting that catch options had not been completed for Greenland Sea harp and hooded seals, and White Sea and Barents Sea harp seals. (SC/6)
- The Joint ICES/NAFO Working Group on Harp and Hooded Seals met in 1998 to complete the assessments for Greenland Sea harp and hooded seals, and White Sea and Barents Sea harp seals. The Scientific Committee used their report as the basis of its advice to Council, and noted that the required assessments had now been completed. Assessment of the effects of recent environmental changes or changes in the food supply and possible interaction with other living marine resources in the areas is ongoing. (SC/7)

Code/Meeting: 4.9.2/NAMMCO/8
Request:

The Scientific Committee is requested to coordinate joint feeding studies of harp and hooded seals in the Nordic Seas (Iceland, Greenland and Norwegian Seas) and off West Greenland.

Response of the Scientific Committee:

The Scientific Committee noted that preparations to coordinate such studies between member countries were already under way, outside of the NAMMCO Scientific Committee. The Scientific Committee therefore emphasised its support for such joint studies and urged member countries to participate. (SC/7)

Code/Meeting: 4.9.3/NAMMCO/11
Request:

The Management Committee recommended that the Scientific Committee regularly update the stock status of North Atlantic harp and hooded seal stock as new information becomes available.

Response of the Scientific Committee:

Ongoing as new information becomes available.

Code/Meeting: 4.9.4/NAMMCO/12

Request:

The Management Committee noted that new information recently had become available on the abundance of harp seals in the Greenland Sea and the Northwest Atlantic. In addition, new information is available on movements and stock delineation of harp seals in the Greenland, Barents and White seas. The Management Committee therefore reiterated its previous request to the Scientific Committee to regularly update the stock status of North Atlantic harp and hooded seals as new information becomes available. The Management Committee noted the likely impact of increasing abundance of these species on fish stocks. For harp seals in the Northwest Atlantic, the immediate management objective is to maintain the stocks at their present levels of abundance.

Response of the Scientific Committee:

Ongoing as new information becomes available.

Code/Meeting: 4.9.5/NAMMCO/13

Request:

The Management Committee requests that the Scientific Committee annually discusses the scientific information available on harp and hooded seals and advice on catch quotas for these species given by the ICES/NAFO Working Group on Harp and Hooded Seals. The advice by the Scientific Committee on catch quotas should not only be given as advice on replacement yields, but also levels of harvest that would be helpful in the light of ecosystem management requirements. For the Barents/White Sea and Greenland Sea stocks, in addition to the advice on replacement yields, advice should be provided on the levels of harvest that would result in varying degrees of stock reduction over a 10 year period. Noting that Canada has instituted a multi-year management plan with a 3-year allowable catch of harp seals totalling 975,000 (not including the catch by Greenland), the Management Committee requested the Scientific Committee to provide advice on the likely impact on stock size, age composition, and catches in West Greenland and Canada under the conditions of this plan.

Response of the Scientific Committee:

With regard to the Canadian Management Plan, the Scientific Committee concluded that the likely effect of the harvest levels outlined in Plan was a slight drop in total abundance in the short term (3-5 years), and an accelerating decline if these harvest levels are maintained over a longer period (*ca.* 10 years), and that the availability of seals to Greenlandic hunters would likely decrease as the total population decreased. (SC/12)

Code/Meeting: 4.9.6/NAMMCO/14

Request:

The Management Committee recommended that the Scientific Committee evaluate how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland.

Response of the Scientific Committee:

Pending.

Code/Meeting: 4.9.7/NAMMCO/14

Request:

The Management Committee requested the Scientific Committee to specify harvest levels for these 2 stocks that would result in a population reduction of 20% over a period of 20 years.

Response of the Scientific Committee:

Pending.

Ringed seals:

Code/Meeting: 4.10.1/NAMMCO/5

Request:

To advise on stock identity of ringed seals (*Phoca hispida*) for management purposes and to assess abundance in each stock area, long-term effects on stocks by present removals in each stock area, effects of recent environmental changes (i.e. disturbance, pollution) and changes in the food supply, and interactions with other marine living resources.

Response of the Scientific Committee:

The Scientific Committee established a Working Group on Ringed Seals. The Scientific Committee considered the report of the Working Group and provided advice to Council. They also provided recommendations for future research. (SC/5) Papers considered by the Working Group as well as other papers were published in the first volume of NAMMCO Scientific Publications, *Ringed Seals in the North Atlantic*.

Code/Meeting: 4.10.2/NAMMCO/7

Request:

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.

Response of the Scientific Committee:

It was noted that the exploitation level of ringed seals in Greenland has shown considerable variability over decades in this century. The Scientific Committee chose to focus on scenarios where exploitation is raised by more than twice the level reported in recent years. The Scientific Committee then identified the main gaps in knowledge, and recommended research required to address them. (SC/6)

Grey seals:

Code/Meeting: 4.11.1/NAMMCO/5

Request:

To review and assess abundance and stock levels of grey seals (*Halichoerus grypus*) in the North Atlantic, with an emphasis on their role in the marine ecosystem in general, and their significance as a source of nematodal infestations in fish in particular.

Response of the Scientific Committee:

The Scientific Committee established a Working Group on Grey Seals. The Scientific Committee considered the report of the Working Group and provided advice to

Council, including recommendations for further research. (SC/4)

Code/Meeting: 4.11.2/NAMMCO/11
Request:

The Management Committee noted that there has been a decline in the numbers of grey seals around Iceland, possibly due to harvesting at rates that are not sustainable. The Scientific Committee had previously provided advice in response to a request to review and assess abundance and stock levels of grey seals in the North Atlantic, with an emphasis on their role in the marine ecosystem in general, and their significance as a source of nematodal infestations in fish in particular (NAMMCO 1995). Given the apparent stock decline in Iceland, an apparent increase in Southwest Norway and in the United Kingdom, and the fact that this species interact with fisheries in three NAMMCO member countries, the Management Committee recommended that the Scientific Committee provide a new assessment of grey seal stocks throughout the North Atlantic.

Response of the Scientific Committee:

The Working Group on Grey Seals met in April 2003 and considered the status of grey seal stocks in Canada, the USA, Iceland, the Faroes, Norway, Great Britain and the Baltic (SC/11)

Dolphin species *(Tursiops* and *Lagenorhyncus spp.):*

Code/Meeting: 4.12.1/NAMMCO/7
Request:

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.

Response of the Scientific Committee:

Not addressed due to insufficient information.

Code/Meeting: 4.12.2/NAMMCO/8
Request:

Noting that ecological interactions between dolphin species of the *Lagenorhynchus* genus and fisheries have caused concern in NAMMCO countries, the Scientific Committee is requested to perform an assessment of distribution, stock identity, abundance and ecological interactions of white-beaked and white-sided dolphins in the North Atlantic area.

Response of the Scientific Committee:

The Scientific Committee noted that the IWC Scientific Committee had dealt with these species in 1996. Generally, it was considered that there is insufficient information on stock structure, abundance and feeding ecology to carry out a meaningful assessment of these species at this time. Some new information on abundance may become available from the NASS-95 survey, but these data have not yet been analysed. The Scientific Committee agreed to begin compiling available information on these species in member countries, with the objective of identifying knowledge gaps and creating a basis for assessment in the longer term. (SC/7)

Code/Meeting: 4.12.3/NAMMCO/9
Request:

At its 8th Meeting in 1998, the Council agreed to the recommendation of the Management Committee to request the Scientific Committee to perform an assessment of distribution, stock identity, abundance and ecological interactions of white-beaked and white-sided dolphins in the North Atlantic area. The Management Committee noted the conclusion of the Scientific Committee that there is insufficient information on stock structure, abundance and feeding ecology to carry out a meaningful assessment of these species at this time. The Management Committee further noted that, in addition to the focus of the Management Committee's former request for advice on these species in relation to their ecological interactions with fisheries, these dolphin species are harvested in significant numbers in the Faroe Islands. The Management Committee therefore agreed to recommend that the Scientific Committee be requested to facilitate the requested assessment of these species, with an emphasis on the following:

to analyse results from NASS 95 and other sightings surveys as a basis for establishing abundance estimates for the stocks; to coordinate the efforts of member countries to conduct research to fill the noted information gaps, taking advantage in particular of the sampling opportunities provided by the Faroese catch, as well as dedicated samples in other areas.

Response of the Scientific Committee:

The Scientific Committee noted that the NASS surveys were optimised for species other than dolphins, and that in some cases, it was not possible to identify dolphins to species. In these cases, mapping of sightings may be the only analysis warranted. Further analyses may be feasible from the Faroese and Icelandic survey areas, and the Scientific Committee made preparations to begin these analyses.

These species are harvested sporadically in drive hunts in the Faroe Islands, and there is some by-catch in Iceland. They are rarely taken in Norway or Greenland. Scientific papers on feeding ecology and life history in Icelandic waters are expected to be published soon. The Scientific Committee recommended that a sampling programme be initiated in the Faroe Islands for white-sided, white-beaked and bottlenose dolphins, primarily to collect information on feeding ecology, life history and stock delineation. They also recommended that sampling should continue in Iceland and Norway on an opportunistic basis.

Code/Meeting: 4.12.4/NAMMCO/9
Request:

The Management Committee noted that bottlenosed dolphins, like white-sided and white-beaked dolphins, are also harvested in the coastal drive fishery in the Faroe Islands. The Management Committee agreed to recommend that, in connection with the updated request for advice from the Scientific Committee on white-sided and white-beaked dolphins, that bottlenosed dolphins also be included in this assessment

Response of the Scientific Committee:

See 4.12.3

Code/Meeting: 4.12.5/NAMMCO/10

Request:

The Management Committee noted that the requested assessments for these species could not at present be completed because of a lack of information on stock identity, distribution, abundance and biology. The Management Committee therefore recommended that the Scientific Committee monitors developments in this area and continues its assessments, as new data become available.

Response of the Scientific Committee:

To be completed as new information becomes available.

Code/Meeting: 4.12.6/NAMMCO/13

Request:

The Management Committee has asked the Scientific Committee to carry out assessments of these species, but to date insufficient information has been available on stock delineation, distribution, abundance and biological parameters to initiate the work. The Committee was pleased to note that considerable progress has been made in the Faroes in describing the ecology and life history of white sided dolphins and that information on white beaked dolphins should be available from Iceland and Norway in about two years' time. Abundance estimates are lacking in all areas except Icelandic coastal waters, and no information on stock delineation or pod structure is yet available. The SCANS survey planned for 2005/6 and coastal surveys planned for Norway (see 9.3) should provide information on distribution and abundance in some areas. The Committee endorsed the plan of the Scientific Committee to proceed with the assessments once the above-mentioned studies have been completed, probably by 2007.

Response of the Scientific Committee:

Pending.

Fin whale:

Code/Meeting: 4.13.1/NAMMCO/8

Request:

The Scientific Committee is requested to undertake an assessment of the status of fin whales in the North Atlantic based on all available data. (This request was later elaborated as follows: “Acknowledging the large amount of work involved in such a comprehensive assessment of all possible fin whale stocks in the North Atlantic, the Council requests the Scientific Committee, when conducting such comprehensive assessment, particularly to: • assess the stock structure of fin whales in the whole North Atlantic. • assess the long-term effects of annual removal of 50, 100 and 200 fin whales in the stock area traditionally assumed to have a main concentration off East Greenland and Iceland (EGI stock area), • identify MSY exploitation levels for that stock area.

Response of the Scientific Committee:

The Scientific Committee established a Working Group on Fin Whales to deal with this request. The Working Group met in April 1999. Their report dealt with the stock structure of fin whales throughout the North Atlantic, and with assessment of the EGI

stock. The Scientific Committee used the report of the Working Group to formulate advice and research recommendations to NAMMCO Council. Detailed assessment of other fin whale stocks was not carried out, but will be if further requests from Council are forthcoming.

Code/Meeting: 4.13.2/NAMMCO/9
Request:

The Management Committee noted that the Scientific Committee has completed its assessment of the stock structure of fin whales in North Atlantic, and that more research on stock structure is required before firm conclusions can be drawn. The Management Committee therefore recommended that member countries initiate the research required to elucidate the stock structure of fin whales.
The Management Committee recommended that the Scientific Committee continue its assessment of fin whale stocks in the North Atlantic, focussing in the near term on the status of fin whales in Faroese territorial waters. The Scientific Committee should focus particularly on the following issues:

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

Response of the Scientific Committee:

The Scientific Committee reactivated the Working Group on North Atlantic Fin Whales and used their report as the basis for their advice to the Council. The results of the assessments indicated that fin whales in the area have likely been substantially depleted by past harvests, but there was great uncertainty in the results. The Scientific Committee noted that in attempting to respond to the Council's request for advice on the long-term effect of various catch levels in the Faroese area, it had immediately become apparent that there is insufficient information on stock identity to carry out a reliable assessment of the status of fin whales in Faroese waters, and thus provide reliable advice on the effects of various catches. The Scientific Committee therefore recommended a research programme primarily geared to understanding the stock relationships of fin whales around the Faroes.

Code/Meeting: 4.13.3/NAMMCO/10
Request:

The Management Committee noted that the requested assessment had not been fully completed and awaited in particular the provision of more information on stock delineation. The Management Committee therefore recommended that the Scientific Committee continue its assessment, as new data become available.

Response of the Scientific Committee:

To be addressed as new information becomes available.

Code/Meeting: 4.13.4/NAMMCO/11
Request:

The Management Committee clarified its previous request for advice on fin whales, asking that the Scientific Committee continue with its assessments of fin whale stocks in the areas of interest to NAMMCO countries with existing and new information on abundance and stock delineation as it becomes available.

Response of the Scientific Committee:

The Scientific Committee completed assessments of EGI and Faroese fin whales. Future effort will be concentrated on Northeast Atlantic fin whales. (SC/11).

Code/Meeting: 4.13.5/NAMMCO/13
Request:

The Management Committee noted that it had previously asked that the Scientific Committee continue with its assessments of fin whale stocks in the areas of interest to NAMMCO countries with existing and new information on abundance and stock delineation as it becomes available, and endorsed the plan of the Scientific Committee to complete an assessment for the Northeast Atlantic stocks and update assessments for other areas, probably in 2005.

Response of the Scientific Committee:

Pending.

Humpback whale:

Code/Meeting: 4.14.1/NAMMCO/11
Request:

The Management Committee noted the conclusions of the Scientific Committee that there was evidence of a rapidly increasing abundance of humpback whales around Iceland, and recommended that the Scientific Committee complete abundance estimates for this species as a high priority. The Scientific Committee should also consider the results of the "Years of the North Atlantic Humpback" (YoNAH) project as it pertains to member countries in providing advice for this species.

Response of the Scientific Committee:

The Scientific Committee concluded that the discrepancy between the NASS and YoNAH estimates suggests that the North Atlantic population of humpback whales is likely considerably larger than estimated in the YoNAH study (SC/11).

Code/Meeting: 4.14.2/NAMMCO/13
Request:

The Management Committee noted the conclusion of the Scientific Committee that there is evidence from the NASS of a rapidly increasing abundance of humpback whales in the Central North Atlantic. The Scientific Committee was requested to assess the sustainable yield levels for humpback whales, particularly those feeding in West Greenlandic waters. The management objective in this case would be to maintain the stock at a stable level.

Response of the Scientific Committee:

Mainly because of a lack of current information on abundance, the Scientific Committee was unable to complete the Assessment for West Greenland. The Scientific Committee noted that they would be able to estimate sustainable yield levels for humpback whales in the Northeast Atlantic. (SC/12)

Code/Meeting: 4.14.3/NAMMCO/14
Request:

The Scientific Committee is requested to continue its assessment of humpback whale stocks in the North Atlantic. For West Greenland, the Scientific Committee should assess the long-term effects of annual removals of 0, 2, 5, 10 and 20 whales. For the Northeast Atlantic the Scientific Committee should provide estimates of sustainable yield for the stocks. In all cases the management objective would be to maintain the stocks at a stable level. The Scientific Committee should identify information gaps that must be filled in order to complete the assessments.

Response of the Scientific Committee:

Pending.

Harbour seal:

Code/Meeting: 4.15.1/NAMMCO/14
Request:

Harbour seal abundance has fluctuated in the Northeast Atlantic in recent years due to local outbreaks of viral distemper. Usually these outbreaks have been followed by rapid recoveries, and harbour seal abundance may have increased in many areas. In some areas, harbour seals are harvested and/or taken incidentally by fisheries and aquaculture operations (*e.g.* Greenland, Norway and Iceland). They also have significant direct and indirect interactions with fisheries in many areas. For these reasons, the Scientific Committee is requested to: • Review and assess the status of harbour seals throughout the North Atlantic; • Review and evaluate the applied survey methods; • Assess stock delineation using available data on genetics, spatial and temporal distribution and other sources; • review available information about harbour seal ecology; • Identify interactions with fisheries and aquaculture.

Response of the Scientific Committee:

Pending.

5. OTHER

Code/Meeting: 5.1/NAMMCO/8
Request:

Greenland noted the need for greater input from hunters and users in the work of the Scientific Committee. While noting the need for scientists to be able to conduct their work on their own scientific terms in the context of their Committee meetings, it was suggested that scientists and users of marine mammal resources which are the subject of examination by the Scientific Committee could, for example, meet prior to meetings of the Scientific Committee in order to exchange information relevant to the work planned by the Scientific Committee. With these ideas in mind, Greenland recommended that concrete steps should be taken to provide for a more active dialogue between scientists and resource users. This recommendation was endorsed by Council.

Response of the Scientific Committee:

The Scientific Committee agreed to consider a proposal put forward by the Secretariat, to use the "Status of Marine Mammals in the North Atlantic" stock status reports as a means of incorporating the knowledge of marine mammal users. This proposal will be presented to NAMMCO Council for approval. (SC/7) The Scientific Committee Working Group on the Population Status of Narwhal and Beluga in the North Atlantic met jointly with the Scientific Working Group of the Joint Commission on the Conservation and Management of Narwhal and Beluga (JCNB) in May 2001. Prior to the main meeting, the Joint Working Group met with hunters from Greenland and Canada, and Canadian hunters participated throughout the meeting. (SC/9)

Code/Meeting: 5.2/NAMMCO/9
Request:

With respect to the language used in the Report of the Scientific Committee, Greenland suggested that it must be kept precise and simple. The Management Committee agreed to convey this as a suggestion to the Scientific Committee.

Response of the Scientific Committee:

No response.

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2.2
REPORT OF THE MANAGEMENT COMMITTEE WORKING GROUP ON BY-CATCH

28. February 2005, Tromsø

Droplaug Ólafsdóttir, chair of the Working Group, welcomed the participants to the meeting. Participants to the meeting were: Arne Bjørge and Hanne Østgård (both from Norway), Bjarni Mikkelsen (Faroe Islands), Karen Motzfeldt and Ole Heinrich (both from Greenland) and Daniel Pike and Christina Lockyer (both from NAMMCO)

1. ADOPTION OF AGENDA

The draft agenda (Appendix 1, p. 196) was adopted. The List of Documents is provided in Appendix 2, p. 196.

2. APPOINTMENT OF RAPPORTEUR

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

3. INFORMATION REGARDING ONGOING MONITORING AND MANAGEMENT OF MARINE MAMMAL BY-CATCHES OUTSIDE THE NAMMCO AREA

3.1 European Union Initiative

Council Regulation 812/2004 pertaining to the incidental catch of cetaceans in fisheries in European Union waters was adopted 26 April 2004 and entered into force by 1 July 2004. The Council Regulation contains three specific measures, as follows:

1. Restrictions on Baltic Sea drift-net fisheries:
   The use of drift nets is to be prohibited altogether in the Baltic Sea from 1 January 2008, and an interim phasing out procedure is advised.
2. Mandatory use of acoustic deterrent devices:
   The use of pingers will become compulsory in EU fisheries deploying bottom-set gillnet, entangling net and other gillnet fisheries. This applies only to vessels larger than 12 m in length. This limitation to the regulation is currently debated among NGOs, and there are NGO initiatives to remove this limitation to the regulation.
3. Use of on board observers:
   On board observers will be used in target fisheries considered to be at high risk for cetacean by-catch. Observers would monitor fishing operations, incidental catches of cetaceans and the use of acoustic devices. As a general rule, monitoring schemes shall be based on a sampling strategy designed to allow the estimation of the by-catch rates of cetaceans, for the most frequently caught species, with a coefficient of variation (cv) not exceeding 0.30. Minimum levels of coverage are specified in the regulation, depending on fishery type and fleet size.

Implementation of the new regulation will be the responsibility of Member States. There is no central coordinating body for the implementation process, and it is anticipated that the progress of implementation will differ between Member States.

Discussion

It was clarified that the new regulation applies only to countries covered by the Common Fishery Policy, *i.e*. member countries of the EU.

It was noted that the use of pingers began some years ago in Danish fisheries, and has been found to be effective in reducing the by-catch of harbour porpoises there.

It was not immediately apparent how the minimum observer coverage levels specified in the regulation and the target minimum precision level of cv ≤ 0.3 for by-catch estimates were related. The precision of estimates from observer programmes depends mainly on the level of observer coverage and the rate of by-catch. Thus coverage rates would have to be relatively higher to give acceptable estimates for rarely by-caught species and for fisheries with low by-catch rates. Therefore the coverage necessary to achieve the specified level of precision would be species and fishery specific.

4. REVIEW PROGRESS IN MONITORING AND MANAGEMENT OF MARINE MAMMAL BY-CATCHES WITHIN THE NAMMCO AREA

4.1 Progress in monitoring marine mammal by-catches by NAMMCO Member Countries

Mikkelsen noted that there had been no changes in the by-catch reporting system in the Faroe Islands. Fishery logbooks are mandatory for all vessels larger than 110 BRT, and no logbook system is in place for smaller boats. The logbook reporting system is not formatted for by-catch reporting, but fishers have been instructed to report by-catch as supplementary comments. Reporting is not mandatory for foreign vessels fishing in Faroese waters.

Motzfeldt reported that, while the monitoring of offshore fisheries through the observer programme is ongoing, there had been no new developments in by-catch monitoring in coastal fisheries in Greenland over the past year. In most cases by-catch of small whales and seals in some coastal fisheries is included in the catch statistics but there is no way to separate out by-catch from directed catch. In this connection the Working Group recalled the definition of by-catch accepted by NAMMCO in 1999: "Marine mammals taken incidentally in fisheries targeting other species". In this context incidental catches of marine mammals should be reported as by-catch even if they are fully utilised. While this may not be important in the management context if there are no conservation issues or harvest controls, if harvest must be controlled in the future, it will be essential to be able to separate directed from incidental catch.

Ólafsdóttir noted that the reporting of marine mammal by-catch in fishery logbooks is mandatory on all vessels in Iceland. These obligations were however not met by fishermen and no effective official control was in place until 2002. An effort to facilitate and introduce a procedure for reporting marine mammal by-catch through the log book system was initiated for the gillnett fishing fleet in 2002. The system is unchanged from last year.

Bjørge reported that the reporting of marine mammal by-catch in fishery logbooks has been mandatory since 2003 on vessels larger than 21 m in Norway. However there is no system in place to collect and analyse the data from the logbooks, so the effectiveness of the programme is not known. In 2004 fisheries observers on larger offshore fishing vessels were instructed to also report by-catches of marine mammals. A computer programme for recording and reporting fishing effort, target species catches and by-catches of fish was modified to incorporate species of marine mammals. An evaluation of the effectiveness of this system is in progress.

In 2004 the Institute of Marine Research began a pilot project in which a limited number of coastal gillnetters were contracted to provide detailed records of their fishing effort, target species catches, and by-catches of marine mammals. The effectiveness of this procedure has been evaluated and the programme will be expanded in 2005.

4.2 Evaluation of procedures developed and implemented by NAMMCO Member Countries

4.2.1 Iceland

In 2004 the Management Committee requested the Scientific Committee to carry out an evaluation of the data collection and estimation procedures used in the Icelandic by-catch monitoring programme. This evaluation was carried out at the 12th meeting of the Scientific Committee in 2004. The evaluation focused on the methods used and the reliability of the by-catch estimates rather than on the significance of the estimates themselves.

In 2002 a procedure of monitoring marine mammal by-catch was introduced to the gillnet fishery in Iceland. From 4.5-4.8% of the operating fishing vessels reported marine mammal by-catch in the fishery log books in 2002 and 2003. The results from a questionnaire survey conducted in 2004 were used to interpret the by-catch data from the log books and estimate the total number of marine mammals, mainly harbour porpoises, entangled in the gillnet fishery in 2002, 2003 and the first half of 2004. The results were compared to the fishermen's own attempts to estimate the annual by-catch and secondly, to information obtained from gillnet research surveys performed in March and April 2003 and 2004. The comparison revealed a considerably lower estimate using the log book reports, probably indicating that estimates produced from the log book reports are negatively biased.

The Scientific Committee noted that it was assumed that those fishermen, who reported by-catch in their logbooks, did so for every by-catch event. This assumption is demonstrably false as some fishermen indicated in response to the questionnaire that they reported by-catch only occasionally. This would cause a negative bias of unknown magnitude in the by-catch estimation. This problem could be solved in the future by modifying the logbook forms such that the presence or absence of marine mammal by-catch was consistently reported for every gear cast.

It was also assumed that fishermen did not deliberately falsify their logbook records or answer untruthfully to the questionnaire survey, by reporting that they had no by-catch when in fact they did. It is impossible to estimate the magnitude of this bias, if it exists, in a self-reporting scheme. The most likely effect of such deliberate falsification would be to cause an underestimation of by-catch.

The uncertainty of the by-catch estimates was not estimated, but it was considered that it should be possible to do so. Given the low return rate of by-catch records, this uncertainty is likely to be very high, especially for species that are rarely taken. The only way to improve the precision of the by-catch estimates would be to increase the response rate of fishermen. While the by-catch estimates from the experimental gillnet survey programme provide an independent check on the estimates from logbooks, the uncertainty in these estimates is likely also to be very high because of the relatively low amount of effort in the survey fishery. Therefore the gillnet survey will likely have very low power to provide estimates of by-catch with required precision.

Similarly, direct independent observation of a subsample of the fishery could provide an unbiased and independent estimate of by-catch. But again, the precision of the estimate would be directly proportional to the fishing effort that could be observed. It is possible to calculate the amount of observer coverage required to produce estimates of a given precision, and the Committee recommended that this be done for the Icelandic fishery.

No estimate of by-catch was provided from the lumpsucker gillnet fishery, which is known to take marine mammals.

In summary the Scientific Committee recommended the following actions to improve the estimation of by-catch in Icelandic fisheries:

i. Logbook reporting forms should be changed such that the presence or absence of by-catch is reported for every gear cast, along with associated effort data;
ii. Full uncertainty should be incorporated into the by-catch estimates from the logbook programme and the experimental gillnet survey;
iii. An analysis should be carried out of the level of observer coverage required to achieve an acceptable level of precision in by-catch estimates from the Icelandic gillnet fishery;
iv. By-catch from the lumpsucker gillnet fishery should be estimated.

Discussion

It was noted that any self reporting is dependent on the willingness of fishermen to participate. It has been the experience in Iceland and other areas that a sustained effort must be made to explain the programme to fishermen and continually remind them of the requirement to report marine mammal by-catch.

The recommendations of the Scientific Committee were supported by the Working Group. The importance of including a level of precision in by-catch estimates was especially emphasised. In this regard it will be necessary to establish target levels of precision that are required for management. It was considered likely that such a level would likely be at least as precise as that established by the EU, *i.e.* cv ≤ 0.3. However such targets may be species specific. Having a target level of precision will simplify the process of designing an effective by-catch monitoring programme.

Bjørge informed the Working Group that Norway is evaluating the use of the catch of target fish as a scaling factor to convert by-catch observations from monitoring programmes to total estimates of by-catch. This is in contrast to the Icelandic programme which uses fishing effort as a scaling factor. The two methods will be compared once the Norwegian programme begins to produce data. This could be done as well within the Icelandic data set, for which catch and effort data are available.

It was concluded that the system used in Iceland of monitoring marine mammal by-catch through fishery logbooks could be a useful model for other countries to use as a starting point. To be effective, the system would have to be modified such that the presence or absence of by-catch is recorded for every gear cast. It was recognised that this would require changes in logbook format which might be problematic for practical reasons in some cases. It was also recognised that such a system was likely to result in negatively biased estimates in most cases due to non-reporting and potentially to deliberate misreporting. Therefore, in high risk fisheries or for species of special conservation concern for which very precise and unbiased estimates are required, a logbook system might have to be augmented by an observer programme with a targeted level of estimation precision.

4.2.2 Other countries

In Norway, observer programmes to monitor by-catch have just begun to function and their effectiveness is currently under evaluation. It was suggested however that in addition the data from the mandatory logbook reporting system should be analysed to see if it can be used to estimate by-catch levels in some fisheries. The Faroe Islands and Greenland have no by-catch monitoring programmes that are suitable for evaluation.

5. EVALUATION OF THE POTENTIAL RISK OF MARINE MAMMAL BY-CATCH IN THE FISHERY WITHIN THE NAMMCO AREA

5.1 Spatial and temporal overlap in the fishing activity and distribution of marine mammals within the NAMMCO area

In 2004 the Management Committee recommended that member countries should prepare working documents outlining the existing knowledge about marine mammal by-catch in their jurisdiction, for the consideration of the Working Group on By-catch at its next meeting. These documents would be evaluated by the Working Group and used to develop recommendations and priorities for by-catch monitoring in member countries.

Faroe Islands

Working paper NAMMCO/14/MC/BC/7 provided a summary of ongoing fisheries, fishery management and marine mammal distribution in the Faroe Islands. The main fisheries in Faroese waters are mixed-species, demersal fisheries and single-species, pelagic fisheries. The demersal fisheries are mainly conducted by Faroese fishermen, whereas the pelagic fishery is conducted by Faroese and foreign fishermen licensed through bilateral and multilateral fisheries agreements. Gears used include jigging, longlines, otter trawls, pair trawls, purse seine and gillnets. In contrast to most other areas however there is no inshore, shallow water gillnet fishery in the Faroes, and only 8 vessels participate in a deep-water gillnet fishery for Greenland halibut and monkfish. Management of fisheries is based on individually transferable effort quotas within fleet categories. In addition there are limitations on the catch of non-target fish within fisheries, as well as seasonal and area closures to protect spawning areas and juvenile fish.

The most common baleen whales in the Faroes are the minke and fin whales. Common toothed whale species include the pilot whale, northern bottlenose whale, harbour porpoise, white-sided and common dolphins. Grey and hooded seals are the most common seal species in the area. The seasonal distribution of marine mammals is highly variable but some species are present year-round, while others apparently migrate through. In general there is a high degree of overlap between the distribution of marine mammals and some fisheries.

Although no formal by-catch reporting system exists, incidental reports of marine mammal by-catch are very infrequent. This is probably because of the very limited use of gillnets in the area. Reports of by-catch in the other gear types used are infrequent or non-existent.

<u>Discussion</u>
The Working Group agreed that the lack of an inshore gillnet fishery was certainly the reason why by-catch appeared to be an infrequent phenomenon in the Faroes. However it was noted that by-catch of harbour porpoises and dolphins is high in some pelagic trawl fisheries in other areas, including the UK and the Bay of Biscay. Given the lack of a formal reporting system and the fact that many of these fisheries are carried out by foreign fleets from which even incidental reports of by-catch could not be expected, the Working Group could not rule out the possibility that by-catch in pelagic trawl and possibly other fisheries was significant in the Faroes.

Greenland
NAMMCO/14/MC/BC/8 provided a tabular presentation of the major fisheries around Greenland. Offshore fisheries are monitored by observers with an approximate coverage of 50%. Reporting of marine mammal by-catch is mandatory. There are no reports of marine mammal by-catch from these fisheries.

Inshore gears used include bottom trawls, gillnets, long lines, crab pots, scallop dredges and pound nets. Reporting of by-catch for smaller vessels is not mandatory and it is assumed that if by-catch occurs it is reported through the general harvest monitoring programme. In such cases it would not be distinguishable as by-catch.

<u>Discussion</u>
While the information presented in NAMMCO/14/MC/BC/8 was considered a useful

first step, the Working Group required more information on the size and spatial distribution of Greenlandic fisheries, and their overlap with marine mammal distributions, in order to evaluate the potential for by-catch in Greenland. This applies particularly to fisheries in nearshore waters. It appears that the offshore fishery is low-risk in terms of by-catch, as it has relatively high observer coverage and no by-catch has been reported. While it was recognised that most by-catch may be included in the catch statistics, it was considered that some way of estimating by-catch from fisheries is required.

By-catches of humpback whales have occurred for the past few years in West Greenland. The whales become entangled in the float lines of crab traps or pound nets. In addition there have been observations of humpback whales carrying entangled gear. While catches have been small, the size of the population is uncertain, so further information will be required to evaluate the significance of this by-catch. It was noted in this regard that the Scientific Committee is already carrying out an assessment of humpback whales off West Greenland.

Iceland

NAMMCO/14/MC/BC/9 provided an overview of fishing effort for the main fisheries operated by the Icelandic fishing fleet, as well as an overview of the present knowledge of the distribution of the most common marine mammals in Icelandic waters. Fisheries in Iceland are spread throughout a large area surrounding Iceland. The main fishing fleet operates within the Icelandic EEZ but some Icelandic fisheries are also conducted on the Reykjanes ridge and Irminger Sea southwest of Iceland, the Iceland Faroe ridge, southeast of Iceland and in the Jan Mayen and Barents sea areas northeast of Iceland. Gears used in the fisheries include hand line, gillnet, bottom and pelagic trawls, longlines, purse seines and Danish seines. Year-round inshore fisheries include gillnet fisheries for lumpsucker, codfishes, flatfishes and wolffish.

The most common whales in the Icelandic inshore are minke, humpback and killer whales, harbour porpoises and white-beaked dolphins. Common species encountered offshore include fin whales, pilot whales, sperm whales, sei whales, northern bottlenose whales and white-beaked and white-sided dolphins. While some humpback whales apparently stay year-round in Icelandic waters, most baleen whale species are present only in the spring, summer and fall. Grey and harbour seals are the most common pinnipeds occurring in Icelandic near shore waters.

Comparison of the distribution the fisheries and that of marine mammals may lead to the conclusion that incidental entanglements of marine mammals may occur for all fisheries in Iceland. The largest overlap in fishing effort and marine mammal distribution occurs on the coastal shelf leading to the highest potentials for by-catch in these fisheries. Varying catchability of marine mammals in different gear types is likely to result in various by-catch levels within the same area and season. The highest risk for by-catch is probably in the coastal and near shore gillnet fishery. Some interactions may also occur in the capelin and herring fisheries.

Discussion
The Working Group agreed that the inshore gillnet fisheries were the most likely to result in by-catch in Icelandic waters. Indeed by-catch of harbour porpoise, seals and other species is known to occur in these fisheries. Thus it was recommended that by-catch monitoring be focussed on these fisheries in the near term. Nevertheless, similar to the situation in the Faroes, it was considered that there was potential for by-catch in other fisheries as well. Therefore every effort should be made to obtain information about marine mammal by-catch in other fisheries, probably by establishing a self-reporting system similar to that used in the gillnet fishery.

Norway
Norway did not provide a working paper as had been recommended by the Management Committee.

5.2 Other indirect or direct evidence of marine mammal by-catch within the NAMMCO area
Bjørge informed the Working Group that the recovery of seal tags from Norwegian coastal fisheries indicated that grey and harbour seals may experience an additional mortality of roughly 5% from fishery by-catch. Bottom set gillnets accounted for most of the mortality but the small cod trap net fishery accounted for a relatively high percentage of seal tag returns.

6. REPORTING OF BY-CATCH TO NAMMCO

6.1 Reporting in 2004.
Pike reviewed the by-catch information in the National Progress Reports applicable for 2003. This year, for the first time, all countries used the new National Progress Report format to report by-catch. The Faroe Islands and Greenland reported some by-catch but did not provide details about the fishery in which these animals were caught, as required in the format. Norway provided a brief description of ongoing programmes to monitor by-catch, but did not provide any estimates from these programmes. Reporting from Iceland followed fully the National Progress Report format, and further details are provided elsewhere in this Report.

7. OTHER ITEMS

No other items were brought to the attention of the Working Group.

8. RECOMMENDATIONS

The Working Group supported the recommendations of the Scientific Committee to improve the estimation of by-catch from the Icelandic monitoring system (see 4.2.1). In addition the Working Group made the following recommendations to improve by-catch monitoring in NAMMCO member countries:

1. The use of self reporting through fishery logbooks to estimate by-catch should be considered the minimum level of monitoring for NAMMCO member countries. To be effective, such a reporting system must report

the presence or absence of by-catch for every gear set. It is also crucial that fishermen be kept informed about the programme.

2. Supplemental monitoring, probably through observer programmes, will be necessary for high risk fisheries and in cases of high conservation concern where more precise and reliable estimates are required.
3. Target levels of precision for by-catch estimation should be established. While these may be species or stock specific it was considered likely that such a level would likely be at least as precise as that established by the EU, *i.e.* cv ≤ 0.3.
4. The use of target species catch *vs* fishery effort as scaling factors to convert by-catch observations from monitoring programmes to total estimates of by-catch should be compared.
5. Norway should continue to develop its observer programme for offshore fisheries and the targeted collection of data from the coastal fishery.
6. Norway should evaluate the usefulness of the existing logbook system for estimating by-catch in some fisheries.
7. For Greenland, catch of marine mammals resulting from some coastal fisheries with mixed species catches should be specified with regard to catching method.

The Working Group recommended that Greenland and Norway provide the information on the potential for fishery by-catch that was requested for this year (see 5.1). For Greenland, the concentration should be on inshore fisheries.

9. FURTHER MEETINGS?

The Working Group considered the face-to-face meeting to be more productive than previous teleconferences and recommended that this practice should be continued, depending on progress, at the discretion of the Chair.

10. ADOPTION OF REPORT.

The Report was adopted on 1 March 2005.

APPENDIX 1 – AGENDA

1. Adoption of agenda
2. Appointment of rapporteur
3. Information regarding ongoing monitoring and management of marine mammal by-catches outside the NAMMCO area
    3.1 European Union Initiative
4. Review progress in monitoring and management of marine mammal by-catches within the NAMMCO area
    4.1 Progress in monitoring marine mammal by-catches by NAMMCO Member Countries
    4.2 Evaluation of procedures developed and implemented by NAMMCO Member Countries
        4.2.1 Iceland
        4.2.2 Other countries
5. Evaluation of the potential risk of marine mammal by-catch in the fishery within the NAMMCO area
    5.1 Spatial and temporal overlap in the fishing activity and distribution of marine mammals within the NAMMCO area
    5.2 Other indirect or direct evidence of marine mammal by-catch within the NAMMCO area
6. Reporting of by-catch to NAMMCO
    6.1 Reporting in 2004.
7. Other items
8. Recommendations
9. Further meetings
10. Adoption of report

APPENDIX 2 - LIST OF DOCUMENTS

NAMMCO/14/MC/BC/1	List of participants
NAMMCO/14/MC/BC/2	Draft agenda.
NAMMCO/14/MC/BC/3	List of documents
NAMMCO/14/MC/BC/4	National Progress Reports: By-catch reporting for 2003.
NAMMCO/14/MC/BC/5	Bjørge, A. Update on the European Union initiative.
NAMMCO/14/MC/BC/6	Excerpt from the Report of the 12th Meeting of the NAMMCO Scientific Committee: 11.1Estimation of by-catch in Icelandic coastal fisheries
NAMMCO/14/MC/BC/7	Potential for by-catch in Faroese fisheries
NAMMCO/14/MC/BC/8	Potential for by-catch in Greenlandic fisheries
NAMMCO/14/MC/BC/9	Potential for by-catch in Icelandic fisheries
NAMMCO/14/MC/BC/10	Potential for by-catch in Norwegian fisheries (not provided)

Additional document

SC/12/15	Ólafsdóttir, D. and Gunnlaugsson, Th. Monitoring of marine mammal by-catch in the Icelandic gillnet fishery

2.3
REPORT OF THE MANAGEMENT SUB-COMMITTEE ON INSPECTION AND OBSERVATION

Copenhagen, Denmark, 27 January 2005

The Management Sub-Committee on Inspection and Observation met in the Office of the Faroe Islands representation in Copenhagen, 27 January 2005 from 11:00 – 13:00. Present were Egil Ole Øen, chair, (Norway), Jústines Olsen (Faroe Islands), Kristjan Loftsson (Iceland), Ole Heinrich and Mads Lillelund (Greenland) and Charlotte Winsnes from the Secretariat.

1.& 2. ADOPTION OF THE AGENDA AND APPOINTMENT OF RAPPORTEUR

The agenda was adopted with the addition of a new item 4: Election of officers. Charlotte Winsnes was appointed as rapporteur.

3. THE 2004 SEASON

The report from the Secretariat of the 2004 season was contained in document NAMMCO I&O-2005-2.

Charlotte Winsnes gave a brief presentation of the 2004 observation season, drawing special attention to the following points:

- it has proven beneficial to focus on one region per year;
- in Greenland the observer's opportunities to observe the actual hunting activities are limited due to the hunt's opportunistic character.

The Sub-Committee took note of the report from the Secretariat.

4. REVIEW OF THE OBSERVATION SCHEME

At its last meeting in January 2004 the Sub-Committee asked the Secretariat to review and recommend improvements to the implementation of the Observation Scheme. The evaluation should only consider the implementation process and not the actual text of the Provisions and the Guidelines. The Management Committee at its meeting in March 2004 endorsed this recommendation from the Sub-Committee. The Secretariat’s review was contained in document NAMMCO I&O-2005-03.

The Scheme came into force in 1998 and hence has been operative for seven seasons. NAMMCO has had observers in Greenland, the Faroe Islands and Norway. With the exception of 1998 when no observer was sent to the Faroe Islands, observers have been placed in all member countries engaged in hunting activities up until 2003 (the Faroe Islands, Greenland and Norway). In 2003 observations were conducted in Norway only, in 2004 the focus was on Greenland alone.

Observations were land-based until 2001, but have since then also been conducted at sea. In Norway observers have been placed on board vessels for periods of up to several weeks, and in Greenland observers have been out at sea for a day both on board hunting vessels and in a rented boat observing the hunt from a distance.

No violations of national or hunting related regulations have occurred during the period the observation scheme has been in operation.

Some characteristics of the hunts having an impact on the implementation of the observation scheme in Greenland, the Faroe Islands and Norway were outlined.

In relation to the Norwegian minke whale hunt, factors such as the number of vessels, quotas, the hunting areas a certain vessel will operate in and the time periods of the hunt are all defined when the hunting season begins. The whaling fleet in Norway consists of small fishing vessels. However when the vessels are rigged for the whaling season, fishing is not permitted. The main concerns with respect to the implementation of the Scheme are therefore to identify the vessels that can accommodate an observer, and to decide on an area and time period that potentially will result in the highest number of observations.

In the Faroe Islands the pilot whale hunt is opportunistic. Schools of pilot whales may arrive all year round, although historically (1584 – 1999) the period July – September has accounted for 67 % of the hunts. The driving and killing of pilot whales may only take place at the 24 authorised whaling bays, the hunt is not quota regulated and everybody may participate. From the point of view of the implementation of the observer scheme the main concern is to pick the "right" observation period. When the observer is stationed in the Faroe Islands it is important to have good communication with the "Sysselman" and to have a means of transportation in order to get to the whaling bay where a drive is ongoing.

The hunting of marine mammals in Greenland is opportunistic. Sealing takes place all year round, with the exception of adult and breeding harbour seals in the period 1 October – 30 April. Seals are hunted on an individual basis from dinghies and from the ice. Whaling is conducted all year round except for minke whales, which can only be hunted in the period 1 April – 31 December. Quotas exist on minke- and fin whales, belugas and narwhals. With respect to minke and fin whaling, most boats are fishing boats, which are also licensed for whaling. If a whale is spotted while the vessel is fishing, the captain may elect to cease fishing and go after the whale if this is believed to be the most lucrative option. The joint rifle hunts are by nature more organised in the sense that if the weather conditions are good the parties to the hunt will go out primarily with the aim of hunting whales.

By far the most decisive and uncontrollable factor influencing the hunting of marine mammals in all member countries is the weather. Other important factors to consider in Greenland are market conditions, *i.e.* the possibility of getting the products from the hunt sold, and hunting seasons for terrestrial mammals such as reindeer, musk ox and birds as most hunters participate in all the different hunts.

The Sub-Committee emphasised the following general comments and points for improvement:

Conducting the Observation Scheme is particularly difficult in Greenland due to the less organised, scattered and unpredictable nature of most hunting activities. Although very different by nature, the hunting activities are more easily accessible in Norway and the Faroe Islands as compared to Greenland.

In the Norwegian minke whale hunt, especially after the planned introduction of the "Blue Box" system[1], the main challenges for the implementation of the scheme will be to make a decision as to which time period and area the observers should work in. The introduction of the "Blue-Box" system will make the hunt more opportunistic and less predictable because the hunting season will be longer. With sealing the main difficulty is the time period needed in order to have an observer on board a vessel. The observer in question will have to be away from her/his job for a period of six to eight weeks.

In the Faroe Islands the main challenge will be to decide on the observation period.

In Greenland, hunting takes place more or less throughout the whole year, but in an unpredictable fashion. To observe the actual killing of the animal may be difficult without interrupting the hunt itself. The documents "fritidsjagtbevis" (spare time

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[1] Øen informed the Committee of the ongoing work with the "Blue Box" system in the meeting of the Committee on Hunting Methods just prior to this meeting.
Briefly sketched, the Blue Box is a trip recorder, a tamper-proof automated computing system designed to independently monitor and log the activities associated with data on certain events on board provided by different sensors, including independent GPS, shock transducers, strain transducers, heel sensors located in different places on a vessel that independently or in sum indicates or proves that a whale is shot and taken on board. The system is configured and calibrated for each individual vessel. The system is automated with programmes designed for the continuous operation and logging of data for minimum four months with backup batteries and automatically restarting function following system interruption. The mandatory logbook is an important part of the overall system. Prototypes have been tested for three seasons and during the 2004 season 13 out of 34 whaling vessels were equipped with the "Blue Box". Based on the data and results from the 2004 season, the system has been upgraded, and for the 2005 season the plan is to install a "Blue Box" on all whaling vessels. National inspectors will still be present on some boats in 2005 to monitor its function and from 2006 it is anticipated that the system will be fully operational, and national inspectors will only make random inspections on board vessels.

Implementation of the "Blue Box" system will ease some of the unnecessary and unintended restrictions of the current monitoring system. It provides a lower cost alternative bringing the hunt back to the traditional opportunistic "good weather" hunt and still secure that the harvest fit within long-term resource conservation targets and sustainable goals. It takes no space, it does not sleep, eat, and does not socialise with anyone. The system probably saves cost of an estimated 6 million NOK every year.

hunter) and "ervervsjagtbevis" (full time hunter) must be carried by all hunters and these can be checked via land based observations.

When assessing the success of the observation scheme it is important to remember that it is not necessarily a high number of actual hunting observations during a period that makes the scheme successful, although this is desirable, but the fact that an observer is present and able to conduct his or her job without interference of any sort.

Nomination process*:* The member countries were urged to follow the prescribed procedures governing nomination and appointment of observers, and also to nominate more than one observer candidate. It was emphasised that the Scheme allows for nominations of observers from countries outside of NAMMCO. In such a case the nominating country is obliged to cover the possible extra expenses incurred due to for instance longer travel. Reference was also made to article B.2.8 in the Provisions noting that in exceptional circumstances an observer may observe in the country of which he or she is resident. The procedures governing the nomination and appointment of observers are somewhat time-consuming and bureaucratic. It is nevertheless very important that these procedures are followed as they secure the legitimacy of the Scheme and also guarantee transparency of the system.

The language and cultural barrier*:* The Scheme stipulates that the observer should not come from the country in which he/she is conducting observations. This has proven to be a special challenge with respect to observations in Greenland. Most foreigners do not speak or understand Greenlandic, and a majority of the hunters in Greenland do not speak English and may not have a good understanding of a Nordic language. The implication of this is that the observer should be accompanied by an interpreter or the national "jagtbetjent". To be able to communicate well is of the outmost importance when being on board a hunting vessel due to safety reasons. The same problem arises to a certain extent with observations out at sea in Norway. Although Norwegian and Danish are similar languages, mutual understanding may still be difficult. Another aspect of the observation scheme is the cultural differences between the observers and the observed. This is not necessarily a problem, but it is an element of the Scheme that should be kept in mind.

Information flow to the Secretariat: To have updated information on hunting statistics, time frames, quotas, the most optimum areas of observation, names of contact persons *etc.* available to the Secretariat is very important for the smooth running of the observation scheme. By focusing on one region at a time the Secretariat has gained valuable information on how the different hunts are being organised in the different countries. It was recommended that this practice should be continued.

Training of observers: With the exception of the courses held in Norway for inspectors in connection with sealing and, up until now, whaling, there exist no organised training courses for observers. It is the Secretariat's responsibility to ensure that every observer has all the relevant documentation regarding regulations and laws governing marine mammal hunting in the respective countries and the Provisions of the Joint NAMMCO Control Scheme. As part of the preparation the Secretariat has made a practice of arranging a meeting at the outset of the observation period between the observer and relevant persons in the country in question to discuss the national regulations and laws and other connected matters.

Duration of the observation period: Especially with respect to observations of sealing in Norway, it was acknowledged that it might be a problem to find observers who can actually be away for such a long period of time as is required. The vessels are out at sea for 6 – 8 weeks. Most observers have jobs and cannot easily be absent for two months with relatively short notice. The sealing fleet leaves Norway around the middle of March, which means that the observer in question will have a maximum of two months but more likely one month to arrange his leave from work *etc*. A possible solution might be to nominate observers two years in advance.

Budget: The budget of NOK 200 000 will never allow for more than partial coverage. In order to observe all marine mammal hunting activities throughout the whole season the budget would have to be much higher.

In conclusion under this agenda item the Sub-Committee agreed that the implementation of the Inspection and Observation Scheme seems to be functioning well, given the human and financial resources at hand. Some administrative challenges still exist, mainly related to the process of nominating and appointing observers, but the overall impression is that the observers are able to carry out their job when they are out in the field. The importance of having observer candidates skilled in languages and with an understanding of the situation, to which she or he will be exposed, *i.e*. long periods of waiting in unfamiliar surroundings, was emphasised.

5. ELECTION OF OFFICERS

The Committee agreed that Greenland should hold the position as Chair of the Committee (name will be forthcoming) and Jústines Olsen (the Faroe Islands) was elected as Vice-Chair, both positions for the next two years (2005/2006). The Committee expressed its thanks to the outgoing Chair Egil Ole Øen (Norway) for his able chairmanship both in this Sub-Committee and in its predecessor.

ADOPTION OF THE REPORT

The final report of the meeting was approved by correspondence on 22 February 2005.

SECTION 3 – SCIENTIFIC COMMITTEE

3.1
REPORT OF THE TWELFTH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE

EXECUTIVE SUMMARY

The Scientific Committee held their 12th meeting at Viđareiđi, the northernmost village in the Faroe Islands, 26 – 29 October 2004. In addition to the regular members, observers from Canada and Japan attended the meeting.

The Scientific Committee was informed that the continuing absence of one of the Norwegian members was due to a lack of funding from the Norwegian government to attend NAMMCO Scientific Committee or Working Group meetings. Noting that this has been and continues to be detrimental to the functioning of the Committee, the Scientific Committee recommended that all members of the Scientific Committee be funded to attend committee meetings, by the government that appointed them.

ROLE OF MARINE MAMMALS IN THE MARINE ECOSYSTEM

At its 8th meeting in Oslo, September 1998, the NAMMCO Council tasked the Scientific Committee with providing advice on the economic consequences of different levels of harvest of marine mammals, especially harp seals and minke whales, in different areas. Working groups established by the Scientific Committee have met on 4 occasions to deal with this and related requests. The Scientific Committee has recognised that the process of developing predictive multi-species models is a long-term one. Therefore the Committee asked the Working Group to review the progress that has been made in the last two years, in 2 specific areas: 1) quantifying the diet and consumption of marine mammals, and 2) the application of multi-species models that include marine mammals to candidate areas of the North Atlantic.

Diet

Preliminary results from the Icelandic research programme on feeding ecology of common minke whales in Iceland show that the diet was overwhelmingly piscivorous, with krill dominating the diet in less than 10% of the stomachs. These data indicate that sandeel is by far the most important prey species for the minke whale around Iceland in the autumn and early summer. However the proportion of Atlantic cod and other gadoids in the diet was higher than had been indicated by previous studies, so the possibility for a direct interaction with fisheries still exists.

Recent work on the diet of Barents and Greenland Sea harp and hooded seals show that the diets of both species in this particular habitat were comprised of relatively few prey species. Pelagic amphipods, squid, polar cod, capelin, and sand eels were particularly important, comprising 63-99% of the observed diet biomass in both seal species, irrespective of sampling period. There was some evidence that capelin formed a larger portion of the diet during the fall and winter. However few samples had been taken from open water areas in the late summer, when harp seals might be expected to switch to capelin.

Satellite tagging of harp seals in the Greenland and Barents Seas suggest that substantial parts of the Greenland Sea stock of harp seals may temporarily share feeding grounds with the Barents Sea stock of harp seals. Temporal and spatial aspects of these migrations, as well as the recorded dive depths, overlap with the temporal and spatial distribution of capelin, suggesting that this is an important prey item during parts of the year. It was noted that, due primarily to budgetary restraint, most tagging studies have had insufficient sample size and been of too short duration to adequately determine natural variation in seasonal distribution and migratory behaviour. Nonetheless it was concluded that satellite tracking studies supply important information on the distribution of seals in time and space that may be used to make inferences concerning their diet.

Energy consumption

A new method for estimating urine production and food ingestion of minke whales was discussed. Utilising allometry of creatinine clearance in relation to body weight and serum and urinary concentrations of creatinine, the average urine volume was predicted to be 214 L per day. From this volume and the known water content of the ingested food the average daily food ingestion was estimated to be about 280 L. This is considerably greater than reported by most workers. In discussion it was pointed out that uncertainty is not incorporated into the prediction of creatinine clearance and thus urine production, and that this uncertainty would likely be substantial given the double-logarithmic relationship used. Hence the prediction of food intake may not in fact be inconsistent with estimates derived from other methods when all sources of uncertainty are incorporated. The Working Group considered that this was a promising new method that should ideally be tested on captive animals.

Recent work on captive seals has provided some direct measurements of the diving metaboloic rate (DMR) in a quasi-natural setting. The resulting mean DMR of both juveniles and adults was 1.7 times the predicted basal metabolic rate of terrestrial mammals of equal size. The Working Group considered that the observed mean of 1.7x BMR for diving animals found in this study was not inconsistent with the rate of 2-3x BMR commonly applied to free living seals to estimate energy consumption.

Multi-species modelling

Recently, a preliminary GADGET model has been set up to model the grey seal population around Iceland as a first GADGET model of marine mammals. Although this GADGET model is still in the early stages of its development, it has shown that some aspects of marine mammal populations can be modelled using the framework provided by the GADGET software. Further work, however, is required before a model that includes the effects of predation by marine mammals on other species is attempted. The Working Group noted that rather little progress had been made in incorporating marine mammals in GADGET-based template models for candidate areas in the North Atlantic, as had been recommended by the NAMMCO Scientific Committee in 2002, presumably because no resources had been allocated for this work. The Working Group again emphasised that progress in this area will not be made unless significant additional resources are dedicated to it.

Scenario C is a model intended for exploring the comparative effects on the catch of cod, herring and capelin of various choices of management regimes for minke whaling and harp sealing, in the Barents Sea. The models for predation are pivotal for the purpose of the study. They have two components: the total food intake of an individual by species and size estimated from energetic considerations, and the relative diet composition given the abundance of the various prey items in the actual area at the time. In addition to modelled prey species, a category of "other food" is included. The abundance of other food is assumed sufficiently abundant to allow the modelled predators to satisfy their energy need regardless of the abundance of the modelled prey species.

Despite the project period soon coming to an end, the model still is inadequate. When harp seals are introduced into the model, the cod is exterminated. The modelled predation of harp seals on cod, in addition to cannibalism and minke whale predation, is simply excessive. The Working Group identified some potential problems with the harp seal diet data used that might have contributed to the unrealistic aspects of the model predictions. Most harp seal stomach samples have been taken from northern areas where cod are uncommon. However a few samples come from coastal northern Norway where the consumption of cod may have been much higher than in other areas. The inclusion of these samples, from outside of the regular distribution area of harp seals, may have positively biased the estimation of the proportion of cod in the diet. Dive profiles obtained from satellite tagged animals indicated that they did not generally dive deep enough to access cod. It was therefore considered unlikely that cod formed an important part of the diet except under exceptional circumstances.

Conclusions
The Working Group made recommendations for research that are detailed in 8.1. In reviewing the amount of multi-species modelling work and associated applications to management decisions that had been conducted world-wide over the past several years, this Working Group noted in 2002 (NAMMCO 2003) a much lower than expected activity in this area. While some progress had been made in further development of the Scenario C model and development of the GADGET platform, it remains the case that the development of multi-species modelling is not proceeding as fast as it should, given the emphasis politicians and management authorities have placed on multi-species (ecosystem) approaches to the management of marine resources. Once again the Working Group emphasised that progress in this area will not be made unless significant additional resources are dedicated to it.

Given this, the Working Group advised that the Chairman should continue to monitor progress in this area, with the possibility of holding another workshop in 2006 if sufficient progress has been made to warrant it, and perhaps also an earlier smaller task group meeting if helpful to maintain momentum.

Discussion by the Scientific Committee
The Scientific Committee supported the recommendations of the Working Group for improving the information base on the diet and energy consumption of harp and hooded seals and minke whales. With respect to multi-species modelling, the Committee, as in 2002, supported the conclusion of the Working Group that progress in this area will not be made in this area unless significant new resources are dedicated. Specifically, the Committee recommended that the Scenario C model be finished and its properties thoroughly tested. The Committee also recommended that the GADGET platform be developed as a model capable of simulating management scenarios and that the template models including marine mammals be developed as soon as possible.

Witting noted a potential for model selection bias in the ecosystem modelling and encouraged an examination of this potential effect before such models are used to provide management advice.

The Committee tasked Walløe with reporting progress in these areas at the 2005 meeting, with the goal of holding a meeting in 2006 to finalize models for the Barents Sea and assess models for other areas, if progress on the identified research and modelling priorities has been sufficient to warrant such a meeting.

HARP SEALS

In 2004 the Management Committee requested that the Scientific Committee annually discuss the scientific information available on harp and hooded seals and advice on catch quotas for these species given by the ICES/NAFO Working Group on Harp and Hooded Seals. The ICES/NAFO Working Group will be meeting in 2005, after which their advice will become available to the NAMMCO Scientific Committee for consideration. In this regard, the Scientific Committee requested that the Council consider the feasibility of NAMMCO assuming a more formal involvement with ICES and NAFO in the Working Group on Harp and Hooded Seals.

Noting that Canada has instituted a multi-year management plan, the Management Committee requested the Scientific Committee to provide advice on the likely impact on stock size, age composition, and catches in West Greenland and Canada under the conditions of this plan.

In 2002, the Department of Fisheries and Oceans (DFO) adopted an Objective Based Fisheries Management approach for seal populations. Under this approach harp seals are managed with the objective of maintaining the stock size above a reference level of 70% of the maximum observed population size of 5.2 million. Between the reference level and the maximum observed population size the hunt will be managed to facilitate a market based harvest that will maximise return to the sealers. The Total Allowable Catch (TAC) for 2003-2005 is 975,000 for the period, with an annual TAC of up to 350,000 in any two years provided the combined TAC is maintained by a reduction in the TAC in the other years.

The DFO has conducted harvest simulations to project the harp seal population forward under the conditions of the Plan. The simulations take account of both the Canadian and Greenlandic harvests. For most scenarios examined, harvest levels exceeded replacement yield and resulted in population decline. Harvest levels at the current average Canadian TAC of 325,000 result in a slow decline up to 2009 and an accelerating decline thereafter. Under this scenario the lower 60% confidence bound reaches the reference level by about 2018. Once such a decline was detected it would trigger management measures estimated to have an 80% chance of halting the decline.

The Scientific Committee accepted the modelling approach used, but noted that Greenlandic harp seal catches had decreased substantially since 2000, and therefore the forecast Greenlandic catch used in the projections may have been too high. In addition the assumed struck and lost rate of 50% used for the Greenlandic hunt may be too high, but there are no data to support a lower level. The effect of using a lower Greenlandic catch in the model would be to increase the length of time before the reference level is reached under most projections.

The TAC levels in the Canadian Management Plan in combination with the Greenlandic harvest exceed the estimated replacement yield and would, if taken, lead to a decline in the size of the stock. It is not known how the proportion of animals that summer in Greenland relates to the size of the overall population. The Scientific Committee could not address this question, but suggested that a modelling approach incorporating historical Greenlandic and Canadian harvest levels and effort and population size might give some indication of the effect of total population size on the numbers summering in Greenland. In addition, the results of the recent abundance survey in Canada will be useful in addressing this question, when they become available. In this regard the Scientific Committee recommended that the ICES/NAFO Working Group should be requested to address the question of how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland.

The Scientific Committee concluded that the likely effect of the harvest levels outlined in the Canadian Management plan was a slight drop in total abundance in the short term (3-5 years), and an accelerating decline if these harvest levels are maintained over a longer period (*ca.* 10 years). However these conclusions may be modified if the Greenlandic harvest is lower than projected. The Committee was not able to directly assess the effect of these measures on the Greenlandic catch, but noted that it was likely that the availability of seals to Greenlandic hunters would decrease as the total population decreased.

HOODED SEALS

The question as to the effects of the Canadian Management Plan on the West Greenland catch (see Harp Seals) was also addressed for this species. Under this plan hooded seals are a "data poor" population as no current estimates of population size are available. The current TAC in Canada is set at 10,000 animals but recent harvests have been very low, as under current regulations the take of bluebacks is prohibited.

Currently, therefore, the effect of Canadian management measures on the stock of hooded seals is negligible.

A new population survey for hooded seal is planned for March 2005 as a cooperative effort between Canada, Greenland and Norway. The survey will probably cover all the known pupping areas for the species.

HARBOUR PORPOISE

An analysis of the distribution, abundance and trends in abundance of cetaceans in Icelandic coastal waters from four aerial surveys carried out under the NASS programme in 1986, 1987, 1995 and 2001 was presented to the Committee. The distribution of harbour porpoise sightings varied greatly between surveys but their occurrence was mainly inshore. Estimates derived from the surveys are likely severely negatively biased because of animals that were missed by the observers and animals that were underwater when the plane passed over. The relative abundance of harbour porpoises decreased over the period at a rate of -4.9% (CV 0.47), with the negative trend due mainly to the low numbers seen in 2001.

The Scientific Committee agreed that the apparent decline in relative abundance between 1986 and 2001 is cause for concern and should be investigated further. The Scientific Committee noted in this regard that there is likely a substantial level of by-catch for this species in Icelandic fisheries. In order to estimate the sustainability of the ongoing by-catch, better estimates of the present by-catch levels of harbour porpoises are required as well as an estimate of absolute abundance for the area. Aerial surveys will be carried out over the next two years as part of the Icelandic Research Programme, and the Scientific Committee recommended that the feasibility of modifying these surveys to generate valid estimates of absolute abundance for this species be investigated.

NARWHAL

The aerial survey attempted off West Greenland in March 2004 was not successful due mainly to poor weather conditions. The Scientific Committee emphasised the importance of continuing this survey series to the continued assessment of both West Greenland narwhal and beluga, and therefore strongly recommended that this survey be attempted again in 2005

The Scientific Committee was informed about recent changes in the management regime for narwhal and beluga in West Greenland. The total quota for narwhal is 300, 200 for West Greenland and 100 for Qaanaaq area. The Scientific Committee welcomed this information and recognised that this was a significant step towards the sustainable management of West Greenland narwhal. Nevertheless the Committee recalled its recommendation from 2004 (NAMMCO 2004), that the total removals should be reduced to no more than 135 individuals, and that there should be no narwhal hunting in the Melville Bay area.The Committee once again advised that delay in implementing catch reductions to the recommended levels will result in delay in stock recovery and probably in lower available catches in the medium term.

Noting that the scientific collaboration between JCNB and NAMMCO has been very successful to date, the Scientific Committee recommended that the respective Scientific Working Groups meet jointly to further assessment work in March 2005.

BELUGA

As noted above the West Greenland survey attempted in 2004 was not successful. The Scientific Committee recommended that this survey be attempted again in 2005.

New management measures in Greenland have established a total quota of 320 beluga for West Greenland and the Qanaaq area. The Scientific Committee recognised that this was a significant step in the right direction in the management of this stock. Nevertheless, the Scientific Committee has advised on 2 occasions (2000 and 2001) that the West Greenland stock is substantially depleted and that present harvests are several times the sustainable yield, and that harvests must be substantially reduced if the stock is to recover. The Committee once again stressed that the delay in reducing the total removal to about 100 animals per year will result in further population decline and will further delay the recovery of this stock.

FIN WHALES

New abundance estimates for fin, humpback and sperm whales from the Norwegian 1996-2001 shipboard surveys, which covered a large part of the northeast Atlantic through annual partial coverages, were presented. For the total area surveyed through the six-year period 1996-2001, the abundance of fin whales was 10,500 (CV 0.239). The substantial increase over the 1995 estimate can be explained by the inclusion of an area north of Iceland that was not surveyed in 1995. Analyses of sighting rates in Icelandic NASS and other surveys conducted between 1982 and 2003 showed an increasing trend in abundance for fin and humpback whales while sperm whale sightings showed the reverse trend.

In 2003 the Scientific Committee recommended that the scheduling of future assessment meetings for fin whales be dependent on the progress made in fulfilling recommendations for research. This year the Scientific Committee provided a list of high priority tasks that must be completed before a productive assessment meeting can be held (see 9.6.2, p. 239). If such a meeting is to be held in autumn 2005, these tasks should be completed by July 2005.

MINKE WHALES

The Committee was informed that an aerial digital photographic survey had been conducted in West Greenland over 2.5 months in Summer/Fall 2004. The target species were minke and fin whales. Estimates from this survey should be available by June 2005. Progress under the Icelandic Research Programme is described in 16.2, pp.

249-250. In Norway the sightings survey programme continued this year with a ship survey in the North Sea.

WHITE-BEAKED, WHITE-SIDED AND BOTTLENOSE DOLPHINS

Aerial surveys conducted in Icelandic coastal waters between 1986 and 2001 show no significant trend in relative abundance of *Lagenorhynchus* spp. (mainly *L. albirostris* (white-beaked)) dolphins over that period. There were an estimated 31,653 (CV 0.30) dolphins in the survey area in 2001.

The Scientific Committee concluded last year that there was still insufficient information on abundance, stock relationships, life history and feeding ecology to go forward with the requested assessments for these species. This may become feasible once feeding, genetic and life history studies have been completed in Iceland, the Faroes and Norway, and when new abundance estimates become available from the SCANS II, NASS and other sightings surveys. Such an assessment could probably be conducted by 2008 at the earliest.

GREY SEALS

In 2003 the Scientific Committee strongly recommended immediate efforts to obtain better information on the population of Faroese grey seals, and on the nature and impact of the take in the Faroes. Noting that this had not yet begun, the Committee reiterated the recommendations made last year.

The Scientific Committee welcomed the information that Iceland was continuing its survey programme for this species as recommended last year. The Committee reiterated its previous recommendations for management of this stock, most notably the immediate establishment of management objectives and conservation reference limits as an urgent priority.

For Norway, the Scientific Committee noted as in 2003 that the new quota levels implemented for this area would, if filled, almost certainly lead to a rapid reduction in population in the area. A formal analysis of the effect of the quota levels of harvest on the population, including the risk of extinction and the sensitivity of the survey programme to detect a population decline, should be conducted as soon as possible.

HUMPBACK WHALES

In 2004 the Management Committee requested the Scientific Committee to assess the sustainable yield levels for humpback whales, particularly those feeding in West Greenlandic waters. The management objective in this case would be to maintain the stock at a stable level. The Scientific Committee reviewed the available new information on this species in order to decide how best to respond to this request.

Photo-identification surveys of humpback whales were conducted in West Greenland during 1988–93, with the primary aim of estimating abundance for the West

Greenland feeding aggregation. Sequential Petersen capture–recapture estimates between 1988 and 1993 averaged 360 humpbacks (CV =0.07), with no detectable trend over the period. However the power to detect a trend was relatively low for these data.

In considering the request for advice posed by the Council, the Scientific Committee agreed that they could not apply the apparent rate of increase observed for the stock around Iceland to the West Greenland stock as there is no information on a similar trend in abundance from this area. The existing abundance estimate is more than 10 years old and a new estimate may become available from recent surveys off West Greenland. Even so, the uncertainty in the new estimate is likely to be high. Due to the effects of environmental and demographic stochasticity in populations of only a few hundred individuals, the models that the Scientific Committee usually apply to assess sustainability would require modification to be applied to humpback whales in West Greenland. For these reasons the Scientific Committee is unable to recommend sustainable yield levels for this stock at this time, and would be unable to do so without additional information on present abundance.

For areas east of Greenland there is current information on abundance and trends in abundance available, so it would be feasible to estimate sustainable yield levels for these areas. The Scientific Committee could establish a working group to carry out this task, if the Council identifies this as having high priority.

KILLER WHALES

In 2004 the Management Committee requested the Scientific Committee to review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, and to provide advice on research needs to improve this knowledge. Priority should be given to killer whales in the West Greenland – Eastern Canada area. Several killer whale researchers were consulted prior to the meeting and the prevailing opinion was that there was insufficient information with which to conduct an assessment, particularly for the West Greenland area. The Scientific Committee therefore reviewed the available new information to consider how it could best deal with this request.

In West Greenland there are insufficient data to estimate abundance or trends in abundance of this species. Killer whales appear sporadically and in varying numbers from year to year (NAMMCO 1993). In recent years, incidental reports suggest that sightings have become more frequent, and the catch has increased in the past two years. Some of these animals were taken during the winter, a time when sightings were previously very infrequent. This incidental information suggests that the spatial and temporal distribution of killer whales may have changed in recent years off West Greenland, but there are no data to support this suggestion. Given the clumped distribution and sporadic incursions of killer whales in the area, it was considered very unlikely that the aerial surveys conducted in 2004 would provide a useful estimate of abundance for this species.

The Scientific Committee found the question posed by the Council to be ambitious and noted that there was not enough information to support a meaningful assessment at this time, particularly for the West Greenland area. Moreover, the Committee considered it unlikely that such information could be obtained in the near term, even if significant resources for research become available. There is no information on trends in abundance for any area, and limited information on stock identity for killer whales throughout most of the North Atlantic. The Committee recommended some immediate steps that could be taken to improve the available information on this species (see 9.11), and agreed to review progress under this item annually with the view of conducting an assessment when sufficient information becomes available.

WALRUS

In 2004 the Management Committee noted that the Scientific Committee had last provided an assessment of walrus in 1994, and requested the Scientific Committee to provide an updated assessment of walrus, to include stock delineation, abundance, harvest, stock status and priorities for research. The Working Group on Walrus will meet in January 2005 to deal with the request from the Management Committee.

SATELLITE TAGGING CORRESPONDENCE GROUP

In 2002 the Scientific Committee decided to establish an intersessional correspondence group to:

- identify progress in satellite tagging made in NAMMCO member countries and elsewhere;
- explore the technical aspects of satellite tagging, including deployment systems;
- briefly consider what tagging experiments have been done and the rates of success;
- Recommend ways to further the development and success of this technique in NAMMCO member countries.

The Chairman of the Group reported that little progress had been made in 2004. The Scientific Committee considered that the importance of this issue warranted a continued effort to try to resolve the problems in tagging whales, particularly large whales that cannot be captured and handled. Therefore the Committee asked the Chairman to continue his efforts, by broadening the membership of the group to include key experts from member and non-member countries. The idea of holding a workshop should also be considered, but again the participation of researchers and technical experts active in this field must be ensured.

PLANNING FOR FUTURE NASS

In 2003 the Management Committee recommended that member countries continue to coordinate cetacean surveys across the North Atlantic, and attempt to broaden the coverage of these surveys through the inclusion of other participants, particularly in the Northwest Atlantic. In 2004 the Scientific Committee agreed that 2006 would be the best year to hold an international sightings survey, in conjunction with a possible SCANS II and other surveys.

The Scientific Secretary reported that he had contacted those responsible for planning the SCANS II survey to discuss the possibility of co-ordinating the offshore portion of that survey with the NASS. The response to this idea was favourable. However, due to lack of funding, the offshore portion of SCANS II has been postponed until 2007, and it is at this point uncertain whether it will be carried out. A research scientist at the Department of Fisheries and Oceans, Canada, was also contacted, and expressed great interest in co-ordinating future surveys off Eastern Canada with the NASS. It was noted that the Icelandic Research Programme would likely continue throughout 2006, which would leave researchers there little time to participate in a sightings survey. Also, an international redfish survey, with which the Icelandic NASS successfully shared a survey platform in 2001, may occur again in 2007. Given this information, the Scientific Committee decided that the next NASS should be planned for 2007.

BY-CATCH OF MARINE MAMMALS

In 2004 the Management Committee requested the Scientific Committee to carry out an evaluation of the data collection and estimation procedures used in the Icelandic by-catch monitoring programme. In 2002 a procedure of monitoring marine mammal by-catch was introduced to the gillnet fishery in Iceland. From 4.5-4.8% of the operating fishing reported marine mammal by-catch in the fishery log books in 2002 and 2003, recording a total number of 195 and 188 entangled animals for 2002 and 2003 respectively. In October 2004 a questionnaire was presented to the fishermen in order to evaluate the efficiency of the monitoring system and the quality of the by-catch data obtained from the log books. The results from the questionnaire were used to interpret the by-catch data from the log books and estimate the total numbers of harbour porpoises entangled in the gillnet fishery in 2002, 2003 and the first half of 2004. These results were compared to the fishermen's own attempts to estimate the annual by-catch and secondly, to information obtained from gillnet research surveys performed in March and April 2003 and 2004. The comparison revealed a considerably lower estimate using the log book reports, indicating a low efficiency of the monitoring system for marine mammal by-catch using the log book reports in the Icelandic gillnet fishery.

In discussion the Scientific Committee noted that the estimates of by-catch from the reporting scheme would be negatively biased because of sporadic reporting of by-catch by reporting fishermen, and possibly by deliberate falsification. The uncertainty of the by-catch estimates was not estimated, but it was considered that it should be possible to do so. Given the low return rate of by-catch records, this uncertainty is likely to be very high, especially for species that are rarely taken. The only way to improve the precision of the by-catch estimates would be to increase the response rate of fishermen. Direct independent observation of a subsample of the fishery could provide an unbiased and independent estimate of by-catch. But again, the precision of the estimate would be directly proportional to the fishing effort that could be observed.

The Scientific Committee made a number of recommendations to improve the estimation of by-catch in Icelandic fisheries (see 11.1, pp. 245-246). The Committee commended the authors for producing the first direct estimation of marine mammal by-catch from a NAMMCO member country, and strongly recommended that other member countries establish by-catch reporting systems for their fisheries.

PUBLICATIONS

Five volumes of *NAMMCO Scientific Publications* have been published to date, the most recent in 2003. Two more are planned: Vol. 6 on the NASS, and Vol. 7 on grey seals.

WORKPLAN

The next meeting of the Scientific Committee will be held in Norway, probably in October 2005.
It is likely that the following working groups will meet in 2005:

- Walrus, January in Copenhagen;
- Narwhal and Beluga, February or March, jointly with the JCNB Scientific Working Group;
- Fin whales, autumn 2005, if progress identified under 9.6.2 (see p. 239) is completed.

Other working groups may be required depending on requests received from the Council.

TWELFTH MEETING OF THE NAMMCO SCIENTIFIC COMMITTEE
MAIN REPORT

1. CHAIRMAN'S WELCOME AND OPENING REMARKS

Chairman Lars Walløe welcomed the members of the Scientific Committee to their 12th meeting (Appendix 1, p. 252), held at Viđareiđi, the northernmost village in the Faroe Islands, 26 – 29 October 2004. He also welcomed the Observer from Canada, Patrice Simon, and the Observer from Japan, Tsutomu Tamura. Members Tore Haug and Christian Lydersen (Norway) and Mads Peter Heide-Jørgensen (Greenland) did not attend the meeting.

The Scientific Committee was informed that Lydersen's absence was due to a lack of funding from the Norwegian government to attend NAMMCO Scientific Committee or Working Group meetings. The Scientific Committee noted that this had also been the case for previous members from Norway, leading to the persistent absence of at least one of the Norwegian members from meetings of the Committee. This has been and continues to be detrimental to the functioning of the Committee. The Scientific Committee therefore recommended that all members of the Scientific Committee be funded to attend committee meetings, by the government that appointed them.

2. ADOPTION OF AGENDA

The Draft Agenda (Appendix 2, pp. 252 – 254) was adopted with minor changes.

3. APPOINTMENT OF RAPPORTEUR

Daniel Pike, Scientific Secretary of NAMMCO, was appointed as Rapporteur for the meeting, with the help of other members as needed.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

4.1 National Progress Reports
National Progress Reports for 2001 from the Faroes, Greenland, Iceland, and Norway were presented to the Committee. In addition a Report was presented from Canada.

4.2 Working Group Reports
Working Group Reports and other documents available to the meeting are listed in Appendix 3, p. 254.

5. COOPERATION WITH OTHER ORGANISATIONS

5.1. IWC
The 56th meeting of the Scientific Committee of the International Whaling Commission was held in Sorrento from 29 June to 10 July 2004. Daniel Pike attended as observer for the NAMMCO Scientific Committee.

At the request of Iceland the Committee agreed to begin a "pre-implementation assessment" of North Atlantic fin whales. The primary purpose of such an assessment is to develop a set of plausible stock structure hypotheses to be used in a possible implementation of the RMP. This requires information on abundance, catch, stock structure, whaling operational details (past and future), and rates of mixing and increase. However, as the Committee has given highest priority to the completion of a pre-implementation assessment for North Pacific Brydes whales, the fin whale review will require at least 2 more years to complete. The main focus for next year's meeting will be to review information on the stock structure of fin whales.

Some new information on North Atlantic fin whales was presented to the Committee. Gunnlaugsson (2004) and Pike *et al.* (2004) presented information on population modelling and abundance respectively that has already been discussed by the NAMMCO Scientific Committee. Hatch and Clark (2004) presented an analysis of the acoustic differentiation of fin whales in the North Pacific and North Atlantic, with a comparison with corresponding information from genetic markers. They found that fin whales could be classified to geographic regions by their songs with a high degree of accuracy. There was no significant relationship between acoustic and geographical distance between regional groups. Interestingly, it was found that acoustic distance was negatively correlated with genetic distance, suggesting that more closely related groups of fin whales tend to have more divergent songs.

The IWC Scientific Committee noted that the NAMMCO Scientific Committee was also undertaking an assessment of fin whales, and agreed that the pre-implementation assessment could benefit from co-ordination between the 2 committees. However there was no discussion of how such co-ordination might occur. The NAMMCO Scientific Committee agreed that such co-ordination could be beneficial, and recommended an open exchange of data on genetics, catch, sightings surveys and tag returns, as well as any analyses done. In addition, the NAMMCO Scientific Committee recommended that the option of holding a joint intersessional workshop to develop stock hypotheses be considered, if the issue of stock structure is not fully resolved at the IWC Scientific Committee meeting in May 2005. Such a workshop would ideally occur later in 2005 or early in 2006.

The Committee continued its effort to develop strike limit algorithms (SLA's) for the Greenlandic minke and fin whale hunts. Some new information on stock structure was available (Andersen 2004), which indicated that while West Greenlandic minke whales were genetically different from other groups based on microsatelite DNA, the power of the discrimination was low and individual whales could not be re-assigned to putative stocks with high reliability.

The Committee expressed its disappointment at the continued low sample returns from Greenlandic hunts (12 minke and 1 fin whales in 2003) and urged the Commission to encourage the Greenlandic government to address this situation as an urgent priority.

The most recent abundance estimates for West Greenlandic minke and fin whales are from 1993 and 1987/88 respectively. The Committee has recommended that catches should normally be phased out after 10-14 years without a valid abundance estimate. The Committee therefore advised the Commission that if no estimates become available by next year, it will likely recommend the reduction or cessation of the take of fin whales off West Greenland.

This year the Scientific Committee undertook an in-depth assessment of the Bering-Chukchi-Beaufort (BCB) stock of bowhead whales. Much of the meeting concentrated on the stock structure of this group, which has heretofore been considered a single stock. Assessments indicated that the population has doubled in size since 1978 and may be approaching carrying capacity. The Committee concluded that the present *SLA*, which was developed and tested under a single stock hypothesis, was still appropriate for use in the short term.

New information on Eastern Arctic bowheads, from satellite tagging, genetics and surveys, was presented to but not discussed by the Committee. Satellite tagging studies suggest that only one stock, rather than 2 as previously thought, may summer in the Canadian Eastern Arctic, while genetic studies are equivocal. Recent surveys suggest the population may number in the low thousands, considerably higher than previously thought.

Norway informed the Committee that it intends to develop a revised RMP for baleen whales. The revised procedure will incorporate a revised CLA, and will be tested by the same simulation trails as the current CLA was tested.

The Committee held a short session dealing primarily with a paper published by Roman and Palumbi (2003), which estimated pre-exploitation population sizes for North Atlantic fin, minke and humpback whales based on levels of genetic variability and estimated mutation rate. For fin and humpback whales, the resultant population estimates were *ca* an order of magnitude higher than estimates based on population modelling. Roman and Palumbi (2003) suggested that inaccurate catch reporting might account for the discrepancy, and suggested that the IWC should consider these estimates when establishing management regimes for whales. The Scientific Committee pointed out several possible technical problems with the genetic estimates, and concluded that they must have considerably more uncertainty than reported. They cannot be assigned to the period immediately prior to whaling, and may apply to a wide period of time before that. Therefore they are of questionable relevance for management. Furthermore it was suggested that historical catch records for fin and humpback whales were reliable and the catches required to reduce populations of the sizes suggested by Roman and Palumbi (2003) simply could not have occurred. The Committee provided recommendations for further research in this area.

The Committee held a "mini-symposium" on the general subject of anthropogenic noise and cetaceans, dealing with the following subject areas: a) the effects of anthropogenic noise on marine animals and the possible synergistic effects between ambient ocean noise levels and other environmental stressors; b) physical acoustics and ambient noise in the ocean; c) audition and the physiology of hearing in cetaceans and the effects of intense sounds on cetacean hearing; and d) whale communication behaviour. It was concluded that military sonar can constitute a direct threat to beaked whales in particular, and that seismic activities and increasing levels of ship noise were cause for serious concern. The Committee made recommendations for further research monitoring, and for measures to protect important cetacean habitats from anthropogenic noise. It was tentatively agreed to hold a workshop on the impacts of seismic exploration at the 2006 meeting.

5.2 ICES

The Joint ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP) last met in 2003 and their report was dealt with by the Scientific Committee last year. Their next meeting will be held in September 2005. Haug reported that the Working Group has dealt with 2 issues by correspondence in the interim.

Referring to the fact that Canada is now giving 3-year-quotas for harp seals with some flexibility to transfer "unharvested" animals over from one year to another, the Norwegian Ministry of Fisheries (NMF) has asked if something similar could be done for the harp and hooded seal populations in the Greenland Sea. After some consideration, WGHARP concluded that it could not provide advice on a quota rollover until more data is available and some modelling and simulations are done. Therefore the issue will be addressed at the next WGHARP meeting.

Biological limits of yield reflecting very low risk of collapse must be developed within a Precautionary Approach framework. WGHARP was asked to consider a recent approach on the application of the Precautionary Approach (PA) and conservation reference points to the management of harp and hooded seals, originally developed to fit the harp seal stock in the Northwest Atlantic. After some consideration intersessionally, WGHARP decided to address this issue at their next meeting in 2005.

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

The Scientific Committee noted that the Report from the joint meeting of the JCNB Scientific Working Group (SWG) and the NAMMCO Working Group on the Conservation Status of Narwhal and Beluga had been dealt with intersessionally and presented to the Council in March 2004. Witting reported that the next meeting of the JCNB SWG will be held in March 2005, to further develop assessments for narwhal and to update assessments for beluga. Witting noted that the cooperation between the NAMMCO and JCNB Working Groups had been very productive, and hoped that such cooperation would continue. The Scientific Committee agreed and recommended that the NAMMCO Working Group meet jointly with the JCNB SWG in March 2005.

The ninth meeting of the JCNB was held in Nuuk, Greenland in May 2004. The JCNB noted the recommendations of the joint NAMMCO/JCNB Scientific Working Group, that West Greenland narwhals are depleted to approximately one quarter of their historical abundance, and that removals in Qaanaaq and West Greenland, except Melville Bay, should be reduced to no more than 135 narwhals. In Melville Bay, the Joint Working Group recommendation, based on a survey in 2003, was for a cessation of narwhal hunting. The JCNB recommended that removals be reduced substantially in the 2004-2005 season, and thereafter to a level as close as possible to the level recommended by the Joint Working Group.

6. INCORPORATION OF THE USERS' KNOWLEDGE IN THE DELIBERATIONS OF THE SCIENTIFIC COMMITTEE.

At its 12th meeting in March 2003 the NAMMCO Council agreed to form a Working Group under the Management Committee to deal with the issue of incorporating users' knowledge into the process of management decision making. One of the terms of reference for this group is to "Consider the Scientific Committee's proposal for procedures on how to incorporate user knowledge into the Scientific Committee's deliberations, in light of the results from the 2003 conference". Consequently the incorporation of users' knowledge into management decision making is now being treated as a process parallel to the use of scientific advice by the Council. The Scientific Committee will therefore await the conclusions of the new Working Group about what role, if any, the Committee can play in this process.

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

At its 7th meeting in 1999, the Scientific Committee agreed that the Secretariat should proceed with the development of stock status reports summarising the view of the NAMMCO Scientific Committee on the status of stocks/species for which it has provided advice. These Reports will be published on the NAMMCO Web Site or elsewhere as appropriate. The Scientific Secretary reported that at present there are four reports on the web site: minke whale, long-finned pilot whale, ringed seal and Atlantic walrus. Two more reports (beluga whales and fin whales) are very near completion and should be sent out to the Scientific Committee for review in the next few weeks. The priority reports for completion this year will be for other species which the NAMMCO Scientific Committee has considered: harp seals, hooded seals, grey seals, narwhal, northern bottlenose whales, killer whales and humpback whales. The Scientific Committee noted the progress on this matter and encouraged the completion and publication of more reports in the coming year.

8. ROLE OF MARINE MAMMALS IN THE MARINE ECOSYSTEM

8.1 Report of the Working Group on Marine Mammal – Fisheries Interactions

At its 8th meeting in Oslo, September 1998, the NAMMCO Council tasked the Scientific Committee with providing advice on the economic consequences of different levels of harvest of marine mammals, especially harp seals and minke whales, in different areas.

Working groups established by the Scientific Committee have met on four occasions to deal with this and related requests. The third workshop entitled "Marine mammals: From feeding behaviour or stomach contents to annual consumption - What are the main uncertainties?" was held in Tromsø, Norway in September 2001, and concentrated its efforts on consideration of the methodological approaches to the calculation of consumption by marine mammals. This workshop resulted in concrete recommendations to estimate consumption by North Atlantic marine mammals, and a list of research priorities to refine existing estimates. The fourth workshop, "Modelling Marine Mammal – Fisheries Interactions in the North Atlantic", was held in Reykjavik, Iceland in September 2002. This Workshop recommended a general modelling approach involving the use of "minimum realistic" models, and developed specific recommendations for their application to candidate areas of the North Atlantic.

The Scientific Committee has recognised that the process of developing predictive multi-species models is a long-term one. Therefore the Committee asked the Working Group to to review the progress that has been made in the last two years, in two specific areas: 1) quantifying the diet and consumption of marine mammals, and 2) the application of multi-species models that include marine mammals to candidate areas of the North Atlantic. Their Report is included as Annex 1 (see p. 255).

Recent developments in the quantitative description of marine mammal diets

Preliminary observations on minke whale diet around Iceland

Víkingsson reported on the status of an Icelandic research programme on feeding ecology of common minke whales in Icelandic waters. The programme involves the sampling of a total of 200 minke whales. Sampling was initiated in 2003 when 37 minke whales were taken during August and September under a special permit granted by the government of Iceland, and continued in June 2004 when an additional 25 whales were taken. It is now assumed that the sampling of 200 minke whales will be completed in August 2006. Laboratory analysis of the stomach contents is still underway, and the preliminary results are mostly based on identification of the primary prey species in each stomach as achieved at sea. The diet was overwhelmingly piscivorous, with krill dominating the diet in less than 10% of the stomachs. These preliminary data indicate that sandeel is by far the most important prey species for the minke whale around Iceland in the autumn and early summer. There is presently no fishery for this species in Iceland, which is obviously a key forage species in the marine food web around Iceland. Therefore the minke whale is only a potentially indirect competitor with fisheries for this species. However the proportion of Atlantic cod and other gadoids in the diet was higher than had been indicated by previous studies, so the possibility for a direct interaction with fisheries still exists. It was emphasised that the study is still at a very early stage of sampling so all conclusions of relative importance of different prey species must be viewed with extreme caution.

Recent work on Barents and Greenland Sea harp and hooded seals

To enable an assessment of the ecological role of harp and hooded seals throughout their distributional range of the Nordic Seas, a project was initiated in 1999. The project concentrates on the period July-February (*i.e.*, between moulting and breeding), which is known to be the most intensive feeding period for both harp and hooded seals. Seals were collected in the pack ice belt east of Greenland in

September/October 1999 and 2002 (autumn), July/August in 2000 (summer), and February/March in 2001 (winter). Results from analyses of stomach and intestinal contents from captured seals revealed that the diets of both species in this particular habitat were comprised of relatively few prey species. Pelagic amphipods, squid, polar cod, capelin, and sand eels were particularly important. Although their relative contribution to the diet varied both with species and sampling period/area, these 5 prey items constituted 63-99% of the observed diet biomass in both seal species, irrespective of sampling period.

In 2001 and 2002, Norwegian and Russian scientists performed an aerial survey to assess whether there was an overlap in distribution, and thus potential predation, between harp seals and capelin in the Barents Sea. This experiment is now being followed up with ship-based surveys to study pelagic feeding by harp seals in the Barents Sea during summer and autumn. In May/June 2004, a Norwegian survey was conducted, aimed to study the feeding habits of harp seals occurring in the open waters of the Barents Sea. Very few seals were observed along the coast of Finnmark, and no seals were seen in the open, ice-free areas. In the northwestern parts of the Barents Sea, however, very large numbers of seals were observed along the ice edge and 20-30 nautical miles south of this. In these areas, 33 harp seals were shot and sampled (stomachs, intestines, blubber cores). Additionally, samples of faeces were taken from the haul out sites on the ice. Preliminary results from the analyses indicate that krill was the main food item for the seals.

Discussion centred around the seasonality and extent of capelin consumption by harp seals in the Greenland and Barents seas. While the diet seemed to be dominated by *Parathemisto* spp. amhipods and krill in the summer, there was some evidence that capelin formed a larger portion of the diet during the fall and winter. However few samples had been taken from open water areas in the late summer, when harp seals might be expected to switch to capelin. In any event it was obvious that the diet of both harp and hooded seals must be disaggregated both seasonally and spatially for modelling purposes, given the extensive migrations and seasonal variation in diet of these species.

<u>Satellite tagging of harp seals in the Greenland and Barents Seas</u>

Folkow described how data obtained by the remote monitoring of marine mammals may be used in the evaluation of their diet composition, as exemplified by results obtained in two studies conducted by scientists from the Department of Arctic Biology, University of Tromsø, on the distribution and diving behaviour of harp seals using satellite-linked dive recorders (SDR). The first study concerns harp seals from the Greenland Sea stock, and describes results obtained from adult females between breeding (late March) and moulting (mid-May) in 1993, and from both females and males (all adults) that were tracked for an average of 244 days after moulting in late May 1999. Tagged animals remained in association with the pack-ice edge for most of the time between breeding and moult. After the moult, however, a majority of the tagged seals migrated into the Barents Sea (in late July) and remained there throughout late summer/early autumn, when harp seals are known to feed intensively and deposit fat reserves. During the course of autumn/winter they returned via the

Greenland Sea to the Denmark Strait. The observations suggest that substantial parts of the Greenland Sea stock of harp seals may temporarily share feeding grounds with the Barents Sea stock of harp seals. Temporal and spatial aspects of these migrations, as well as the recorded dive depths, overlap with the temporal and spatial distribution of capelin, suggesting that this is an important prey item during parts of the year.

The second study describes results obtained from SDR-tagged adult harp seals from the Barents Sea stock, both between breeding and moulting and after moulting. The seals displayed a northward migration after the moult and largely foraged in open waters in the northern parts of the Barents Sea during summer and autumn, presumably on a fish-dominated diet. From November and onwards, however, an increasing proportion of time was spent in association with the pack-ice edge which then progressively extended southwards.

In the discussion it was noted that, due primarily to budgetary restraint, most tagging studies have had insufficient sample size and been of too short duration to adequately determine natural variation in seasonal distribution and migratory behaviour. Tagging studies in the Northwest Atlantic have shown that the migratory patterns of hooded seals can vary greatly from year to year. Also, it is known that in some years, harp seals approach the northern Norwegian coast (seal invasions), while in most years they do not. Therefore annual variability would need to be considered to give an accurate description of the seasonal distribution of these animals. Given the variation between individuals observed, many more animals, of all sex and age classes, would have to be followed throughout a full migratory cycle to give a full description of the variability in seasonal distribution.

It was concluded that satellite tracking studies supply important information on the distribution of seals in time and space that may be used to make inferences concerning their diet. This is of particular interest in studies of species such as harp and hooded seals which are not readily accessible for traditional diet composition studies based on collection of stomach/intestinal/faecal samples. Satellite tracking, thus, represents an important and necessary supplement to traditional dietary studies in these species.

<u>Recent developments in the estimation of energy consumption</u>

New studies of relevance for the estimated consumption by marine mammals in Greenland waters were presented and the consumption estimates first presented at the NAMMCO Workshop in 2001 were updated in SC/12/IN/10. Major gaps in knowledge were identified to be: Studies of prey selection: a) Harp seals in offshore waters. b) Hooded seals and narwhals in Baffin Bay (offshore) c) Fin whales along the edge of the southeast Greenland drift ice.The Working Group welcomed this update and noted that Baffin Bay/Davis Strait/Denmark Strait could be a focus of future workshops.

<u>Urine production and food ingestion of minke whales</u>

In August and September 2003 blood and urine samples were obtained from minke whales caught off the coast of Iceland. Both blood and urine samples were obtained, and the animals weight was derived from their length. Na^+, K^+, Cl^-, Mg^{++}, Ca^{++}, creatinine, urea and uric acid were measured in blood and urine. Utilising allometry of creatinine clearance in relation to body weight and serum and urinary concentrations of creatinine, the average urine volume was predicted to be 214 L per day. From this volume and the known water content of the ingested food the average daily food ingestion was estimated to be about 280 L. This is considerably greater than reported by most workers.

In the discussion it was pointed out that uncertainty is not incorporated into the prediction of creatinine clearance and thus urine production, and that this uncertainty would likely be substantial given the double-logarithmic relationship used. Hence the prediction of food intake may not in fact be inconsistent with estimates derived from other methods when all sources of uncertainty are incorporated. The Working Group noted that further work is required in order to quantify the water balance in general, and the sea water ingestion in particular. The group considered that this was a promising new method that should ideally be tested on captive animals. Applying this method to Antarctic minke whales, which are nearly stenophagous on krill, may be informative, since the water and electrolyte components of the diet could then easily be estimated.

Recent work on captive seals

Food consumption estimates of marine mammals are mostly based on an assessment of the energy requirements of the animal, which is then translated into the amount of food that is needed in order to cover these requirements. In this context, the daily energy expenditure, or field metabolic rate (FMR), is a key determinant of the total energy requirement. Current estimates of FMR for pinnipeds have been based on metabolic studies of both captive and free-ranging animals, but most of these have not been able to realistically account for energy expenditure during diving. A paper by Sparling and Fedak (2004) describing an approach that could shed more light on the metabolic costs associated with free diving was discussed. In that study, metabolic rates of eight captive grey seals were determined in connection with voluntary diving in a quasi-natural setting (large tank), using open circuit indirect calorimetry based on measurements of oxygen consumption rates. The resulting mean diving metabolic rate (DMR) of both juveniles and adults was 1.7 times the predicted basal metabolic rate of terrestrial mammals of equal size. The Working Group considered that the observed mean of 1.7 x basal metabolic rate (BMR) for diving animals found by Sparling and Fedak (2004) was not inconsistent with the rate of 2-3x BMR commonly applied to free living seals to estimate energy consumption. The Working Group recommended that studies of the type carried out by Sparling and Fedak (2004) on grey seals, should also be carried out on harp and hooded seals.

Recent developments in multi-species modelling

GADGET-based models

GADGET is a flexible and powerful software framework for creating ecosystem models, that was presented at the last Scientific Committee Working Group Modelling meeting (NAMMCO 2003). Since that last meeting GADGET has been extended in a number of ways, including the implementation of a closed life cycle model and the inclusion of information from mark-recapture experiments on tagged sub-populations, including the use of bootstrapping experiments when estimating the migration parameters. Recently, a preliminary GADGET model has been set up to model the grey seal population around Iceland as a first GADGET model of marine mammals. Further work is planned on this model, to include more detail on the dynamics of the pup population, to look at modelling a stock recruit relationship, and to investigate using different growth functions that may be more applicable to marine mammals. Although this GADGET model is still in the early stages of its development, it has shown that some aspects of marine mammal populations can be modelled using the framework provided by the GADGET software. Further work, however, is required before a model that includes the effects of predation by marine mammals on other species is attempted.

The Working Group welcomed this new information, but noted that rather little progress had been made in incorporating marine mammals in GADGET-based template models for candidate areas in the North Atlantic, as had been recommended by the NAMMCO Scientific Committee in 2002, presumably because no resources had been allocated for this work. The Working Group again emphasised that progress in this area will not be made unless significant additional resources are dedicated to it. Also as noted in 2002, GADGET lacks the scenario aspect where the management process itself is modelled in prognostic simulations. Only when this option is available will it be possible to compare management strategies and their related assessment machinery. The Working Group again recommended that such a facility be developed, noting that this should be fairly straightforward since it will involve only data transfer to a module, with users to define and code the catch algorithm within that module.

<u>SCENARIO model</u>
Scenario C is a model intended for exploring the comparative effects on the catch of cod, herring and capelin of various choices of management regimes for minke whaling and harp sealing. Cod, capelin, herring, harp seals and minke whales are distributed over age, and over seven areas of the Barents Sea, and simulated forwards in monthly time steps. Fishing (catch) mortality is regulated by quotas. Natural mortality is composed of endogenous predation mortality and excess natural mortality. Models for recruitment and mortality are estimated piecewise on available data. The models for predation are pivotal for the purpose of the study. They have two components: the total food intake of an individual by species and size estimated from energetic considerations, and the relative diet composition given the abundance of the various prey items in the actual area at the time. In addition to modelled prey species, a category of “other food” is included. The abundance of other food is assumed sufficiently abundant to allow the modelled predators to satisfy their energy need regardless of the abundance of the modelled prey species.

Despite the project period soon coming to an end, Schweder reported that the model is still inadequate. When harp seals are introduced into the model, the cod is exterminated. This happens with the harp seal stock at the estimated current abundance, and is contrary to what is known of the system. The modelled predation of harp seals on cod, in addition to cannibalism and minke whale predation, is simply excessive. He suggested various causes for this lack of balance. The Working Group identified some potential problems with the harp seal diet data used that might have contributed to the unrealistic aspects of the model predictions. Most harp seal stomach samples have been taken from northern areas where cod are uncommon. However a few samples come from coastal northern Norway where the consumption of cod may have been much higher than in other areas. The inclusion of these samples, from outside of the regular distribution area of harp seals, may have positively biased the estimation of the proportion of cod in the diet. Dive profiles obtained from satellite tagged animals indicated that they did not generally dive deep enough to access cod. It was therefore considered unlikely that cod formed an important part of the diet except under exceptional circumstances. The Working Group also suggested estimating harp seal total abundance using a wide range of mortality, and using the resulting estimates as input to the Scenario model to see if the mortality required to stabilise the model was within a plausible range.

Recommendations for future research

Diet

The Working Group noted that there has been progress on a number of the recommendations for research priorities identified by the WG in their 2001 meeting, and prioritised them explicitly for future action:

1. Distribution of prey species in space and time.
   Progress: Ongoing resource surveys covering main commercial species, such as capelin, cod and herring in all areas. However there continue to be problems in integrating the spatial and temporal scales of resource surveys with our knowledge of predator distribution. Limited information is available on the spatial and temporal distribution of pelagic crustaceans and polar cod, which are extremely important in the harp seal diet.
2. Spatial and temporal distribution of the diet composition of harp and hooded seals;
   Progress: Progress has been made in describing the diet of Barents and Greenland sea harp seals, but important gaps remain, particularly the diet in open water areas in the late summer, autumn and winter.
3. Diet composition of dolphins (white-beaked, white-sided and bottlenose dolphins);
   Progress: Some progress has been made in describing the diet of white-sided and bottlenose dolphins around the Faroe Islands, and studies in Iceland are in progress. There has been no progress in other areas.
4. Field metabolic rate of harp and hooded seals;
   Progress: None on harp and hooded seals, but some methodological advances have been made with other phocid species.
5. Temporal changes in energy density of prey species;
   Progress: None
6. Diet of minke whales in Icelandic waters and further west;
   Progress: The Icelandic Research Programme is making progress in describing the diet of minke whales in that area.
7. Consumption estimates synthesised within a modelling framework including full uncertainty evaluation;
   Progress: Some progress in Canada but no new estimates from NAMMCO member countries.

The highest priority items identified amongst the above were 2, 6 and 7.

In the immediate future, the Working Group recommended maintaining a focus on modelling the Barents Sea Ecosystem, the area for which the best data are available and where model development is ongoing at present. The Working Group also recommended that although minke whales are an important marine mammal predator in this area, improving the data inputs related to harp seals should be the primary immediate focus. The Working Group therefore recommended that research in the short term should be focused on:

1. Gaining a better understanding of the spatial and temporal distribution of the diet composition of harp seals;
2. Quantifying (with uncertainty) the seasonal abundance and distribution of major prey species of harp seals;
3. Repeating studies on distribution of harp seals in the Barents Sea to determine individual and inter-annual (natural) variation in distribution.

<u>Energy consumption</u>
Little new information specifically relevant to the target species was available to the Working Group. Nevertheless it was considered that existing estimates were probably adequate for modelling purposes at present. It was recommended that experiments should be conducted to determine the diving metabolic rates of harp and hooded seals similar to that of Sparling and Fedak (2004), but, if possible, under more realistic prey availability conditions, such as by using live prey.

<u>Modelling</u>
In general the Working Group reiterated the recommendations for further development of multi-species models made in 2002:
Prey selection

- theoretical and practical work on prey selection models
- development aggregated consumption functions
- migratory and spatial aspects of consumption models

<u>Multi-species modelling</u>

- Further work on the Scenario C Barents Sea model
- Use GADGET as a framework to generate template models for candidate areas in the North Atlantic

With regard to the Scenario C model, the Working Group noted that considerable effort had already gone into developing this model, and recommended that sufficient resources be allocated to finish its development and thoroughly test its properties. Recommendations for the short term included:

- Re-run cod assessment models using a higher value of mortality for young cod and use the results as input for Scenario runs, to determine what levels of mortality would be necessary to achieve compatibility in the model.
- Since pelagic crustaceans and polar cod are important prey to harp seals, the impact of including them explicitly in multi-species models should be explored.

- Investigate the sensitivity of the model to other functional forms of the predation model for harp seals, specifically forms where consumption of particular prey approaches 0 at very low densities of that species.
- Given that the diet information for harp seals is imprecise and probably biased, the sensitivity of the model to changing the proportion of cod in the diet should be explored.

With regard to the GADGET modelling framework, the Working Group noted that further work is required on the existing grey seal model to bring it up to a standard suitable for use as a template model. Once this has happened, work on models that include other marine mammals should be attempted. As in 2002, the Working Group also noted that GADGET lacks the scenario aspect where the management process itself is modelled in prognostic simulations, in a similar manner to that provided by the Scenario Barents Sea model. The inclusion of such a process would allow GADGET to compare management strategies and their related assessment machinery, and developments in the direction should be encouraged.

Workplan

In reviewing the amount of multi-species modelling work and associated applications to management decisions that had been conducted worldwide over the past several years, this Working Group noted in 2002 (NAMMCO 2003) a much lower than expected activity in this area. While some progress had been made in further development of the Scenario C model and development of the GADGET platform, it remains the case that the development of multi-species modelling is not proceeding as fast as it should, given the emphasis politicians and management authorities have placed on multi-species (ecosystem) approaches to the management of marine resources. Once again the Working Group emphasised that progress in this area will not be made unless significant additional resources are dedicated to it.

Given this, the Working Group advised that the Chairman should continue to monitor progress in this area, with the possibility of holding another workshop in 2006 if sufficient progress has been made to warrant it, and perhaps also an earlier smaller task group meeting if helpful to maintain momentum.

Discussion by the Scientific Committee

The Scientific Committee supported the recommendations of the Working Group for improving the information base on the diet and energy consumption of harp and hooded seals and minke whales. With respect to multi-species modelling, the Committee, as in 2002, supported the conclusion of the Working Group that progress in this area will not be made in this area unless significant new resources are dedicated. Specifically, the Committee recommended that the Scenario C model be finished and its properties thoroughly tested. The Committee also recommended that the GADGET platform be developed as a model capable of simulating management scenarios, and that the template models including marine mammals be developed as soon as possible.

Witting noted a potential for model selection bias in the ecosystem modelling and encouraged an examination of this potential effect before such models are used to provide management advice.

The Committee tasked Walløe with reporting progress in these areas at the 2005 meeting, with the goal of holding a meeting in 2006 to finalize models for the Barents Sea and assess models for other areas, if progress on the identified research and modelling priorities has been sufficient to warrant such a meeting.

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

9.1. Harp seals

In 2004 the Management Committee requested that the Scientific Committee annually discuss the scientific information available on harp and hooded seals and advice on catch quotas for these species given by the ICES/NAFO Working Group on Harp and Hooded Seals. The advice by the Scientific Committee on catch quotas should not only be given as advice on replacement yields, but also levels of harvest that would be helpful in light of ecosystem management requirements

For the Barents/White Sea and Greenland Sea stocks, in addition to the advice on replacement yields, advice should be provided on the levels of harvest that would result in varying degrees of stock reduction over a 10 year period.

Noting that Canada has instituted a multi-year management plan with a 3-year allowable catch of harp seals totalling 975,000 (not including the catch by Greenland), the Management Committee requested the Scientific Committee to provide advice on the likely impact on stock size, age composition, and catches in West Greenland and Canada under the conditions of this plan.

As noted under 5.2, the ICES/NAFO Working Group will be meeting in 2005, after which their advice will become available to the NAMMCO Scientific Committee for consideration. In this regard, the Scientific Committee requested that the Council consider the feasibility of NAMMCO assuming a more formal involvement with ICES and NAFO in the Working Group on Harp and Hooded Seals.

9.1.1 Update on progress

In Norway, studies of age- and sex composition, body condition and feeding ecology were performed on harp seals invading the coast of North Norway in March. In addition, fatty acid profiles and lipid biomarkers from 20 harp seals were used to investigate their foraging ecology in the northeastern Barents Sea. High level of the *Calanus* biomarkers 20:1n9 (mean 14.6 %) and 22:1n11 (mean 6.5%) were recorded together with typical dinoflagellate markers 22:6n3 (mean 6.5%) and C18PUFA (mean 5.5%). Based on analyses of the fatty acid profile by Principal Component Analysis (PCA) the importance of polar cod and the pelagic amphipod *Parathemisto libellula* in harp seal diets was confirmed. The high level of dinoflagellate and

Calanus biomarkers indicates that harp seal fatty acids originate mainly from these plankton organisms.

A model for a historical assessment of Barents Sea harp seals has been developed. The model has been applied within the context of the ICES WGHARP but needs some further refinements which are scheduled to be completed in 2004.

Final analyses of data from the satellite tagging study of adult Greenland Sea harp seals that was completed in May 2000 have revealed that a large proportion of the tagged seals migrated into the Barents Sea in mid-July, to return in late autumn/winter, thus sharing feeding grounds with the Barents Sea stock of harp seals for a considerable part of the year (4-5 months). Moreover, diving behaviour data show that the seals display both diurnal and seasonal variations in diving depths, with dives being much deeper in winter and at day-time, than in summer and during night-time. Further information is given in Folkow *et al.* (2004).

The Observer for Canada reported that diet studies are continuing and satellite tagging studies are being conducted to determine significant areas and times of co-occurrence between harp and hooded seals and cod, and provide details on the overall habitat use by each species to be used to estimate seal consumption on each cod stock. A new population survey of harp seal was conducted in March 2004 and the estimate from this survey will be considered by WGHARP at their next meeting.

9.1.2 Impact of Canadian management measures

In 2002, the Department of Fisheries and Oceans adopted an Objective Based Fisheries Management approach for seal populations (SC/12/7 and 9). This scheme adopts two different approaches based on whether seal populations are considered data rich or data poor. A population is considered data rich if recent estimates of catch levels, reproductive rates and estimates of mortality are available. Under a data rich scenario, two precautionary reference points are established at 70% (N_{70}) and 50% (N_{buffer}) of the largest estimated population size. Management objectives ensure that the population size remains above $N_{70.}$ If harvesting results in a declining population, harvest quotas must be established at a level assuming a much lower risk that the population will continue to decline. If a population continues to decline below a Reference limit point set at 30% below the maximum estimated population size, then it is considered that the population has suffered serious harm and harvesting is discontinued.

Harp seals are considered a data rich population, and are therefore managed with the objective of maintaining the stock size above the N_{70} level of 3.85 million. Between N_{max} (5.2 million) and N_{70} the hunt will be managed to facilitate a market based harvest that will maximise return to the sealers. The Total Allowable Catch (TAC) for 2003-2005 is 975,000 for the period, with an annual TAC of up to 350,000 in any two years provided the combined TAC is maintained by a reduction in the TAC in the other years.

Document SC/12/8 described harvest simulations carried out as background to the implementation of the Plan. Owing to uncertainty associated with the current estimates of population size, the lower 60% confidence limit served a metric to determine when N_{70} had been reached. Regular and frequent surveys are necessary to reduce the uncertainty surrounding these estimates. Annual harvests ranging from 75,000 to 500,000 over 3 years were examined to determine their impact on the population. The replacement yield for the population is estimated as approximately 255,000 animals. The Greenland harvest was assumed to remain constant at the 2000 level of 108,000, and this was doubled to account for struck and lost animals. For most scenarios examined, harvest levels exceeded replacement yield and resulted in population decline. Harvests levels at the current average Canadian TAC of 325,000 result in a slow decline up to 2009 and an accelerating decline thereafter. Under this scenario the lower 60% confidence bound reaches N_{70} by about 2018. Once such a decline was detected it would trigger management measures estimated to have an 80% chance of halting the decline. It was noted in this respect that the frequency and precision of surveys would affect the performance of the management approach, in that better and more frequent surveys would result in tighter confidence intervals for the forecast population and a lower probability of driving the population below the N_{70} level inadvertently.

The Scientific Committee accepted the modelling approach used in SC/12/8, but noted that Greenlandic harp seal catches had decreased substantially since 2000, and therefore the forecast Greenlandic catch used in the projections may have been too high. In addition the assumed struck and lost rate of 50% used for the Greenlandic hunt may be too high, but there are no data to support a lower level. The effect of using a lower Greenlandic catch in the model would be to increase the length of time before N_{70} is reached under most projections.

The TAC levels in the Canadian Management Plan in combination with the Greenlandic harvest exceed the estimated replacement yield and would, if taken, lead to a decline the the size of the stock. It is not known how the proportion of animals that summer in Greenland relates to the size of the overall population. Low population levels in the 1970s coincided with very low harvest levels in Greenland, so it is possible that the fraction migrating to Greenland might have been disproportionally affected. Present harvests are substantially lower than they were as recently as 2000, and the decrease apparently coincides with a period of relatively high harvest in Canada. However the West Greenlandic marine ecosystem is very dynamic and there have been changes throughout this period, which might also affect the number of harp seals using the area. The Scientific Committee could therefore not address this question, but suggested that a modelling approach incorporating historical Greenlandic and Canadian harvest levels and effort and population size might give some indication of the effect of total population size on the numbers summering in Greenland. In addition, it was noted that the results of the recent abundance survey in Canada will be useful in addressing this question.

The Scientific Committee concluded that the likely effect of the harvest levels outlined in the Canadian Management plan was a slight drop in total abundance in the short term (3-5 years), and an accelerating decline if these harvest levels are maintained over a longer period (*ca*. 10 years). However these conclusions may be modified if the Greenlandic harvest is lower than projected. The Committee was not able to directly assess the effect of these measures on the Greenlandic catch, but noted that it was likely that the availability of seals to Greenlandic hunters would likely decrease as the total population decreased. The effect on the age composition was not assessed, but the Committee noted that as the Canadian and Greenlandic harvests were mainly of young of the year animals, the proportion of these animals in the population would decrease under higher levels of harvest.

9.1.3 Future work

The Scientific Committee recommended that the ICES/NAFO Working Group should be requested to address the question of how a projected decrease in the total population of Northwest Atlantic harp seals might affect the proportion of animals summering in Greenland.

9.2. Hooded seals

9.2.1 Update on progress

This year 6 hooded seals were tagged with satellite transmitters in the moulting area for the Northwest Atlantic population off southeast Greenland in a joint project between Greenland and Canada.

Anatomical and physiological studies of hooded seals from the Greenland Sea stock were conducted in connection with a research cruise in the Greenland Sea in spring 2003. Two adult female and 4 newborn hooded seals were used in studies of the vascular arrangement in the front flippers, in connection with ongoing studies of thermoregulatory aspects of diving in this species. Another 8 weanling hooded seals were live captured and brought back to Department of Arctic Biology for later use in studies of the ability of seals to tolerate hypoxia (oxygen shortage) during diving.

9.2.2 Impact of Canadian management measures

The Canadian Management Plan is described under 9.1.1 (see p. 232 earlier). Under this plan hooded seals are a data poor population as no current estimates of population size are available (see 9.2.3 below). The current TAC in Canada is set at 10,000 animals but recent harvests have been very low, as under current regulations the take of bluebacks is prohibited. Currently, therefore, the effect of Canadian management measures on the stock of hooded seals is negligible.

9.2.3 Future work

A new population survey for hooded seal is planned for March 2005 as a cooperative effort between Canada, Greenland and Norway. The survey will probably cover all the known pupping areas for the species.

Greenland and Canada will continue their joint programme of satellite tagging to determine the migratory patterns for hooded seals in the Northwest Atlantic.

9.3. Harbour porpoise

9.3.1 Update on progress

Working paper SC/12/11 was an analysis of the distribution, abundance and trends in abundance of cetaceans in Icelandic coastal waters from four aerial surveys carried out in 1986, 1987, 1995 and 2001. The surveys had nearly identical designs in three of the four years. The target species was the minke whale but all species encountered were recorded. Sighting rates and line transect densities were used as indices of relative abundance to monitor trends over the period, and abundance estimates corrected for perception biases were calculated for some species from the 2001 survey. The distribution of harbour porpoise sightings varied greatly between surveys but their occurrence was mainly inshore. Few harbour porpoises were sighted in 2001 compared to earlier surveys. Total uncorrected abundance was 4,239 (95% CI 2,724 – 6,599) in 1986 and 5,156 (95% CI 3,027 – 8,739) in 1995, but these estimates are negatively biased, probably severely so, by uncorrected perception and availability biases. The relative abundance of harbour porpoises decreased over the period at a rate of -4.9% (CV 0.47), with the negative trend due mainly to the low numbers seen in 2001.

The Scientific Committee agreed with the conclusions of the authors that the point estimates of abundance were likely heavily negatively biased, and that the evidence for a decline in harbour porpoise in the area was weak. Nevertheless the apparent decline in relative abundance between 1986 and 2001 is cause for concern and should be investigated further. The Scientific Committee noted in this regard that there is likely a substantial level of by-catch for this species in Icelandic fisheries (see 11.1, p. 245). In order to estimate the sustainability of the ongoing by-catch, better estimates of the present by-catch levels of harbour porpoises are required as well as an estimate of absolute abundance for the area. Aerial surveys will be carried out over the next two years as part of the Icelandic Research Programme, and the Scientific Committee recommended that the feasibility of modifying these surveys to generate valid estimates of absolute abundance for this species be investigated.

9.3.2 Future work

Bloch indicated that satellite tagging would be attempted for this species in the Faroes if funding could be found. In addition a small number of samples for genetic analysis are available and these will be analyzed soon.

In Iceland, seasonal aerial surveys in coastal waters will continue for the next two years, and the protocols of these surveys will be modified to make them more effective for harbour porpoises. Norway has carried out vessel surveys in coastal waters but the status of these was unknown. Norway will be participating in the SCANS II survey to take place in 2005.

9.4. Narwhal

9.4.1 Update on progress

Witting reported that the aerial survey attempted off West Greenland in March 2004 had not been successful due mainly to poor weather conditions. Some “platform of opportunity” observations of narwhals had been carried out in 2004 from hunters’ and research vessels. Three narwhals had been instrumented with satellite tags in Inglefied Bredning. The tags were of the harpoon type and were applied by Greenlandic hunters using traditional hunting equipment and kayaks. The lifetime of these tags was expected to be short. In addition 8 narwhal were tagged in Admiralty Inlet, Canada. Work continued on refinement of the assessment model for West Greenland narwhal. Recent publications (Laidre and Heide-Jørgensen 2004, Laidre *et al.* 2004) provided new information on the feeding ecology of narwhals in Baffin Bay: this information was considered by the JCNB/NAMMCO Joint Working Group in February 2004 (NAMMCO 2004).

The three-year survey programme for narwhal in Canadian High Arctic and off eastern Baffin Island was completed in 2004, and the results will be discussed at the next meeting of the Joint Working Group. Efforts continue to estimate the loss rates in narwhal hunts, and to allocate catches to putative narwhal stocks.

The Scientific Committee was informed about recent changes in the management regime for narwhal and beluga in West Greenland. The total quota for narwhal is 300, 200 for West Greenland and 100 for Qaanaaq area.

The Scientific Committee welcomed this information and recognised that this was a significant step towards the sustainable management of West Greenland narwhal. Nevertheless the Committee recalled its recommendation from 2004 (NAMMCO 2004), that the total removals should be reduced to no more than 135 individuals. It was also emphasised that this recommendation was given in terms of total annual removal rather than a landed catch. Given the unknown but perhaps substantial loss rates in some areas, limits on landed catch should be lower than this. The Committee also recommended a cessation of narwhal hunting in the Melville Bay area.The Committee once again advised that delay in implementing catch reductions to the recommended levels will result in delay in stock recovery and probably in lower available catches in the medium term.

9.4.2 Future work

Noting that there was some uncertainty as to whether the survey off West Greenland would be attempted again in 2005, the Scientific Committee emphasised the importance of continuing this survey series to the continued assessment of both West Greenland narwhal and beluga. The Committee therefore strongly recommended that this survey be attempted again in 2005.

Witting informed the Committee that the JCNB SWG wished to hold their next meeting in February or March 2005, and expressed the hope that the coordination with the NAMMCO Working Group could be continued. Noting that this collaboration has been very successful to date, the Scientific Committee recommended that the Working Group once again be made a joint one between JCNB and NAMMCO.

9.5 Beluga

9.5.1 Update on progress

As noted under 9.4.1 (see p. 236) the West Greenland survey attempted in 2004 was not successful.

New management measures in Greenland (see 9.4.1) have established a total quota of 320 beluga for West Greenland and the Qaanaaq area. The Scientific Committee recognised that this was a significant step in the right direction in the management of this stock. Nevertheless, the Scientific Committee has advised on two occasions (2000 and 2001) that the West Greenland stock is substantially depleted and that present harvests are several times the sustainable yield, and that harvests must be substantially reduced if the stock is to recover. The Committee once again stressed that the delay in reducing the total removal to about 100 animals per year will result in further population decline and will further delay the recovery of this stock. Given what is known about loss rates in beluga hunts, the landed catch should be reduced to a lower level than this.

9.5.2 Future work

As for narwhal (see 9.4.2, p. 237), the Committee strongly recommended that the West Greenland winter survey be attempted again in 2005.

9.6 Fin whales

9.6.1 Update on progress

Working paper SC/12/20 presented estimates of abundance for fin, humpback and sperm whales from the Norwegian 1996-2001 shipboard surveys which covered a large part of the northeast Atlantic through annual partial coverages. The surveys were conducted with two independent observer platforms. The target species of the surveys was the minke whale and the implemented tracking procedures for this species implied that the survey had to be conducted in passing mode so the possibilities for closing on sightings for determining species identity and group sizes were limited. Abundances of large whale species have been calculated based on a combination of the double platform data. For the total area surveyed through the six-year period 1996-2001, the abundance of fin whales was 10,500 (CV 0.239). The apparent increase in numbers compared to those based on the synoptic survey in 1995 can be explained by inclusion of the block NVS north of Iceland in the survey coverage.

The Scientific Committee welcomed this new information. It was noted that the estimates are likely negatively biased due to uncorrected perception and availability biases. Also, because the survey was conducted in strictly passing mode, many sightings were classified as unidentified large whales. This would also lead to underestimation of identified species abundances. The precision of the total estimates is likely overestimated, as the "extra variance" due to changes in distribution between survey years was not taken into consideration.

There was overlap in coverage between the NVS block of this survey and some Icelandic blocks of the NASS 1995 and 2001 surveys. Gunnlaugsson and Pike agreed to compare the estimates in the area of overlap and produce a combined estimate if feasible.

Working paper SC/12/21 presented an analysis of sighting rates in Icelandic NASS and other surveys conducted between 1982 and 2003. The data show high variability for some species but appear to confirm the observed trend of increase in abundance for fin and humpback whales while sperm whale sightings show the reverse trend. Apparently there has been an increase in sighting efficacy and sighting rates seem to increase almost linearly with the number of observers from one to 7.

9.6.2 Future work

In 2003 the Scientific Committee recommended that the scheduling of future assessment meetings for fin whales be dependent on the progress made in fulfilling recommendations for research. As recommended by the Working Group on Minke and Fin whales in 2003, a small Task Group was convened to review the progress that had been made since the last meeting of the Working Group. The Group reviewed the recommendations that had been made in 2003 and noted what progress had been made, and their report is includes as Annex 2 (see p. 275).

The Scientific Committee supported the recommendations of the Task Group on some high priority tasks that must be completed before a productive assessment meeting can be held. If such a meeting is to be held in autumn 2005, these tasks should be completed by July 2005.

The Faroe Islands

2. Genetic analyses of existing and additional samples, combined with those from other areas;
3. Completion of revised catch series and development of a CPUE series if feasible;
4. Collection of additional samples for genetic analyses, if possible.

East Greenland - Iceland

1. Spatial disaggregation of abundance, catch, effort and mark-recapture data;
2. Genetic analyses of existing samples combined with those from other areas.

Other (mainly North Norway)

1. Rectification and verification of catch data as described above, and development of a CPUE series. Additional funding is required for both these tasks;
2. Analysis of genetic samples in combination with those from other areas.

The Scientific Committee emphasised that samples from all areas should be combined into a single genetic analysis for the purpose of stock delineation. It was also recommended that the possibility of building a large whale biopsy programme into the SCANS-2005 survey be investigated.

9.7 Minke whales

9.7.1 Update on progress

Witting informed the Committee that an aerial digital photographic survey had been conducted in West Greenland over 2.5 months in Summer/Fall 2004. The target species were minke and fin whales. Estimates from this survey should be available by June 2005.

Progress under the Icelandic Research Programme is described in 16.2.

In Norway the sightings survey programme continued this year with a ship survey in the North Sea.

9.7.2 Future work

To investigate the feasibility of estimating migration rates from genetic data, the IWC Scientific Committee agreed to fund a simulation study to determine what sample sizes and loci numbers would be required to arrive at more definitive conclusions. It is expected that this work will be carried out in the coming year.

9.8 White-beaked, white-sided dolphins and bottlenose dolphins

9.8.1 Update on progress

Abundance and trends of *Lagenorhynchus* spp. (mainly *L. albirostris* (white-beaked)) dolphins in Icelandic coastal waters were reported in SC/12/11 (see 9.3.1, p. 236). There were an estimated 31,653 (CV 0.30) dolphins in the survey area in 2001, and there was no significant trend in relative abundance between 1986 and 2001.

In the Faroes, sex and total body length have been recorded from nearly all white-sided and bottlenose dolphins caught in 2003-2004. In addition full samples were taken from as many individuals as possible in this period. Some biopsy sampling of mainly white-beaked dolphins was carried out during Norwegian sightings surveys in 2003. Analysis of samples from white-beaked dolphins collected from Icelandic by-catch is ongoing.

9.8.2 Future work

The Scientific Committee concluded last year that there was still insufficient information on abundance, stock relationships, life history and feeding ecology to go forward with the requested assessments for these species. This may become feasible once feeding, genetic and life history studies have been completed in Iceland, the Faroes and Norway, and when new abundance estimates become available from the SCANS II, NASS and other sightings surveys. Such an assessment could probably be conducted by 2008 at the earliest.

9.9 Grey seals

9.9.1 Update on progress

Abundance estimation (using pup counts) and sampling of biological material for studies of breeding biology (including tagging of pups), in particular the temporal distribution of births, stock identity and feeding ecology were performed for grey seals in ship borne surveys in Mid and North Norway in October – December 2003.

Grey seal pups were counted repeatedly from an aircraft (3^x to 5^x) during the breeding season in the autumn, in selected rookeries in Frameyjar, Breidafiord, W-Iceland and on the South-Coast. The area investigated accounts for about 45% of the estimated Icelandic pup-production. A few grey seal pups were marked with plastic tags in the autumn on Skeiðarársandur, South-Iceland.

The Faroes reported no progress in research or new management measures for this species.

9.9.2 Future work

In 2003 the Scientific Committee strongly recommended immediate efforts to obtain better information on the population of Faroese grey seals, and on the nature and impact of the take in the Faroes. Noting that this had not yet begun, the Committee reiterated the recommendations made last year.

The Scientific Committee welcomed the information that Iceland was continuing its survey programme for this species as recommended last year. The Committee reiterated its previous recommendations for management of this stock, most notably the immediate establishment of management objectives and conservation reference limits as an urgent priority. A formal assessment of the effect of present levels of harvest on the population, including the risk of extinction and the sensitivity of the survey programme to detect a population decline, should be conducted as soon as possible.

For Norway, the Scientific Committee noted as in 2003 that the new quota levels implemented for this area would, if filled, almost certainly lead to a rapid reduction in population in the area. A formal analysis of the effect of the quota levels of harvest on the population, including the risk of extinction and the sensitivity of the survey programme to detect a population decline, should be conducted as soon as possible.

9.10 Humpback whales

9.10.1 Update on progress

In 2004 the Management Committee noted the conclusion of the Scientific Committee that there is evidence from the NASS of a rapidly increasing abundance of humpback whales in the Central North Atlantic, and requested the Scientific Committee to assess the sustainable yield levels for humpback whales, particularly those feeding in West Greenlandic waters. The management objective in this case would be to maintain the stock at a stable level. The Scientific Committee reviewed the available new information on this species in order to decide how best to respond to this request.

The distribution and abundance of humpback whales in the Northeast Atlantic was described in SC/12/20 (see 9.6.1, p. 238) For the total area surveyed through the six-year period 1996-2001 the estimate for humpback whales was 4,659 animals (CV 0.391). The majority of the animals was found in the NVS block north of Iceland, which confirms the findings from the Icelandic NASS 1995 and 2001 surveys of a large humpback whale population summering in that area.

The distribution, abundance and trends in abundance of humpback whales in Icelandic coastal waters were described in SC/11/12 based on aerial surveys during 1986 – 2001 (see 9.3.1, see earlier). Humpback whales increased rapidly at a rate of 10.8% (CV 0.24), with much of the increase occurring off eastern and northeastern Iceland. In 2001 there were an estimated 5,129 (CV 0.462) humpback whales in the survey area.

A similar trend was reported by Gunnlaugsson and Sigurjonsson for the period 1950 – 1984 based on observations by whalers. In SC/12/21 (see 9.6.1) additional support is given for an increasing trend from the NASS vessel surveys 1987 – 2003 and from a comparison of sighting rates in a series of 0-group surveys conducted in late August in the early 1980s and early 1990s.

The Scientific Committee noted that the findings of both these studies supported its conclusion from 2003 with regard to the Years of the North Atlantic Humpback (YoNAH) surveys, that the discrepancy between the NASS and YoNAH estimates suggests that the North Atlantic population of humpback whales is likely considerably larger than that estimated in the YoNAH study.

SC/12/14 provided the results of photo-identification surveys of humpback whales conducted at West Greenland during 1988–93, the last two years of which were part of the YoNAH research programme, with the primary aim of estimating abundance for the West Greenland feeding aggregation. The area studied stretched from the coast out to the offshore margin of the banks, determined approximately by the 200 m depth contours. Sequential Petersen capture–recapture estimates between 1988 and 1993 averaged 360 humpbacks (CV 0.07), with no detectable trend over the period. However the power to detect a trend was relatively low for these data.

9.10.2 Future work
In considering the request for advice posed by the Council, the Scientific Committee agreed that they could not apply the apparent rate of increase in the stock around Iceland to the West Greenland stock as there is no information on a similar trend in abundance from this area. The existing abundance estimate is more than 10 years old and a new estimate may become available from recent surveys off West Greenland. Even so, the uncertainty in the new estimate is likely to be high. Due to the effects of environmental and demographic stochasticity in populations of only a few hundred individuals, the models that the Scientific Committee usually apply to assess sustainability would require modification to be applied to humpback whales in West Greenland. For these reasons the Scientific Committee is unable to recommend sustainable yield levels for this stock at this time, and would be unable to do so without additional information on present abundance.

For areas east of Greenland there is current information on abundance and trends in abundance available, so it would be feasible to estimate sustainable yield levels for these areas. The Scientific Committee could establish a working group to carry out this task, if the Council identifies this as having high priority.

9.11 Killer whales
9.11.1 Update on progress
In 2004 the Management Committee requested the Scientific Committee to review the knowledge on the abundance, stock structure, migration and feeding ecology of killer whales in the North Atlantic, and to provide advice on research needs to improve this knowledge. Priority should be given to killer whales in the West Greenland – Eastern Canada area.

Several killer whale researchers were consulted prior to the meeting and the prevailing opinion was that there was insufficient information with which to conduct an assessment, particularly for the West Greenland area. The Scientific Committee therefore reviewed the available new information to consider how it could best deal with this request.

In West Greenland there are insufficient data to estimate abundance or trends in abundance of this species. Killer whales appear sporadically and in varying numbers from year to year (NAMMCO 1993). In recent years, incidental reports suggest that sightings have become more frequent, and the catch has increased in the past two years. Some of these animals were taken during the winter, a time when sightings were previously very infrequent. This incidental information suggests that the spatial and temporal distribution of killer whales may have changed in recent years off West Greenland, but there are no data to support this suggestion. Given the clumped distribution and sporadic incursions of killer whales in the area, it was considered very unlikely that the aerial surveys conducted in 2004 would provide a useful estimate of abundance for this species.

Iceland has had a photo-ID programme for this species and maintains a catalogue of about 400 photographed animals. No matches have been found between the Icelandic catalogue and a similarly sized catalogue of killer whales off Norway.

Seven killer whales were instrumented with satellite tags in 2000 and 2001 off Norway, and the data are being analyzed to describe movement patterns, home ranges and dive behaviour.

9.11.2 Future work

The Scientific Committee found the question posed by the Council to be ambitious and noted that there was not enough information to support a meaningful assessment at this time, particularly for the West Greenland area. Moreover, the Committee considered it unlikely that such information could be obtained in the near term, even if significant resources for research become available. Abundance estimation for this species is particularly difficult because of their clumped spatial distribution and unpredictable seasonal distribution in some areas. While mark-recapture estimation is applicable to such situations, such a study in West Greenland would be logistically difficult and likely take many years. There is no information on trends in abundance for any area, and limited information on stock identity for killer whales throughout most of the North Atlantic.

The Committee recommended some immediate steps that could be taken to improve the available information on this species:

i. Obtain samples for genetic, life history and ecological studies from all animals harvested in Greenland;
ii. Take biopsy samples from and photos of killer whales on an opportunistic basis, especially during sightings surveys;

iii. Compare the existing photo-ID catalogues in Norway and Iceland with available photos from other regions;
iv. Conduct genetic analyses using all new and existing samples for stock delineation.

The Scientific Committee will review progress under this item annually with the view of conducting an assessment when sufficient information becomes available.

9.12 Walrus

9.12.1 Update on progress

In 2004 the Management Committee noted that the Scientific Committee had last provided an assessment of walrus in 1994. Noting that considerable new information has become available since then, the Management Committee therefore requested the Scientific Committee to provide an updated assessment of walrus, to include stock delineation, abundance, harvest, stock status and priorities for research.

In 2003 satellite transmitters were deployed on 10 adult walrus males in the Tusenøyane area, Svalbard, in early August. In addition blubber and blood samples were collected from these animals for studies of pollutants, diets and for a general health assessment.

Samples and ID-photos were collected from walruses from Young Sound – Northeast Greenland as part of an ongoing study that will estimate population numbers in this area.

9.12.2 Future work

Dr Erik Born has agreed to chair a Working Group on Walrus, which will meet in January 2005 to deal with the request from the Management Committee. The Working Group will include members from Norway, Denmark, Greenland, Canada, the Russian Federation and the USA.

9.13 Sperm whales

9.13.1 Update on progress

A description of the distribution and abundance of sperm whales in the Northeast Atlantic was provided in SC/12/20 (see 9.6.1, p. 238). Sperm whales were concentrated mainly in the Norwegian Sea in offshore waters. For the total area surveyed through the six-year period 1996-2001, the abundance of sperm whales was 6,375 animals (CV 0.216). It was noted that the estimate is likely to be negatively biased due to availability for this long-diving species. There appears to have been an increase in the abundance of sperm whales in the Norwegian Sea over the course of the NASS and NILS surveys. In contrast the analysis of sighting rates in the Central Atlantic from the NASS and other surveys (SC/12/21 - see 9.6.1) showed no trend in the relative abundance of sperm whales in that area. It was noted that historical catch and other data showed that virtually all the sperm whales seen in both areas were males.

9.13.2 Future work

No advice has been requested by the NAMMCO Council for this species. The IWC

Scientific Committee is planning for an in-depth assessment of sperm whales, and a research planning meeting is planned for early 2005.

10. NORTH ATLANTIC SIGHTINGS SURVEYS

10.1 NASS-2001 and earlier surveys

Working papers SC/12/11 (see 9.3.1), SC/12/20 (see 9.6.1) and SC/12/21 (see 9.6.1) provided new analyses using data from these surveys. In addition several papers are in various stages of development for the new volume of *NAMMCO Scientific Publication* on the NASS (see 13.1, p. 247).

10.2 Planning for future NASS

In 2003 the Management Committee recommended that member countries continue to coordinate cetacean surveys across the North Atlantic, and attempt to broaden the coverage of these surveys through the inclusion of other participants, particularly in the Northwest Atlantic. In 2004 the Scientific Committee agreed that 2006 would be the best year to hold an international sightings survey, in conjunction with a possible SCANS II and other surveys.

Pike reported that he had contacted those responsible for planning the SCANS II survey to discuss the possibility of coordinating the offshore portion of that survey with the NASS. The response to this idea was favourable. However, due to lack of funding, the offshore portion of SCANS II has been postponed until 2007, and it is at this point uncertain whether it will be carried out. A research scientist at the Department of Fisheries and Oceans, Canada, was also contacted, and expressed great interest in coordinating future surveys off Eastern Canada with the NASS.

It was noted that the Icelandic Research Programme would likely continue throughout 2006, which would leave researchers there little time to participate in a sightings survey. Also, an international redfish survey, with which the Icelandic NASS successfully shared a survey platform in 2001, may occur again in 2007.

Given this information, the Scientific Committee decided that the next NASS should be planned for 2007. Planning will be done by the Working Group on Abundance Estimates and should begin by correspondence immediately and with a first planning meeting planned for early 2006. It will be important for the Working Group to maintain or establish contact with other potential partners in the survey, including SCANS II, Canada and possibly the USA.

11. BY-CATCH OF MARINE MAMMALS

11.1 Estimation of by-catch in Icelandic coastal fisheries

In 2004 the Management Committee requested the Scientific Committee to carry out an evaluation of the data collection and estimation procedures used in the Icelandic by-catch monitoring programme. Paper SC/12/16 provided a description of the programme and preliminary estimates of by-catch. The Chairman clarified that the

Committee should focus on the methods used and the reliability of the by-catch estimates rather than on the significance of the estimates themselves.

In 2002 a procedure of monitoring marine mammal by-catch was introduced to the gillnet fishery in Iceland. From 4.5-4.8% of the operating fishing reported marine mammal by-catch in the fishery log books in 2002 and 2003, recording a total number of 195 and 188 entangled animls for 2002 and 2003 respectively. In October 2004 a questionnaire was presented to the fishermen in order to evaluate the efficiency of the monitoring system and the quality of the by-catch data obtained from the log books. The results from the questionnaire was used to interpret the by-catch data from the log books and estimate the total number of harbour porpoises entangled in the gillnet fishery in 2002, 2003 and the first half of 2004. The results were compared to the fishermen's own attempts to estimate the annual by-catch and secondly, to information obtained from gillnet research surveys performed in March and April 2003 and 2004. The comparison revealed a considerably lower estimate using the log book reports, indicating a low efficiency of the monitoring system for marine mammal by-catch using the log book reports in the Icelandic gillnet fishery.

In discussion the Scientific Committee noted that it was assumed that those fishermen who reported by-catch in their logbooks, did so for every by-catch event. This assumption is demonstrably false as some fishermen indicated in response to the questionnaire that they reported by-catch only occasionally. This would cause a negative bias of unknown magnitude in the by-catch estimation. However it was recognised that it was probably not feasible at this point to estimate the proportion of by-catch reported by reporting fishermen. This problem could be solved in the future by modifying the logbook forms such that the presence or absence of marine mammal by-catch was consistently reported for every gear cast.

It was also assumed that fishermen did not deliberately falsify their logbook records or answer untruthfully to the questionnaire survey, by reporting that they had no by-catch when in fact they did. It is impossible to estimate the magnitude of this bias, if it exists, in a self-reporting scheme. The most likely effect of such deliberate falsification would be to cause an underestimation of by-catch. The authors of SC/12/16 indicated that most fishermen responded positively to the questionnaire, and they did not think deliberate falsification would be an important problem.

The uncertainty of the by-catch estimates in SC/12/16 was not estimated, but it was considered that it should be possible to do so. Given the low return rate of by-catch records, this uncertainty is likely to be very high, especially for species that are rarely taken. The only way to improve the precision of the by-catch estimates would be to increase the response rate of fishermen. While the by-catch estimates from the experimental gillnet survey programme provide an independent check on the estimates from logbooks, the uncertainty in these estimates is likely also to be very high because of the relatively low amount of effort in the survey fishery. Therefore the gillnet survey will likely have very low power to provide estimates of by-catch with required precision.

Similarly, direct independent observation of a subsample of the fishery could provide an unbiased and independent estimate of by-catch. But again, the precision of the estimate would be directly proportional to the fishing effort that could be observed. It is possible to calculate the amount of observer coverage required to produce estimates of a given precision (Northridge and Thomas 2003), and the Committee recommended that this be done for the Icelandic fishery.

No estimate of by-catch was provided from the lumpfish gillnet fishery, which is known to take marine mammals. It was noted that this fishery is under a different reporting system than other gillnet fisheries, so by-catch estimation would have to be done independently.

The Scientific Committee recommended the following actions to improve the estimation of by-catch in Icelandic fisheries:

i. Logbook reporting forms should be changed such that the presence or absence of by-catch is reported for every gear cast, along with associated effort data;
ii. Full uncertainty should be incorporated into the by-catch estimates from the logbook programme and the experimental gillnet survey;
iii. An analysis should be carried out of the level of observer coverage required to achieve an acceptable level of precision in by-catch estimates from the Icelandic gillnet fishery;
iv. By-catch from the lumpfish gillnet fishery should be estimated.

It was recognised that intentional falsification may produce a negative bias in any self reporting system, but the magnitude of this bias cannot be addressed without an independent estimate of by-catch.

In conclusion, the Scientific Committee commended the authors for producing the first direct estimation of marine mammal by-catch from a NAMMCO member country, and strongly recommended that other member countries establish by-catch reporting systems for their fisheries.

12. DATA AND ADMINISTRATION

There was nothing to report under this item.

13. PUBLICATIONS

13.1 NAMMCO Scientific Publications

Five volumes of *NAMMCO Scientific Publications* have been published to date, the most recent in 2003. Two more are planned: Vol. 6 on the NASS, and Vol. 7 on grey seals. The order of these volumes will depend on which is completed first, as both are expected to be published in 2005. There has also been some discussion about publishing a volume on narwhal, and this will be reconsidered at the next meeting of the Beluga/Narwhal Working Group, probably in 2005.

The planned volume on the NASS is edited by Nils Øien and Daniel Pike. All relevant authors initially confirmed their contribution to the volume, but it has proven difficult

to get authors to submit their papers by the required deadlines. Nevertheless the editors expect all papers to be in early in 2005, for an expected publication later in that year.
The grey seal volume is edited by Tore Haug, Mike Hammill and Droplaug Ólafsdóttir. All relevant authors have confirmed their contributions to the volume. The core of the book will be articles reviewing the status of grey seals in various areas (including at least distribution, population sizes and trends (and how these were assessed), and removals (and sustainability of removals, if possible)). The deadline for receipt of articles is January 1 2005, and the book should be completed sometime in 2005.

The idea of publishing a volume on oceanic dolphins (*Lagenorhynchus, Tursiops, Delphinus*) was discussed, but a decision on this was considered premature until the planned assessment has been conducted (see 9.8.2, p. 240).

13.2 Other publications

The proceedings from the Conference on the Incorporation of Users' Knowledge in Management Decision Making, held in 2003, are expected to be published in book form in 2005.

14. BUDGET

The Scientific Secretary presented a draft budget for the Scientific Committee for 2003. He noted that the budget allocation of the Scientific Committee was utilised for the most part for funding invited experts to participate in Working Group meetings, and for contracted work. The Scientific Committee approved the budget as presented.

15. FUTURE WORK PLANS

15.1 Scientific Committee

The next meeting of the Scientific Committee will be held in Norway, probably in October 2005.

15.2 Working groups

It is likely that the following working groups will meet in 2005:

- Walrus, January in Copenhagen;
- Narwhal and Beluga, February or March, jointly with the JCNB Scientific Working Group;
- Fin whales, autumn 2005, if progress identified under 9.6.2 is completed.

Other working groups may be required depending on requests received from the Council.

16. ANY OTHER BUSINESS

16.1 Satellite tagging correspondence group

In 2002 the Scientific Committee decided to establish an intersessional correspondence group to:

- identify progress in satellite tagging made in NAMMCO member countries and elsewhere;
- explore the technical aspects of satellite tagging, including deployment systems;
- briefly consider what tagging experiments have been done and the rates of success;
- Recommend ways to further the development and success of this technique in NAMMCO member countries.

Mikkelsen, chairman of the Group, reported that little progress had been made in 2004. An attempt had been made to put together an overview of past tagging attempts, focussing on the technical details of tag type and attachment, and the relative success of the deployment. However, insufficient information had been provided to warrant a more formal review. Mikkelsen concluded that without the participation of researchers who are active in this area, it will be difficult to make progress on this issue.

The Scientific Committee considered that the importance of this issue warranted a continued effort to try to resolve the problems in tagging whales, particularly large whales that cannot be captured and handled. Therefore the Committee asked Mikkelsen to continue his efforts, by broadening the membership of the group to include key experts from member and non-member countries. The idea of holding a workshop should also be considered, but again the participation of researchers and technical experts active in this field must be ensured.

16.2 Icelandic research programme

In 2003 the Marine Research Institute, Reykjavík, in cooperation with a number of other research institutes, introduced a research programme on minke whales in Icelandic waters. The original plan assumed a catch of 100 common minke whales, 100 fin whales and 50 sei whales in each of the two years of the programme. The primary objective of the research on minke whales was to increase our knowledge on the feeding ecology of minke whales in Icelandic waters by studies on diet composition, energetics, seasonal variation in distribution and abundance, consumption of different prey species and multi-species modelling.

In August 2003 the Government of Iceland decided to start implementation of the part of the programme concerning common minke whales by issuing a special permit for the takes of up to 38 animals from 15 August to 30 September 2003 in accordance with the original plan for this period. A total of 37 common minke whales were taken during this period, including one struck and lost animal. In June 2004 a special permit was granted for the takes of a further 25 minke whales. Thus, the sampling has proceeded considerably more slowly than assumed in the original plan, with a total of 62 common minke whales taken during the first whole year of the programme (first two summer seasons).

The objectives, methodology, total sample size and spatial and seasonal distribution of the sample remain unchanged from the original proposal and the modifications involve only a reduced rate of sampling. It is now assumed that the sampling of 200 minke whales, originally scheduled to take two years, will be completed in August 2006. The proposed catches in 2005 and 2006 are 39 and 100, respectively.

In 2003 there was a dominance of males in the sample (23 males/13 females), while the opposite was true in 2004 (10 males/15 females).

Some very preliminary results from the programme were presented at the NAMMCO workshop on marine mammal fisheries interaction in Oslo (see 8.1, p. 223).

The status of laboratory work for the different subprojects is given in SC/12/NPR-I. In addition to research directly based on sampling of minke whales, three aerial surveys were conducted in Icelandic coastal waters to investigate seasonal distribution and abundance of minke whales in Icelandic waters (SC/12/19) and 7 minke whales were instrumented with satellite tags.

No decision has been taken by Icelandic authorities regarding implementation of the part of the programme concerning fin and sei whales.

17. ACCEPTANCE OF REPORT

The Report was accepted on November 29, 2004. The Scientific Committee expressed their thanks to Dorete Bloch for arranging the meeting at such a spectacular location.

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APPENDIX 1 - LIST OF PARTICIPANTS

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Aqqalu Rosing-Asvid
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Gísli A. Víkingsson

Norway
Lars Walløe (Chairman)

Observers
Japan Dr Tsutomu Tamura
Canada Patrice Simon

Ex-Officio Member
Daniel Pike, NAMMCO Secretariat

Other
Charlotte Winsnes, NAMMCO Secretariat

APPENDIX 2 - AGENDA

1. Chairman's welcome and opening remarks
2. Adoption of Agenda
3. Appointment of Rapporteur
4. Review of available documents and reports
4.1 National Progress Reports
4.2 Working Group Reports
4.3 Other reports and documents
5. Cooperation with other organisations
5.1. IWC
5.2 ICES
5.3 Canada/Greenland Joint Commission on Conservation and Management of Narwhal and Beluga
6. Incorporation of the users knowledge in the deliberations of the Scientific Committee.
7. Update on Status of Marine Mammals in the North Atlantic
8. Role of marine mammals in the marine ecosystem
8.2 Report of the Working Group on Marine Mammal – Fisheries Interactions
8.3 Other matters
9. Marine mammal stocks -status and advice to the Council
9.1. Harp seals
9.1.1 Update on progress
9.1.2 Impact of Canadian managment measures
9.1.3 Future work
9.2. Hooded seals
9.2.1 Update on progress
9.2.2 Impact of Canadian managment measures
9.2.3 Future work

9.3. Harbour porpoise
9.3.1 Update on progress
9.3.2 Future work
9.4. Narwhal
9.4.1 Update on progress
9.4.2 Future work
9.5 Beluga
9.5.1 Update on progress
9.5.2 Future work
9.6 Fin whales
9.6.1 Update on progress
9.6.2 Future work
9.7 Minke whales
9.7.1 Update on progress
9.7.2 Future work
9.8 White-beaked, white-sided dolphins and bottlenose dolphins
9.8.1 Update on progress
9.8.2 Future work
9.9 Grey seals
9.9.1 Update on progress
9.9.2 Future work
9.10 Humpback whales
9.10.1 Update on progress
9.10.2 Future work
9.11 Killer whales
9.11.1 Update on progress
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9.12 Walrus
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9.13 Sperm whale
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10. North Atlantic Sightings Surveys
10.1 NASS-2001 and earlier surveys
10.2 Planning for future NASS
11. By-catch of marine mammals
11.1 Estimation of by-catch in Icelandic coastal fisheries
11.2 Other
12. Data and administration
13. Publications
13.1 NAMMCO Scientific Publications
13.2 Other publications
14. Budget
15. Future work plans
15.1 Scientific Committee
15.2 Working groups

15.3 Other matters
16. Any other business
16.1 Satellite tagging correspondence group
17. Acceptance of Report

APPENDIX 3 - LIST OF DOCUMENTS

SC/12/1	List of Participants
SC/12/2	Provisional Annotated Agenda (Draft)
SC/12/3	List of Documents
SC/12/NPR-F	National Progress Report – Faroe Islands
SC/12/NPR-G	National Progress Report – Greenland
SC/12/NPR-I	National Progress Report – Iceland
SC/12/NPR-N	National Progress Report – Norway
SC/12/NPR-C	National Progress Report – Canada
SC/12/4	Observers Report: 54th Meeting of the IWC Scientific Committee, Shimonoseki, Japan
SC/12/5	Update on Status of Marine Mammals in the North Atlantic
SC/12/6	Report of the Working Group on Marine Mammal – Fisheries Interactions
SC/12/7	Atlantic Seal Hunt 2003-2005 Management Plan
SC/12/8	Hammill, M.O. and Stenson, G.B. Harvest simulation for 2003-2006 harp seal management plan.
SC/12/9	Hammill, M.O. and Stenson, G.B. Application of the precautionary approach and conservation reference point to the management of Atlantic seals: a discussion paper.
SC/12/10	Proceedings of the Marine Mammal Peer Review Committee.
SC/12/11	Pike, D.G., Paxton, G.M., Gunnlaugsson, Th. and Víkingsson, G.A. Trends in the distribution and abundance of cetaceans in Icelandic coastal waters from aerial surveys, 1986-2001.
SC/12/12	Report of the NAMMCO Fin Whale Assessment Planning Meeting
SC/12/14	Larsen, F. and Hammond, P.S. Distribution and abundance of West Greenland humpback whales *(Megaptera novaeangliae*). *J. Zool. Lond.* 263:343-358.
SC/12/15	Ólafsdóttir, D. On the by-catch monitoring system in Iceland
SC/12/16	Status of NAMMCO Scientific Publications
SC/12/17	Draft Budget 2004
SC/12/18	Summary of requests by NAMMCO Council to the Scientific Committee, and responses by the Scientific Committee
SC/12/19	Aerial sightings surveys around Iceland in 2003 and 2004: Preliminary report.
SC/12/20	Øien, N. Distribution and abundance of large whales in the northeast Atlantic, based on data from partial coverages 1996-2001.
SC/12/21	Gunnlaugsson, Th., Víkingsson, G.A. and Pike, D.G. Comparison of sighting rates from NASS and other dedicated cetacean vessel effort around Iceland during 1982 to 2003.

ANNEX 1

MARINE MAMMALS AND FISHERIES IN THE NORTH ATLANTIC: ESTIMATING CONSUMPTION AND MODELLING INTERACTIONS

Oslo, 22-24 October, 2004

1. OPENING REMARKS

Chairman Lars Walløe welcomed the participants (see Section 5,6, p. 349) to the meeting.

At its 8th meeting in Oslo, September 1998, the NAMMCO Council tasked the Scientific Committee with providing advice on the following:

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

Working groups established by the Scientific Committee have met on four occasions to deal with this and related requests. It was realised early on that important uncertainties remain in the calculation of consumption by marine mammals, and that such uncertainty was the most important factor hindering the development of models linking consumption with fishery economics. Therefore the Scientific Committee has heretofore concentrated its efforts on consideration of the methodological approaches to the calculation of consumption by marine mammals. These issues were fully reviewed at the third workshop with the title of "Marine mammals: From feeding behaviour or stomach contents to annual consumption - What are the main uncertainties?" held in Tromsø, Norway in September 2001. This workshop resulted in concrete recommendations to estimate consumption by North Atlantic marine mammals, and a list of research priorities to refine existing estimates.

Most recently the Scientific Committee hosted a workshop under the title “Modelling Marine Mammal – Fisheries Interactions in the North Atlantic” in Reykjavik, Iceland in September 2002. This Workshop recommended a general modelling approach involving the use of “minimum realistic” models, and developed specific recommendations for their application to candidate areas of the North Atlantic. However the Workshop emphasised that better data on diet and consumption was needed before marine mammals could be adequately represented in models.

The Scientific Committee has recognised that the process of developing predictive multi-species models is a long-term one. Therefore the Committee would now like to review the progress that has been made in the last two years, in two specific areas: 1) quantifying the diet and consumption of marine mammals, and 2) the application of multi-species models that include marine mammals to candidate areas of the North Atlantic.

2. ADOPTION OF AGENDA

The agenda (Appendix 1, p. 273) was adopted without changes.

3. APPOINTMENT OF RAPPORTEUR

Daniel Pike, Scientific Secretary of NAMMCO, was appointed as Rapporteur for the meeting, with the help of other members as needed.

4. REVIEW OF AVAILABLE DOCUMENTS

Documents available to the meeting are listed in Appendix 2, p. 273.

5. RECENT DEVELOPMENTS IN THE QUANTITATIVE DESCRIPTION OF MARINE MAMMAL DIETS

i. Baleen whales

Preliminary observations on minke whale diet around Iceland

Víkingsson reported on the status of an Icelandic research programme on feeding ecology of common minke whales in Icelandic waters (SC/12/IN/4). The programme involves the sampling of a total of 200 minke whales. According to the original plan, the sampling was to be completed in two years. Sampling was initiated in 2003 when 37 minke whales were taken during August and September under a special permit granted by the government of Iceland, and continued in June 2004 when an additional 25 whales were taken. Thus, the sampling has proceeded considerably more slowly than originally planned. The objectives, methodology, total sample size and spatial and seasonal distribution of the sample remain unchanged from the original proposal. It is now assumed that the sampling of 200 minke whales will be completed in August 2006.

Laboratory analysis of the stomach contents is still underway, and the preliminary results presented here are mostly based on identification of the primary prey species in each stomach as achieved at sea. In addition these results should be viewed with caution as they represent only a small fraction of the overall study, from a selected part of the season (late summer/autumn in 2003 and early summer in 2004). Judging from the limited sampling and very preliminary analyses conducted to date, the following observations can be made:

- The diet was overwhelmingly piscivorous, with krill dominating the diet in only 3% and 8% of the stomachs in 2003 and 2004 respectively.

- Sandeel was the single most important prey type with 70% and 54% prevalence in 2003 and 2004 respectively.
- Cod was dominant in 10% and 11% of the stomachs in 2003 and 2004 respectively, and gadoid-like fish, unidentifiable at sea, were dominant in 7% and 16% of the stomachs.
- The diet composition varied considerably with geographic location. Sandeel dominated the diet in the southern and western areas, while the diet seemed to be more diverse off northern and eastern Iceland.

Discussion

It was noted that several aerial surveys have found that the distribution of minke whales around Iceland is quite predictable in mid-summer, with highest densities found to the west and southeast of Iceland. The seasonal patterns of distribution are being evaluated by carrying out additional surveys in the spring, summer and autumn. With these data it will be possible to estimate consumption by area and season, once diet sampling has been completed for all spatio-temporal combinations.

Preliminary data indicate that sandeel is by far the most important prey species for the minke whale around Iceland. There is presently no fishery for this species in Iceland, which is obviously a key forage species in the marine food web around Iceland. Therefore the minke whale is only a potentially indirect competitor with fisheries due to its consumption of this species. However the proportion of Atlantic cod and other gadoids in the diet was higher than had been indicated by previous studies, so the possibility for a direct interaction with fisheries still exists. Víkingsson emphasised the preliminary nature of these findings, and that further conclusions must await the results of field and laboratory studies to take place over the next two years.

Diet and consumption of three baleen whales and their possible interaction with fisheries in the western North Pacific

SC/12/IN/6 presented the results of analyses of the stomach contents of the common minke whale, Bryde's whale and sei whale sampled from May to September 1996-2003. The main prey species of common minke whale consisted of two fish species (Japanese anchovy *Engraulis japonicus* and Pacific saury *Cololabis saira*). The main prey species of Bryde's whale consisted of krill (*Euphausia pacifica*) and Japanese anchovy. The main prey species of sei whale consisted of two species of copepods (*Neocalanus cristatus*, *N. plumchrus*), krill, Japanese anchovy and Pacific saury). There were seasonal, geographical and yearly changes of prey species in western North Pacific.

The estimated total prey consumptions by weight for common minke, Bryde's and sei whales during the feeding period in the western North Pacific were 912,000 tons, 2,260,000 tons and 8,472,000 tons, respectively. In this region the prey consumptions of economically important Pacific saury, walleye pollock and herring by common minke whales were calculated as 175,000 tons, 177,000 tons and 169,000 tons, respectively. The prey consumption of the economically important chub mackerel (*Scomberjaponieus*) by Bryde's whales was calculated as 21,000 tons. The prey consumption of the economically important Pacific saury by sei whales was calculated as 23,000 tons. Based on these results, there is a possibility of direct competition between these whales and the fisheries for these resources in the western North Pacific. To evaluate this competition, more information on accurate abundance in prey species and these whales, and their residence period in the Pacific region, are needed.

Discussion

Discussion by the Working Group focussed on the methodological aspects of this study. To estimate consumption the allometric equation developed by Sigurjónsson and Víkingsson (1997) was used. It was noted that one of the assumptions of this method is that the whales consume 80% of their total intake in the summer months. If the whale feeding is spread more evenly throughout the year the method would therefore overestimate consumption in the summer months. However the generalized allometric model was used because no information on energetics is available for Brydes or sei whales, and the existing information on seasonal distribution, while limited, is in rough agreement with the model.

The Working Group noted that there was a need to include all known sources of uncertainty in the estimates of consumption. Sources of uncertainty that had not yet been included were energy use, the proportional description of the diet, and the seasonal variation in the energy content of the prey species, which can be considerable for small pelagic fish.

ii. Seals

Recent work on Barents and Greenland Sea harp and hooded seals

To enable an assessment of the ecological role of harp and hooded seals throughout their distributional range of the Nordic Seas, a project was initiated in 1999 by members of the NAMMCO Scientific Committee. The project concentrates on the period July-February (*i.e.* between moulting and breeding), which is known to be the most intensive feeding period for both harp and hooded seals. To provide data, seals were collected for scientific purposes on expeditions with R/V ”Jan Mayen”, conducted in the pack ice belt east of Greenland in September/October 1999 and 2002 (autumn), July/August in 2000 (summer), and February/March in 2001 (winter). Results from analyses of stomach and intestinal contents from captured seals revealed that the diet of both species in this particular habitat were comprised of relatively few prey taxa (Haug *et al.* 2004). Pelagic amphipods of the genus *Parathemisto* (probably almost exclusively *P. libellula*), the squid *Gonatus fabricii,* the polar cod *Boreogadus saida,* the capelin *Mallotus villosus*, and sand eels *Ammodytes* spp were particularly important. Although their relative contribution to the diet varied both with species and sampling period/area, these 5 prey items constituted 63-99% of the observed diet biomass in both seal species, irrespective of sampling period.

During sampling in summer (July/August) in 2000 and winter (February/March) in 2001, harp and hooded seals were observed to co-occur in the sampling areas. This facilitated description and comparison of their diets. For hooded seals, *G. fabricii* and capelin were the dominant food items in winter 2001, but the summer 2000 diet comprised a mixture of this squid and polar cod. *Parathemisto* was most important for the harp seals during summer 2000, whereas in winter 2001 the contribution from krill and capelin were comparable to that of *Parathemisto*. Multivariate analyses revealed significant differences in the intestinal contents of hooded and harp seals, in areas where the 2 species' occurrence showed spatial overlap. Different foraging depths of the 2 seal species may have contributed to the observed differences in diets. Studies of diving behaviour of harp and hooded seals in the Greenland Sea have revealed that both species usually perform more shallow dives during summer than during winter, and that hooded seals dive to deeper waters than harp seals in both periods. Except for the youngest stages, which may occur in the upper water layers during summer, the major hooded seal prey *G. fabricii* has a typical mesopelagic distribution with occurrence mainly at depths greater than 400 m. This is in contrast to the distribution of the major food of harp seals: the observed krill and amphipod species are usually confined to the more upper water layers (< 200m depth).

Based on dorsal blubber cores collected in October 1995, fatty acid profiles and lipid biomarkers from 20 harp seals were used to investigate the foraging ecology of the species and the transfer of energy through the Franz Josef Land – Novaya Zemlya food chain (Falk-Petersen *et al.* 2004). High levels of the *Calanus* fatty acid trophic markers (FATMs) 20:1(n-9) (mean 14.6 %) and 22:1(n-11) (mean 6.5%), together with the typical dinoflagellate FATM 22:6(n-3) (mean 6.5%) and C18PUFA (mean 5.5%), were found in blubber samples. Based on analyses of the fatty acid profiles by principal component analysis, the importance of polar cod and the *Parathemisto libellula* in the diet of harp seals was confirmed. The high levels of 22:6(n-3), C18PUFA and C20 and C22 FATMs indicate that the harp seal lipids mainly originate from dinoflagellates consumed by *Calanus* copepods.

In 2001 and 2002, Norwegian and Russian scientists performed an aerial survey to assess whether there was an overlap in distribution, and thus potential predation, between harp seals and capelin in the Barents Sea. This experiment is now being followed with ship-based surveys to study pelagic feeding by harp seals in the Barents Sea during summer and autumn. In May/June 2004, a Norwegian survey was conducted to study the feeding habits of harp seals occurring in the open waters of the Barents Sea. Very few seals were observed along the coast of Finnmark, and no seals were seen in the open, ice-free areas. In the northwestern parts of the Barents Sea; however, very large numbers of seals were observed along the ice edge and 20-30 nautical miles south of this. In these areas, 33 harp seals were shot and sampled (stomachs, intestines, blubber cores). Additionally, samples of faeces were taken from the haul out sites on the ice. Preliminary results from the analyses indicate that krill was the main food item for the seals.

The project is planned to run over a three-year period (2004-2006), and the next survey to address these questions will take place in June/July 2005. In the Norwegian area (NEZ) a chartered Norwegian coast guard vessel will be used, whereas a Russian vessel will be applied in REZ. The boat-based survey may be supported with aerial reconnaissance surveys performed by a Russian aeroplane.

Discussion

Discussion centred on the seasonality and extent of capelin consumption by harp seals in the Greenland and Barents seas. While the diet seemed to be dominated by *Parathemisto* spp amhipods and krill in the summer, there was some evidence that capelin formed a larger portion of the diet during the autumn and winter. However few samples had been taken from open water areas in the late summer, when harp seals might be expected to switch to capelin. In any event it was obvious that the diet of both harp and hooded seals must be disaggregated both seasonally and spatially for modelling purposes, given the extensive migrations and seasonal variation in diet of these species.

Satellite tagging of harp seals in the Greenland and Barents seas

Folkow described how data obtained by the remote monitoring of marine mammals may be used in the evaluation of their diet composition, as exemplified by results obtained in two studies conducted by representatives of the Department of Arctic Biology, University of Tromsø, on the distribution and diving behaviour of harp seals using satellite-linked dive recorders (SDR). The first study (Folkow *et al*. 2004) concerns harp seals from the Greenland Sea stock, and describes results obtained from adult females between breeding (late March) and moulting (mid-May) in 1993, and from both females and males (all adults) that were tracked for an average of 244 days after moulting in late May 1999. Tagged animals remained in association with the pack-ice edge for most of the time between breeding and moult. After the moult, however, a majority of the tagged seals (N=7) migrated into the Barents Sea (in late July) and remained there throughout late summer/early autumn, when harp seals are known to feed intensively and deposit fat reserves. During the course of autumn/winter they returned via the Greenland Sea to the Denmark Strait. The observations suggest that substantial parts of the Greenland Sea stock of harp seals may temporarily share feeding grounds with the Barents Sea stock of harp seals. The seals mainly performed shallow dives (<50 m) during summer in the Greenland Sea, while the depth of dives gradually increased throughout autumn and winter. The seals spent a considerable proportion of time in open water in summer and early autumn, while an increasing proportion of time was spent near the pack-ice edge in winter and spring. Temporal and spatial aspects of these migrations, as well as the recorded dive depths, overlap with the temporal and spatial distribution of capelin, suggesting that this is an important prey item during parts of the year.

The second study (in prep.) describes results obtained from SDR-tagged adult harp seals from the Barents Sea stock, both between breeding and moulting and after moulting. The seals displayed a northward migration after the moult and largely foraged in open waters in the northern parts of the Barents Sea during summer and autumn, presumably on a fish-dominated diet. From November and onwards, however, an increasing proportion of time was spent in association with the pack-ice edge which then progressively extended southwards.

Discussion

It was noted that, due primarily to budgetary restraint, most tagging studies have had insufficient sample size and been of too short duration to adequately determine natural variation in seasonal distribution and migratory behaviour. Tagging studies in the Northwest Atlantic have shown that the migratory patterns of hooded seals can vary greatly from year to year. Also, it is known that in some years, harp seals approach the northern Norwegian coast (seal invasions), while in most years they do not. Therefore annual variability would have to be considered to give an accurate description of the seasonal distribution of these animals. It was also noted that sample sizes were in most cases far too low in satellite tagging studies. Given the variation between individuals observed, many more animals, of all sex and age classes, would have to be followed throughout a full migratory cycle to give a full description of the variability in seasonal distribution.

There was some discussion about the ways in which data from satellite tagging experiments could be integrated into multi-species models. The approach used here of disaggregating seal distribution at relatively small spatial and temporal scales and developing a seal "usage surface" was considered a viable way of proceeding, if diet data could be obtained for all or most areas and times. A more complex approach would involve developing models relating seal distribution to prey distribution and environmental variables in a "state space" framework, which, if successful, would enable the prediction of seal distribution from these data. However it was recognised that data on pelagic fish distribution in particular was usually gathered at different spatial and temporal scales, and independently from data on seal distribution, so the two data types could not easily be integrated in the same model. It was noted in this regard that there was some effort in Norway to carry out multipurpose cruises to collect several types of data simultaneously, which may make this type of analysis more feasible in the future.

It was concluded that satellite tracking studies supply important information on the distribution of seals in time and space that may be used to make inferences concerning their diet. This is of particular interest in studies of species such as harp and hooded seals which are not readily accessible for traditional diet composition studies based on collection of stomach/intestinal/faecal samples. Satellite tracking thus represents an important and necessary supplement to traditional dietary studies in these species.

There are plans to follow up the successful joint Norwegian-Russian 1996 project (and a similar project during harp seal breeding in 1995) with tagging of harp seals with satellite transmitters in the White Sea. This will contribute to a better understanding of the temporal and spatial distribution of the seals, which is important input data for multi-species modelling. Animals of both sexes and a range of ages are to be tagged. The programme is planned to run for 5 years, with 15 tags being deployed every spring (*i.e.* immediately after the moulting period). If funding allows the first deployment of tags will be conducted in 2005.

Quantifying sources of uncertainty in estimating consumption

Working paper SC/12/IN/9 provided a quantitative analysis of the sources of uncertainty in the estimation of consumption of cod by harp seals. The decline in many groundfish stocks in Atlantic Canada has raised concerns about the role of seals in the Northwest Atlantic ecosystem. Estimates of consumption by predators are one piece of information that is required in order to determine the impact predators are having on the recovery of cod stocks. The objective of this paper was to describe the model used to estimate prey consumption by harp seals and to assess the sensitivity of estimate to model parameters. Consumption of Atlantic cod by harp seals in the northern Gulf of St Lawrence (NAFO zone 4RS3Pn) was estimated for the period 1985-2003. Estimates were obtained by combining information on harp seal abundance, energy requirements, diet composition and the distribution of animals. Consumption of Atlantic cod in 2003 was estimated to be in the order of 27,000 (SE 6,800) tonnes. Current estimates differ from earlier studies by attempting to incorporate variability in population estimates, energy requirements, seal distribution, and diet composition. Sensitivity analysis indicated that the model was most sensitive to changes in population size, the parameters required to estimate energy requirements, the proportion of seals that enter the Gulf and the length of winter residency. Assumptions about the proportion of animals that remain throughout the year in the Arctic or southern waters had little impact on the estimates of cod consumption.

Discussion

While the paper identified several sources of uncertainty that were the most important in modelling consumption, it was noted that the estimation of consumption was sensitive to many of the other factors as well. In this regard it would be important to consider which factors are likely to vary substantially from available estimates. For example, even though the model is sensitive to changes in estimated body mass, this factor is probably well estimated. In contrast there is considerably greater uncertainty in estimates of basal metabolic rate and activity factors. Both the sensitivity of the model and the likely variability of estimated parameters should therefore be considered in developing priorities for data collection to improve consumption estimates. These priorities also need to take account of the relative importance of different factors in quantifying functional relationships (*i.e.*, how consumption estimates vary in response to changes in abundance).

6. RECENT DEVELOPMENTS IN THE ESTIMATION OF ENERGY CONSUMPTION

New studies of relevance for the estimated consumption by marine mammals in Greenland waters were presented and the consumption estimates first presented at the NAMMCO Workshop in 2001 were updated in SC/12/IN/10. Relevant ongoing studies included telemetry studies on adult harp and hooded seals, an aerial survey of marine mammals along the west coast of Greenland and a study of harp seal consumption in coastal areas along west Greenland, and deal with most of the major gaps in our knowledge identified in 2000. Major remaining gaps in knowledge were identified to be: Studies of prey selection: a) Harp seals in offshore waters. b) Hooded seals and narwhals in Baffin Bay (offshore) c) Fin whales along the edge of the southeast Greenland drift ice.

The Working Group welcomed this update and noted that Baffin Bay/Davis

Strait/Denmark Strait could be a focus of future workshops.

i. Baleen whales

Urine production and food ingestion of minke whales (SC/12/IN/5)

In August and September 2003 blood and urine samples were obtained from 30 common minke whales caught off the coast of Iceland for scientific purposes. Both blood and urine samples were obtained from 16 of these animals, four non-pregnant females and 12 males. The animals' weights were derived from their lengths, which gave a mean weight of 4,571 (SD 1337). Na^+, K^+, Cl^-, Mg^{++}, Ca^{++}, creatinine, urea and uric acid were measured in blood and urine as well as pH and osmolality. Utilising allometry of creatinine clearance in relation to body weight and serum and urinary concentrations of creatinine, the average urine volume was predicted to be 214 L per day. From this volume and the known water content of the ingested food, the average daily food ingestion was estimated to be about 280 L. This is considerably greater than reported by most workers. Energy calculations suggest considerable heat loss as the metabolic rate is over 3x that of an equally heavy terrestrial mammal. Concentrations of electrolytes in urine are compatible with the fact that the minke whale is a piscivorous animal and are quite different from those of the krill eating fin whale. The high sodium and magnesium levels in urine suggest some sea water ingestion.

<u>Discussion</u>

The allometric prediction of creatinine clearance in minke whales extends beyond the range of the data used to derive the relationship. Nevertheless it was considered unlikely that cetaceans would vary greatly from the generalized relationship for mammals. More importantly, uncertainty is not incorporated into the prediction of creatinine clearance and thus urine production, and this uncertainty would likely be substantial given the double-logarithmic relationship used. Hence the prediction of food intake may not in fact be inconsistent with estimates derived from other methods when all sources of uncertainty are incorporated.

The Working Group noted that further work is required in order to quantify the water balance in general, and the sea water ingestion in particular. The group considered that this was a promising new method that should ideally be tested on captive animals. Applying this method to Antarctic minke whales, which are nearly stenophagous on krill, may be informative, since the water and electrolyte components of the diet could then easily be estimated. Víkingsson informed the Working Group that measurements of the energy, water and electrolyte composition of the observed components of the minke whale diet were being conducted as part of the Icelandic research programme.

ii. Seals

Recent work on captive seals

Food consumption estimates for marine mammals are mostly based on an assessment of the energy requirements of the animal, which are then translated into the amount of food that is needed in order to cover these requirements. In this context, the daily energy expenditure, or field metabolic rate (FMR), is a key determinant of the total energy requirement. Current estimates of FMR for pinnipeds have been based on metabolic studies of both captive and free-ranging animals, but most of these have not been able to realistically account for energy expenditure during diving, which, after all, is what these animals do during a major proportion of their time at sea. This problem is particularly evident in some species (*e.g.*, southern elephant seals (*Mirounga leonina*), hooded seals), which have been demonstrated to dive repeatedly for durations exceeding their calculated aerobic dive limit, strongly suggesting that their diving metabolic rate (DMR) is actually lower than first assumed. A paper by Sparling and Fedak (2004) describing an approach that could shed more light on the metabolic costs associated with free diving was discussed. In that study, metabolic rates of 8 captive grey seals were determined in connection with voluntary diving in a quasi-natural setting (large tank), using open circuit indirect calorimetry based on measurements of oxygen consumption rates. The seals displayed dive durations which realistically mimicked those recorded in free-living grey seals by use of telemetric techniques. The resulting mean DMR of both juveniles and adults was 1.7x the predicted basal metabolic rate of terrestrial mammals of equal size. Based on these results, a model was developed to allow prediction of DMR from information on dive behaviour of the type routinely collected in telemetry studies of wild seals.

Another paper by Williams *et al*. (2004) was also briefly discussed. It describes how the energy cost of swimming during diving is related to the number of swimming strokes made, as recorded with accelerometer-linked data loggers that were attached at the base of the tail of freely diving Weddell seals (*Leptonychotes weddellii*). The established relationship could be used to predict locomotor costs of freely diving seals.

Both the approaches described could be employed to produce similar data for harp and hooded seals, which could then be used in conjunction with relevant data collected by use of telemetry from free-ranging animals, in order to obtain more reliable estimates of DMR as well as FMR.

Discussion

The Working Group considered that the observed mean of 1.7x BMR for diving animals found by Sparling and Fedak (2004) was not inconsistent with the rate of 2-3x BMR commonly applied to free living seals to estimate energy consumption. Resting seals were observed to have a higher metabolic rate than diving seals, and it is likely that non-diving, active seals would have still higher metabolic rates. In addition, free living diving seals must actively pursue and capture prey, and thus would probably use more energy than under the experimental conditions used in this study. A valuable next step in this type of study would be to use live prey to increase the effort that the seals must expend to obtain food. Seals have been shown to display reduced core temperature during diving, which would be expected to also reduce their metabolic rate.

The Working Group recommended that studies of the type carried out by Sparling and Fedak (2004) on grey seals, should also be carried out on harp and hooded seals. The Working Group also considered the methodology developed by Williams *et al.* (2004) to be promising and recommended that it should be further tested with captive seals and applied to other species of free ranging seals.

7. RECENT DEVELOPMENTS IN MULTI-SPECIES MODELLING

i. GADGET-based models

GADGET (the Globally applicable Area Disaggregated General Ecosystem Toolbox) is a flexible and powerful software framework for creating ecosystem models, that was presented at the last Scientific Committee Working Group Modelling meeting (NAMMCO 2003). Since that last meeting GADGET has been extended in a number of ways, including the implementation of a closed life cycle model and the incorporation of information from mark-recapture experiments on tagged sub-populations, together with the use of bootstrapping experiments when estimating the migration parameters (SC/12/IN/7).

Recently, a preliminary GADGET model has been set up to model the grey seal population around Iceland as a first GADGET model for marine mammals. At this early stage in the model development, most of the parameters have been fixed to values obtained outside GADGET, and only the parameters governing the size of the initial population and annual recruitment have been estimated within GADGET. Further work is planned on this model, to include more detail on the dynamics of the pup population, to look at modelling a stock recruit relationship, and to investigate using different growth functions that may be more applicable to marine mammals. Although this GADGET model is still in the early stages of its development, it has shown that some aspects of marine mammal populations can certainly be modelled using the framework provided by the GADGET software. Further work, however, is required before a model that includes the effects of predation by marine mammals on other species is attempted.

Discussion

The Working Group welcomed this new information, but noted that rather little progress had been made in incorporating marine mammals in GADGET-based template models for candidate areas in the North Atlantic, as had been recommended by the NAMMCO Scientific Committee in 2002 (NAMMCO 2003), presumably because no resources had been allocated for this work. The Working Group again emphasised that progress in this area will not be made unless substantial additional resources are dedicated to it.

Also as noted in 2002, GADGET lacks the scenario aspect where the management process itself (*i.e.*, updating parameter estimates given new data before using these updates to compute future catch limits) is modelled in prognostic simulations. Only when this option is available will it be possible to compare management strategies and their related assessment machinery. The Working Group again recommended that such a facility be developed, noting that this should be fairly straightforward since it will involve only data transfer to a module, with users to define and code the catch algorithm within that module.

Discussion ensued about the advisability and feasibility of “testing” multi-species models. One possibility would be to re-implement in GADGET a model that had already been realized in another form, such as the seal-fishery model for the Benguela ecosystem (Punt and Butterworth 1995). However it was recognised that while this could verify that the functionality of the original model was reproducible in another framework, it would not be a test in any real sense as the predictions of the original model had not been tested in the field. Ecosystems cannot easily be replicated: hence ecosystem models cannot be tested experimentally. Another possibility might be to test model predictions in replicated micro- or mesocosm systems. While such experimental work would be expensive and difficult, it could be conducted by an interdisciplinary team in an international context. Given that multi-species models built using GADGET and other frameworks are likely to be applied to address important management issues, the feasibility of testing such models at some scale should be investigated.

ii. SCENARIO model

Scenario C is a model intended for exploring the comparative effects on the catch of cod, herring and capelin of various choices of management regimes for minke whaling and harp sealing. The model is described in the web document http://www.nr.no/files/sammba/emr/scenario_document.pdf. Cod, capelin, herring, harp seals and minke whales are distributed over age, and over 7 areas of the Barents Sea, and simulated forwards in monthly time steps. Fishing (catch) mortality is regulated by quotas. Natural mortality is composed of endogenous predation mortality and excess natural mortality. Models for recruitment and mortality are estimated piecewise on available data in cooperation with the Marine Institute. Work is under way to estimate parameters of natural mortality in excess of mortality caused by modelled predation. This estimation is done by a systems approach by running the model forward from estimated initial conditions and comparing the one step ahead predictions with observed abundances.

In addition to yearly stochasticity in recruitment and abundance internal estimates fed to the management procedures calculating quotas, uncertainty is accounted for by repeating simulation runs for parameters drawn from distributions reflecting estimation uncertainties, and kept fixed for the individual runs.

The models for predation are pivotal for the purpose of the study. They have two components: the total food intake of an individual by species and size estimated from energetic considerations, and the relative diet composition given the abundance of the various prey items in the actual area at the time. In addition to modelled prey species, a category of "other food" is included. The abundance of other food is assumed sufficiently abundant to allow the modelled predators to satisfy their energy need regardless of the abundance of the modelled prey species.

Despite the project period soon coming to an end, Schweder reported that the model still is inadequate. When harp seals are introduced into the model, the cod is exterminated. This happens with the harp seal stock at the estimated current abundance, and is contrary to what is known of the system – where fortunately the cod population still is viable. The modelled predation of harp seals on cod, in addition to cannibalism and minke whale predation, is simply excessive. He suggested various causes for this lack of balance, and asked advice regarding the modelled energy needs for harp seals, and also regarding the current abundance estimate of harp seals.

Schweder also asked advice regarding the management strategies for harp seal to explore. He was happy to learn from the group that this question is premature since the model is inadequate.

Discussion

The Working Group identified some potential problems with the harp seal diet data used that might have contributed to the unrealistic aspects of the model predictions. Most harp seal stomach samples have been taken from northern areas (Areas 6 and 7) where cod are uncommon. However a few samples come from coastal northern Norway where the consumption of cod may have been much higher than in other areas. The inclusion of these samples, from outside of the regular distribution area of harp seals, may have positively biased the estimation of the proportion of cod in the diet. It was noted that the distributions of cod and harp seals overlap only for a short time in the spring, and that the seals gained most weight in the summer and autumn when their distribution did not overlap with that of cod. Dive profiles obtained from satellite tagged animals indicated that they did not generally dive deep enough to access cod. It was therefore considered unlikely that cod formed an important part of the diet except under exceptional circumstances. It was recommended that the diet data used in the model be re-examined in this context.

It was suggested that the sensitivity of the model to initial fish abundances should be tested. In particular, the cod assessment data used in the model assume a natural mortality (M) of 0.2 for cod, even though it is generally recognised that M may be much higher than this for the small cod that harp seals might be expected to consume. Assuming a higher mortality for young cod would have the effect of increasing the estimated numbers of small cod that would be available to harp seals. One avenue to pursue might therefore be to conduct sensitivity analyses to determine what level of cod mortality would be sufficient to stabilise the cod population. If this level was beyond the bounds of plausibility, other potential influences must be considered.

In the model the consumption of cod and other prey by harp seals is related to prey abundance by a function that reduces consumption of prey to a low but positive rate when prey abundance is 0. A function that results in a cessation of predation when that prey is absent would be more realistic, and might allow the predicted cod abundance to stabilise. However this would not prevent the initial reduction of cod by seal predation that the model predicts and so would not resolve the immediate difficulty. In addition the population dynamics of both harp seals and minke whales are endogenous in the model in that they are assumed to always obtain their daily rations, regardless of prey abundances. This was considered to be a weak assumption in that both species exhibit strong prey preferences and harp seals have been observed to "invade" the Norwegian coast under conditions of low capelin and polar cod availability. Clearly their population dynamics must be resource dependent to some degree. However it was recognised that at present there were simply no data to support a functional response of predator population dynamics to prey availability.

Projected levels of cod predation by harp seals are of course directly proportional to harp seal abundance. Stenson informed the Working Group that pup counts had been carried out on the White Sea whelping patch almost annually since 1998. These counts have been very consistent in estimating a pup production of around 300,000. Total population estimates are derived from pup production using an assumed level of pup mortality and an assumed range of 1+ mortality, but it was noted that both these parameters had been estimated directly for the population using trend and age structure data, and are entirely consistent with the estimates for other harp seal stocks. The population estimate of around 2 million animals has been thoroughly evaluated by the ICES/NAFO Working Group on Harp and Hooded Seals, and by the NAMMCO Scientific Committee. It was therefore considered unlikely that a positive bias in the abundance estimate for Barents Sea harp seals was contributing to the difficulties with the Scenario model. Nevertheless the Working Group suggested estimating harp seal total abundance using a wider range of 1+ mortality, and using the resulting estimates as input to the Scenario model to see if the 1+ mortality required to stabilise the model was within a plausible range.

iii. Others

The model Bifrost used in the management of capelin was presented by Tjelmeland. Work has been initiated to incorporate predation from harp seal on capelin and problems and possibilities connected to this were pointed out. The predation of herring by minke whales has been included in the model used in managing the Norwegian spring spawning herring stock, SeaStar, on an experimental basis.

The Russian-Norwegian Fishery Commission has initiated work over a 10 year period to evaluate maximum sustainable yield from commercial species in the Barents Sea, taking into account species interactions and influence of the environment. For the first three years cod will be the main focus and in the following 7 years multi-species models will be used for a comprehensive evaluation.

In discussion the Working Group noted that the primary focus of this work is to refine medium and long term predictions of fish stock biomass by including predation by marine mammals, which differs somewhat from the objectives of NAMMCO in this area. Nevertheless it was considered that there was an appreciable degree of overlap between these projects and the Scenario C project, and the Working Group urged the developers to closely coordinate their efforts in order to optimise the use of scarce resources in this area.

Simulation of minke whale predation (SC/12/IN/11)

Using realistic simulated prey fields (herring, capelin and krill), the behaviour of simulated predators is modified until the resulting simulated diet observations mimic those observed in the field under similar conditions. The modelling framework was first presented to the working group in Reykjavik in 2002. Since then the foraging model has been developed and now includes four predator functions: 1. prey encounter function, 2. ingestion rate function, 3. food digestion rate function and 4. patch selection function. A total of 6 parameter vectors and 5 single parameters are included in these functions. An objective function of the least squares type is minimised with respect to the vector containing the switching coefficients of the ingestion rate function. The model is under development, but a future objective of this simulation work will be to run simulations which improve our understanding of how local- and large-scale predator-prey processes are linked.

Discussion

The Working Group considered this to be an ambitious attempt to model the foraging behaviour of a marine predator at a very detailed level, but it was not obvious if or how the model could be directly integrated into multi-species ecosystem models. One benefit may be a better understanding of the implications of applying diet data gathered from small areas to rather large spatial and temporal scales used in most ecosystem models. It was suggested that, once the model is more fully developed, it could be applied to other predator prey systems for which better empirical data are available.

8. RECOMMENDATIONS FOR FUTURE RESEARCH

i. Diet

The Working Group noted that there has been progress on a number of the recommendations for research priorities identified by the WG in their 2001 meeting, and prioritised them explicitly for future action:

1. Distribution of prey species in space and time.
   Progress: Ongoing resource surveys covering main commercial species, such as capelin, cod and herring in all areas. However there continue to be problems in integrating the spatial and temporal scales of resource surveys with our knowledge of predator distribution. Limited information is available on the spatial and temporal distribution of pelagic crustaceans and polar cod, which are extremely important in the harp seal diet.

2. Spatial and temporal distribution of the diet composition of harp and hooded seals;
   Progress: Progress has been made in describing the diet of Barents and Greenland seas harp seals, but important gaps remain, particularly the diet in open water areas in the late summer, autumn and winter.

3. Diet composition of dolphins (white-beaked and white-sided dolphins);
   Progress: Some progress has been made in describing the diet of white-sided dolphins around the Faroe Islands, and studies in Iceland are in progress. There has been no progress in other areas.

4. Field metabolic rate of harp and hooded seals;
   Progress: None on harp and hooded seals, but some methodological advances have been made with other phocid species.

5. Temporal changes in energy density of prey species;
   Progress: None

6. Diet of minke whales in Icelandic waters and further west;
   Progress: The Icelandic Research Programme is making progress in describing the diet of minke whales in that area.
7. Consumption estimates synthesised within a modelling framework including full uncertainty evaluation;
   Progress: Some progress in Canada but no new estimates from NAMMCO member countries.

The highest priority items identified amongst the above were 2, 6 and 7.

In the immediate future, the Working Group recommended maintaining a focus on modelling the Barents Sea ecosystem, the area for which the best data are available and where model development is ongoing at present. The Working Group also recommended that although minke whales are an important marine mammal predator in this area, improving the data inputs related to harp seals should be the primary immediate focus. The Working Group therefore recommended that research in the short term should be focused on:
1. Gaining a better understanding of the spatial and temporal distribution of the diet composition of harp seals;
2. Quantifying (with uncertainty) the seasonal abundance and distribution of major prey species of harp seals;
3. Repeating studies on distribution of harp seals in the Barents Sea to determine individual and inter-annual ('natural') variation in distribution.

ii. Energy consumption

Little new information specifically relevant to the target species was available to the Working Group. Nevertheless it was considered that existing estimates were probably adequate for modelling purposes at present. The following specific recommendations were made:
- Conduct experiments to determine the diving metabolic rates of harp and hooded seals similar to that of Sparling and Fedak (2004), but, if possible, under more realistic prey availability conditions, such as by using live prey.
- Apply the methodology developed by Williams *et al.* (2004) to free ranging harp and hooded seals, after validation using captive seals.

iii. Modelling

In general the Working Group reiterated the recommendations for further development of multi-species models made in 2002:
Prey selection
- theoretical and practical work on prey selection models
- development aggregated consumption functions
- migratory and spatial aspects of consumption models

Multi-species modelling
- Further work on the Scenario C Barents Sea model
- Use GADGET as a framework to generate template models for candidate areas

- in the North Atlantic

With regard to the Scenario C model, the Working Group noted that considerable effort had already gone into developing this model, and recommended that sufficient resources be allocated to finish its development and thoroughly test its properties. Recommendations for the short term included:

- Re-run cod assessment models using a higher value of mortality for young cod and use the results as input for Scenario runs, to determine what levels of mortality would be necessary to achieve compatibility in the model.
- Since pelagic crustaceans and polar cod are important prey to harp seals, the impact of including them explicitly in multi-species models should be explored.
- Investigate the sensitivity of the model to other functional forms of the predation model for harp seals, specifically forms where consumption of particular prey approaches 0 at very low densities of that species.
- Given that the diet information for harp seals is imprecise and probably biased, the sensitivity of the model to changing the proportion of cod in their diet should be explored.

With regard to the GADGET modelling framework, the Working Group noted that further work is required on the existing grey seal model to bring it up to a standard suitable for use as a template model. Once this has happened, work on models that include other marine mammals should be attempted. As in 2002, the Working Group also noted that GADGET lacks the scenario aspect where the management process itself is modelled in prognostic simulations, in a similar manner to that provided by the Scenario Barents Sea model. The inclusion of such a process would allow GADGET to compare management strategies and their related assessment machinery, and developments in the direction should be encouraged.

9. WORKPLAN

In reviewing the amount of multi-species modelling work and associated applications to management decisions that had been conducted worldwide over the past several years, this Working Group noted in 2002 (NAMMCO 2003) a much lower than expected activity in this area. While some progress had been made in further development of the Scenario C model and development of the GADGET platform, it remains the case that the development of multi-species modelling is not proceeding as fast as it should, given the emphasis politicians and management authorities have placed on multi-species (ecosystem) approaches to the management of marine resources. Once again the Working Group emphasised that progress in this area will not be made unless substantial additional resources are dedicated to it.

Given this, the Working Group advised that the Chairman should continue to monitor progress in this area, with the possibility of holding another workshop in 2006 if sufficient progress has been made to warrant it, and perhaps also an earlier smaller task group meeting if helpful to maintain momentum.

10. ADOPTION OF REPORT

The Report was adopted by the Working Group on October 24, 2004.

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Appendix 1

AGENDA

1. Opening remarks
2. Adoption of agenda
3. Appointment of rapporteur
4. Review of available documents
5. Recent developments in the quantitative description of marine mammal diets
   i. Baleen whales
   ii. Seals
6. Recent developments in the estimation of energy consumption
   i. Baleen whales
   ii. Seals
7. Recent developments in multi-species modelling
   i. GADGET-based models
   ii. SCENARIO model
   iii. Others
8. Recommendations for future research
   i. Diet
   ii. Energy consumption
   iii. Modelling
9. Workplan
10. Adoption of report

Appendix 2

LIST OF DOCUMENTS

SC/12/IN/1	Draft List of Participants
SC/12/IN/2	Draft Agenda
SC/12/IN/3	Draft List of Documents
SC/12/IN/4	Galan, A. and Víkingsson, G.A. Progress report on the analyses of stomach contents of Icelandic minke whales.
SC/12/IN/5	Kjeld, M. and Ólafsson, O. A preliminary report on predicted urine production and food ingestion rate and salt balance of the common minke whale (*Balaenoptera acutorostrata*) off Iceland. IWC SC/56/O11
SC/12/IN/6	Tamura, T. Preliminary analyses of prey consumption of three baleen whales and their possible interaction with fisheries in the western North Pacific.
SC/12/IN/7	Begley, J. and Howell, D. An overview of GADGET, the Globally applicable Area-Disaggregated General Ecosystem Toolbox
SC/12/IN/8	Ólafsdóttir, E.I. and Begley, J. Grey seal in GADGET.
SC/12/IN/9	Stenson, G.B. and Hammill, M.O. Quantifying uncertainty in estimates of Atlantic cod (*Gadus morhua*) consumption by harp seals (*Phoca groenlandica*).
SC/12/IN/10	Rosing-Asvid, A. Consumption by marine mammals in Greenland waters.

SC/12/IN/11	Lindstrøm, U. Simulation of minke whale foraging behaviour with special emphasis on capelin, herring and krill: A model description.
SC/12/IN/12	Sparling, C.E. and Fedak, M.A. 2004. Metabolic rates of captive grey seals during voluntary diving. *J. Exp. Biol.* 207:1615-1624.
SC/12/IN/13	Haug, T., Nilssen, K.T. and Lindblom, L. 2004. Feeding habits of harp and hooded seals in drift ice waters along the east coast of Greenland in summer and winter. *Polar Res.* 23:35-42.
SC/12/IN/14	Falk-Petersen, S., Haug, T., Nilssen, K.T., Wold, A. and Dahl, T.M. 2004. Lipids and trophic linkages in harp seal (*Phoca groenlandica*) from the eastern Barents Sea. *Polar Res.* 23:43-50.
SC/12/IM/15	Schweder, T. Scenario C progress report.

ANNEX 2

FIN WHALE ASSESSMENT PLANNING MEETING

Oslo, 25 October, 2004

In 2003 the Scientific Committee recommended that the scheduling of future assessment meetings for fin whales be dependent on the progress made in fulfilling recommendations for research. As recommended by the Working Group on Minke and Fin whales in 2003, a small Task Group (see Section 5,7, p. 351) was convened to review the progress that had been made since the last meeting of the Working Group. The Group reviewed the recommendations that had been made in 2003 and noted what progress had been made.

All stocks

1. ***Additional genetic sampling in all areas, but particularly in areas from which samples are few or lacking, such as East Greenland, northern and eastern Iceland, the Faroes and Norway. Any existing samples from past whaling should be analysed using modern techniques.***

Iceland is extending genetic analyses on *ca* 600 samples that were collected in the 1980's, mostly from Denmark Strait, to include microsatellite analyses. A few samples from other areas (Norway and Canada) will also be included. Norway has about 30 biopsy samples available that were taken during sightings surveys. It was agreed that these should be added to the Icelandic analysis if feasible. The Faroes has 14 biopsy samples that were taken in 2000/2001, and these have been sent to Per Palsbøll's laboratory for analysis. Víkingsson indicated that they were also coordinating their analyses with Dr Palsbøll.

Øien suggested that historical material may be available from museums, and agreed to look into this.

2. ***Satellite tagging to determine habitat use and migratory patterns. If possible, a biopsy should be obtained from all tagged animals for genetic analysis and sex determination.***

No new tagging programmes for fin whales have been carried out, mainly because past attempts have had limited success. The technological problems with this methodology must be addressed before large-scale programmes can be done.

Faroes

1. ***The revision of catch statistics for Faroese and adjacent whaling operations should be completed.***

Dorete Bloch has been working in cooperation with the IWC Secretariat to resolve the inconsistencies in catch data between baleen whaling statistics kept at the IWC office in Cambridge and the material found by the Faroese Museum of Natural History. With funding from the Museum and NAMMCO, the IWC office, different archives in Scotland and England and the Whaling Museum in Sandefjord were visited in 2004 and material copied.

The material contains the baleen whaling taken from the land stations in Ireland, Orkney, the Shetlands, the Faroes, Norway, and the pelagic Norwegian catch. The material is under preparation now and later the Faroese Museum of Natural History and the IWC office will end up with catch records agreed by both institutions.

2. ***The feasibility of preparing a CPUE index from Faroese and adjacent whaling operations should be investigated.***

The Task Group recommended that Bloch investigate this after the catch series has been corrected.

3. ***Biopsy sampling for genetic analysis from the Faroes and adjacent areas should be continued. Existing biopsy samples should be analysed as soon as possible.***

No samples have been taken in recent years and the Task Group encouraged further biopsy sampling over as wide an area as possible. As noted above the analysis of existing samples is in progress.

4. ***Satellite tagging should continue once methodological/technical issues are addressed.***

See above.

East Greenland-Iceland Stock

1. ***The early CPUE series (1901-1915) should be reanalysed and split between eastern and western Icelandic whaling areas. The possibility of using data prior to 1901 should be investigated.***

No progress has been made on this issue. The Task Group strongly recommended that these analyses should be completed by July 2005.

2. ***If new catches are taken, samples should be taken if possible both within and outside the traditional whaling grounds. The material should be investigated to get an updated view of age structure and sex distribution on and outside the whaling grounds, and biological parameters such as age at sexual maturity and fecundity.***

There have been no catches.

3. ***Additional samples for genetic analysis are required particularly from areas outside the traditional whaling grounds, such as East Greenland and northern and eastern Iceland.***

No new samples are available. The Task Group recommended that the feasibility of conducting biopsy sampling during sighting surveys in these areas be investigated.

4. ***Existing analyses of data on biological parameters from previous commercial and research whaling should be published as soon as possible.***

No progress has been made on this recommendation.

5. ***Satellite tagging should be attempted to investigate the movements of fin whales, particularly between the traditional whaling grounds west of Iceland and areas outside.***

See above.

6. *To facilitate the development of spatially structured models to better represent the overall dynamics, it was recommended that all data (catch, effort, catch-at-age, sightings survey abundance and mark-recapture) be split into 4 subareas.*
No progress as yet. Pike agreed to work with Gunnlaugsson on splitting the abundance estimates in this way.

Other (Primarily North Norway)
1. *Preparation of abundance estimates from the 1996-2001 survey series.*
Øien provided a working paper (SC/12/20) that gave estimates for fin, sperm and humpback whales from this survey series. The Task Group recommended that the estimate for fin whales for the areas of overlap with the NASS-2001 survey should be compared and a combined estimate derived if feasible. Pike and Øien agreed to do this in cooperation with Gunnlaugsson.

2. *Revision of catch statistics.*
The 2003 Working Group recommended that Bloch extend her work on the Faroese data to include Norwegian, Irish and northern British Isles land stations. The catch data includes information on catch position, and therefore can be aggregated by any potential stock division and might provide a basis for valuable CPUE series. Unfortunately no funding was available from Norway to complete this work. The Task Group strongly recommended that this work be funded.

3. *Preparation of a CPUE series if possible.*
Dependent on above.

4 *Collection of additional biopsy samples for genetic analysis, and analysis of existing samples in a timely manner.*
As reported above about 30 samples have been collected during Norwegian surveys. Øien reported that more samples would be collected on an opportunistic basis.

5. *Satellite tagging once methodological/technical problems have been addressed.*
See above.

Critical Items
The Task Group agreed on some high priority tasks that must be completed before a productive assessment meeting can be held. If such a meeting is to be held in Autumn 2005, these tasks should be completed by July 2005.

Faroes
1. Genetic analyses of existing and additional samples, combined with those from other areas;
2. Completion of revised catch series and development of a CPUE series if feasible;
3. Collection of additional samples for genetic analyses, if possible.

EGI
1. Spatial disaggregation of abundance, catch, and mark-recapture data as previously described;

2. Genetic analyses of existing samples combined with those from other areas;

Other (mainly North Norway)

1. Rectification and verification of catch data as described above, and development of a CPUE series. Additional funding is required for both these tasks;
2. Analysis of genetic samples in combination with those from other areas.

SECTION 4 – NATIONAL PROGRESS REPORTS

4.1
FAROE ISLANDS - PROGRESS REPORT ON MARINE MAMMALS IN 2003-2004

Dorete Bloch, Bjarni Mikkelsen, Maria Dam and Jústines Olsen

1. INTRODUCTION

This report summarises the Faroe Islands research on cetaceans and pinnipeds conducted in 2003 and updated until 1 October 2004.

Since 1984, the main bulk of research on marine mammals in the Faroe Islands has been conducted by the Zoological Department of the Faroe Islands Museum of Natural History, supplied with some assistance from the Faroe Islands Fisheries Laboratory, the Food and Environmental Agency of the Faroe Islands, and the veterinarians involved in the pilot whaling.

2. RESEARCH

2.1 Species and stocks studied

Pinnipeds

- Grey seals (*Halichoerus grypus*) - coastal waters

Cetaceans

- Fin whale (*Balaenoptera physalus*) - biopsy
- Sperm whale (*Physeter macrocephalus*) - stranded animals
- Pilot whales (*Globicephala melas*) - landed animals
- White-sided dolphins (*Lagenorhyncus acutus*) - landed animals
- Bottlenose dolphin (*Tursiops truncatus*) - landed animals

2.2 Field Work (e.g. sighting, tagging, scientific catches and research)

Fin whale (Balaenoptera physalus)

A total of 14 biopsies was collected inside the Faroe Islands EEZ in the years 2000 and 2001. Presently, these are analysed by Martine Berubé in California.

Sperm whale (Physeter macrocephalus)

Teeth from stranded or dead floating sperm whales are being age determined. The total body length will if possible be recorded.

Pilot whale (Globicephala melas)

Sex, *skin* values and total body length in cm have been recorded from nearly all pilot whales caught in 2003-2004 with kind assistance from the *sýslumen* and the persons who assess the whales. The museum has monitored every grind with the aim of finding the four whales that were satellite tagged on 15 July 2000.

In order to investigate migration and distribution range as well as diving behaviour of pilot whales in the north Atlantic, seven pilot whales out of a pod of about 80 were equipped with satellite transmitters on 25 August 2004. The tagging locality was one of the authorised whaling bays at Sandavágur. The whole tagging procedure took about one hour. It seems that the traditional Faroe Islands driving procedure is very suitable for tagging small shoaling *odontocetes*. The movement of the whales is updated daily on www.ngs.fo. The satellite tags used in the study are three SPOT2 (transmitting every second day) and four SDR-T16 (transmitting daily and including depth measurements); both types manufactured by Wildlife Computers Inc., USA.

In 2003, the Food, Veterinary and Environmental Agency initiated a study of elucidating possible adverse effects of persistent organic pollutants. The project is done in cooperation with the Faroe Islands Museum of Natural History, and the Department of Marine Biogeochemistry & Toxicology at the Royal Netherlands Institute for Sea Research (NIOZ), and is funded by the Danish Cooperation for Environment in the Arctic Programme (DANCEA). The focus of the project is on analyses of bio-markers as thyroxin, Vitamin A and EROD in plasma and liver as well as estrogens activity and testosterone hydroxylase. Successful sampling requires immediate access to the pilot whales during the kill, and that the kill is undertaken at a site where the whale is not submerged. Sampling for the project, which includes blood, liver, kidney, muscle and blubber samples, began in August 2003 and ended in September 2004.

Samples were also taken by the Food, Veterinary and Environmental Agency in the pilot whaling at Hvalvík, August 2003, to examine the levels of heavy metals and organochlorines in meat and blubber used as food

Bottlenose dolphin (Tursiops truncatus)

Three bottlenose dolphins were taken in a grind 3 August 2003, see Tables 1-2. Full samples were taken.

White-sided dolphin (Lagenorhynchus acutus)

Sex and total body length in cm have been recorded from nearly all white-sided dolphins caught in 2003-2004 with kind assistance from the *sýslumen* and the persons assessing the whales. Besides sex and body length, full samples were taken from as many whales as possible inside the timeframe from the catches in Table 2.

2.3 Other studies

Cetaceans

Fin whale *(Balaenoptera physalus)*

In connection with the NAMMCO study group on fin whales, the discovered differences between the baleen whaling statistics kept at the IWC office in Cambridge and the material found by the Faroe Islands Museum of Natural History have been worked on as team work between NAMMCO and IWC. The differences concerned mainly the whaling period, 1894-1950. With funding from the Faroe Islands, different archives in Scotland and England as well as the IWC office, Cambridge were visited in April 2004 to find as much as possible of the missing material and to exchange materials between the institutions. With funding from NAMMCO the archive at the Whale Museum in Sandefjord was visited in May and material copied.

The material contains the baleen whaling taken from the land stations in Ireland, Orkney, the Shetlands, the Faroe Islands, Norway, and the pelagic Norwegian catch. The material is under preparation now and later the Faroe Islands Museum of Natural History and the IWC office will end up with ONE whaling statistic agreed by both institutions.

The Norwegian request from the meeting in the NAMMCO study group on fin whales in Copenhagen in 2004, to the Faroe Islands Museum of Natural History to clear the Norwegian catch still lacks funding from Norway.

Pilot whale (*Globicephala melas*)
Ballistic studies were made on heads of dead pilot whales to investigate the effect of different type and strength of ammunition.

A new knife with a longer blade than on the traditional knife has been tried with positive results and further examinations will go on.

Bottlenose dolphin (*Tursiops truncatus*)
Out from the very tiny length-weight material sampled from 2003, a length-weight correlation is made: $W = 0.0383 * L^{**1.569}$, where W is the total body weight in kg and L the total body length in cm.

White-sided dolphin (*Lagenorhynchus acutus*)
Out from the length-weight material sampled during 2003, a new and better length-weight correlation is made: $W = -13.902 + 0.00056884 * L^{**2.321}$ with 95% CL for k: -26.366 - -1.438; 95% confidence for a: -0.00019129-0.00132898; 95% CL for b: 2.0886-2.5541; Correlation: r = 0.984. W is the total body weight in kg and L the total body length in cm.

3. CATCH DATA

Pinnipeds
Some grey seals are shot every year when entering the salmon fish farms, but the numbers are unknown. Proposals are made to improve upon this, so the catch numbers are given and sampling made possible.

Cetaceans

Table 1: Pilot whale drives in the Faroe Islands, 2003-2004.

Date	Locality	Number of whales
21 May 2003	Húsavík	24
3 August 2003	Hvalvík*	152
7 August 2003	Hvannasund	153
6 September 2003	Tórshavn	130
1 December 2003	Tórshavn	44

20 March 2004	Tórshavn	1
8 June 2004	Bøur	445
28 June 2004	Vágur	26
29 June 2004	Leynar	84
5 July 2004	Fámjin	78
31 July 2004	Trongisvágur	30
4 September 2004	Tórshavn	22
22 September 2004	Leynar	82
2003	**5 grinds**	**503 whales**
2004 - until 1. October	**8 grinds**	**768 whales**

Table 2: Drives of species other than *G. melas* in the Faroe Islands, 2003-2004

Date	Locality	Number	Species	Full samples
3 August 2003	Hvalvík*	3	T. truncatus	3
26 August 2003	Hvalvík	104	L. acutus	104
5 September 2003	Tórshavn	6	L. acutus	6
6 September 2003	Hvannasund	50	L. acutus	0
8 September 2003	Hvalba	6	L. acutus	0
12 September 2003	Klaksvík	20	L. acutus	0
21 August 2004	Boðoyarvík	6	L. acutus	0
28 August 2004	Gøta	24	L. acutus	24
8 September 2004	Klaksvík**	291	L. acutus	35
9 September 2004	Rúnavík	7	L. acutus	0
18 September 2004	Hvannasund	5	L. acutus	0
2003	**1 pod**	**3**	**T. truncatus**	**3**
2003	**5 pods**	**186**	**L. acutus**	**110**
2004 - 1 October	**5 pods**	**333**	**L. acutus**	**59**

*Mixed pod, see Table 1 also, ** Part of a larger pod

4. BY-CATCH DATA

No mandatory reporting scheme is implemented in the Faroes. In the mandatory fisheries logbook fishermen have the possibility to comment on by-catches, but the regularly of this reporting is not investigated. By-catches of larger whales are usually reported by phone to the Museum. To incidents of grey seal by-catches during long-line operation is reported directly to the Museum in 2004.

5. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

None.

6. PUBLICATIONS AND DOCUMENTS

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4.2
GREENLAND - PROGRESS REPORT ON MARINE MAMMALS IN 2003

1. INTRODUCTION

This report summarises the Greenland research on pinnipeds and cetaceans done in 2003. 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 Danish Environmental Research Institute (Department of Arctic Environment), Denmark and Biodinamica, Rio de Janeiro.

2. RESEARCH

2.1 Species and stocks studied

Pinnipeds

- Walrus *Odobenus rosmarus* – Northeast Greenland
- Ringed seal *Phoca hispida* – West Greenland
- Harp seal *Phoca groenlandica* – West Greenland

Cetaceans

- Narwhal *Monodon monoceros* – Admiralty Inlet, Canada
- Fin Whale *Balaenoptera physalus* –West Greenland
- Minke Whale *Balaenoptera acutorostrata* – West Greenland
- Humback Whale *Megaptera novaeangliae* – West Greenland and Brazil
- Bowhead Whale *Balaena mysticetus* – Disko Bay (West Greenland)

2.2 Field work

Pinnipeds

DNA samples were collected from walruses from Young Sound – Northeast Greenland.

Samples from ringed seals and harp seals that can tell about age- and sex composition in the catch, condition, reproduction and stomach content were collected in three settlements in West Greenland.

Cetaceans

Tagging

Species	*Number of whales*	*Area*	*Cooperators*
Narwhal	13	Admiralty Inlet, Canada	Department of Fisheries and Oceans
Fin whale	1	West Greenland	
Minke whale	2	West Greenland	

Bowhead whale	4	Disko Bay, West Greenland	
Humpback whales	4	West Greenland	
Humpback whales	11	Brazil	Biodinamica, Rio de Janeiro

Biopsies
Thirteen biopsies were obtained from narwhals in parallel with tagging operations in Admiralty Inlet, Canada. 11 biopsies were taken from bowhead whales in Disko Bay in May, and 4 biopsies were taken from humpback whales in West Greenland in the fall.

2.3 Research results

Pinnipeds

Id-photos and DNA samples were collected from walruses as part of an ongoing study that will estimate population numbers.

The sampling from harp seals was part of an ongoing study of the harp seal ecology along the West Greenland coast.

The sampling of ringed seals (n=561) is used to describe various aspects of ringed seal ecology in West Greenland. Preliminary results show that the ringed seals caught here mainly are juvenile animals. Age composition is, however, related to catch method, with a higher fraction of old animals when seals are shot compared to netted seals. Seals caught in the North Water (near Qaanaaq) became heavier and had more stomach content during winter (Dec-Mar) and were during this period in much better condition than ringed seals caught along the Baffin Bay coastline. Main diet in the high Arctic areas was Arctic and polar cod (*Arctogadus glacialis* and *Boreogadus saida*), whereas diet seemed to be more opportunistic in the low Arctic zone.

Cetaceans

Thirteen narwhals were tagged in Admiralty Inlet, Canada. Migration data were obtained for up to 6 months. The animals did not frequent other and previous investigated summer areas in Canada and Greenland. The timing of autumn migration routes and winter home ranges were estimated.

One fin whale, two minke whales and four humpback whales were instrumented with satellite transmitters (West Greenland) in August-September 2003. The fin whale and one minke whale received the instruments too low on the side and no positions were obtained from these whales. One minke whale was caught by local whalers a couple of weeks after the instrumentation with the tag (a Telonics ST15) still functioning. Two of the humpback whales provided positions for 2.5 months of detailed movements along West Greenland and across Baffin Bay to the east coast of Baffin Island.

Four bowhead whales were instrumented with satellite transmitters in northwestern Disko Bay, West Greenland, May 2003. The movements within Disko Bay showed that the tagged whales preferred the northwestern part of the bay. Two of the tags were successful in tracking the whales during their migration. The two whales moved from Disko Bay to northern Canada in late May whereafter they stayed along the east coast of Baffin Island until late October when both whales moved south into Hudson Strait.

Eleven humpback whales were successfully instrumented in Brazil in October 2003. All tags provided positions from the whales and three tags documented the southward migration. One tag is still transmitting after 7 months.

3. CATCH DATA

For ringed seals the East Greenland population is here defined as ringed seals that are caught in East Greenland or in one of the three southernmost municipalities on the West coast, whereas the rest belongs to the Baffin Bay population. Hooded seals are only considered East Atlantic if they are caught in Ittoqqortoormiit. All harp seals caught in Ittoqqortoormiit are considered to be coming from the Greenland Sea population, whereas catches from Ammassalik are split fifty-fifty between the Greenland Sea and the West Atlantic populations.

Reported catches on pinnipeds and small cetaceans are only available from 2002. The figures are preliminary and small adjustments are likely to be made. For harbour seals and east Greenland walrus, however, the figures are known to contain major errors and they will not be presented before they have been further validated.

Pinnipeds 2002
Walrus:
East Greenland: (are being validated) Central West Greenland: 210 Avanersuaq: 109
Ringed seal:
East Greenland Population: 11,832 Baffin Bay Population: 49,111
Hooded seals:
East Atlantic: 10 West Atlantic: 3,525
Harp seals (adult):
Greenland Sea: 203 West Atlantic: 22,089
Harp seals (Juvenile):
Greenland Sea: 619 West Atlantic: 28,213
Habour seals: (are being validated)
Bearded seals: 1,394

Small Cetaceans 2002
Narwhals:
East Greenland: 74 West Greenland: 414
Belugas:
East Greenland : 0 West Greenland : 399
Habour porpoises: 1,373
Pilot Whales: 24

Killer whales: 13

Large cetaceans 2003
Fin Whales:
6 (all West Greenland) and 3 reported struck but lost.
Minke Whales:
East Greenland: 13 landed and 1 reported struck but lost.
West Greenland: 178 landed and 7 reported struck but lost.

3. BY-CATCH DATA

Fishermen in Greenland are obliged to report any by-catch of large cetaceans to the Home Rule Department for Fishery. Seals are not reported as by-catch, but should be reported as catch.

In 2003 one humpback whale was reported as by-catch (West Greenland).

4. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

None

5. PUBLICATIONS AND DOCUMENTS

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4.3
ICELAND -PROGRESS REPORT ON MARINE MAMMALS IN 2003

Víkingsson, G.A., Ólafsdóttir, D., Gunnlaugsson, Th. and Hauksson, E.

1. INTRODUCTION

The following are reports on studies conducted by or in cooperation with the Marine Research Institute (MRI) and the Research Committee for Biological Seafood Quality (RCBSQ).

2. RESEARCH

2.1 Species/stocks studied

Pinnipeds

- Grey seal (*Halichoerus grypus*)
- Harbour seal (*Phoca vitulina*)
- Hooded seal (*Cystophora cristata*)
- Harp seal (*Pagophilus groenlandica*)
- Ringed seal (*Phoca hispida*)
- Bearded seal (*Eringnathus barbatus*)

Cetaceans

- Blue whale (*Balaenoptera musculus*)
- Fin whale (*Balaenoptera physalus*)
- Sei whale (*Balaenoptera borealis*)
- Minke whale (*Balaenoptera acutorostrata*)
- Humpback whale (*Megaptera novaeangliae*)
- Sperm whales (*Physeter macrocephalus*)
- Northern bottlenose whale (*Hyperoodon ampullatus*)
- Long-finned pilot whale (*Globicephala melas*)
- Killer whale (*Orcinus orca*)
- White-beaked dolphins (*Lagenorhyncus albirostris*)
- Harbour porpoise (*Phocoena phocoena*)

2.2. Field Work

Pinnipeds

Grey seal

Grey seal pups were counted repeatedly from an aircraft (3x to 5x) during the breeding season in the autumn, in selected rookeries in Frameyjar, Breidafiord, W-Iceland and on the South-Coast. The area investigated holds about 45% of the pup-production estimate in year 2002. A few grey seal pups were marked with plastic tags, from the Marine Research Institute, in the autumn on Skeiðarársandur, South-Iceland.

Harbour seal

Aerial survey of the harbour seal on the whole coast of Iceland, was undertaken in August. This was the eighth survey since 1980.

Vagrants
One hooded seal pup was marked with a plastic tag on Skeiðarársandur South-Iceland.

Cetaceans
Information on stranded or beached whales on the Icelandic coast in 2003 was collected by the MRI. Various tissue samples for pollution studies have been routinely collected during dissections of stranded or by-caught cetaceans in recent years. These are stored frozen at the MRI.

Table 1. Samples from stranded animals 2003

Species	Area	Calendar year/ season/ no. collected	Archived (Y/N)	Tissue types*	Contact institute
Long finned pilot	E-Iceland	2003/Jan/ one	Y		INH
Minke	W-Iceland	2003/Mar/ one	Y	bul, go, st, mu, bl, sk, blo, li, ki	MRI
Minke		2003/Jul/one	Y	go, st, mu, bl, sk	MRI
Sperm		2003/Jul/one	Y	te	MRI

* te=teeth, go=gonads, st=stomach, mu=muscle, bl=blubber, sk=skin, blo=blood, he=heart, li=liver, ki=kidney, bul=bulla

Table 2. Samples from by-catches 2003

Species	Area	Calendar year/ season/ no. collected	Archived (Y/N)	Tissue types*	Contact institute
Humpback (foetus)	NE-Iceland	2003/Nov/1	Y	whole	MRI
Humpback	E-Iceland	2003/Jun/1	Y	go, li, ki, sk, blo, bl, mu, st	MRI
Humpback	SE-Iceland	2003/Apr/1	N		MRI
Humpback	N-Iceland	2003/May/1	N		MRI

* te=teeth, go=gonads, st=stomach, mu=muscle, bl=blubber, sk=skin, blo=blood, he=heart, li=liver, ki=kidney, bul=bulla

Research takes
During 18 August-30 September 2003, 36 common minke whales were caught and sampled in Icelandic waters under special permit in accordance with the original research proposal. In addition one animal was lost post-mortem and could thus not be sampled. The whales were caught from three minke whale catching boats hired by the Marine Research Institute: *Njörður, KÓ-7* (29.7m, 30 tons), *Halldór Sigurðsson, ÍS-14* (17.6m, 41 tons) and *Sigurbjörg ST-55* (21.5m, 95 tons). The crew was mostly composed of experienced minke whalers, and 2-4 scientists were on board each of the vessels. Cruise leaders from the Marine Research Institute were in charge of the

operation on board each vessel.

Searching effort was distributed all around Iceland in proportion to known densities of minke whales as laid out in the sampling scheme for the nine areas. Minor sampling constraints were imposed by avoidance of whale watching areas and bad weather in offshore areas.

Basic information on the sampled animals is tabled in Appendix 1 (see p. 306). Further information, including the spatial sampling distribution, length- and sex distribution is given in the table in Appendix 2 (see p. 307) and NAMMCO/12/IN/4. Males dominated in the sample (male/female ratio: 23/13) and the sampling distribution indicates geographical segregation by sex although sample size is small. Dissection and sampling took place on board the vessels.

<u>Systematic sighting data</u>

Two cetacean sightings surveys were carried out as a part of a programme for increased whale research introduced in the Scientific Committee of the IWC in 2003 (SC/55/O2-revised).

A shipboard sighting survey was conducted by one research vessel in a joint cetacean, redfish and plankton survey in the area southwest of Iceland in the period 4 to 30 June 2003. Generally four observers operated on a single platform.

Results of a sighting survey SW of Iceland in June 2003

Effort (Nm)	1,121
Number of species	11
Number of sightings	295
Number of animals	1,249
Number of minke whales	11

One experimental aerial sighting survey was carried out in the Faxaflói area south west off Iceland in September 2003 in cooperation with the Greenland Nature Institute. The primary goal was to get a comparison between the sightings identified by observers and aerial photographs taken from another aircraft flying at slightly higher altitude (Witting and Pike 2004a,b; Witting 2004).

MRI and a whale watching company operating in SW Iceland cooperated in reporting and compiling sightings data during whale watching excursions. This is a 4-year pilot project, initiated in 1999, for investigating the feasibility of using whale watching boats for systematic collection of data on distribution and relative abundance of cetaceans in nearshore Icelandic waters.

<u>Natural marking</u>

Catalogues of individuals based on natural marking data are held at the Marine Research Institute for blue, humpback, and killer whales. Photographs are obtained in special cruises as well as from opportunistic platforms. No cruises were conducted in 2003 specifically to collect photo-id data.

2.3 Laboratory work

Pinnipeds

Preliminary analysis of the grey seal data from the partial aerial survey (in an area where 43% of pup-production in year 2002 took place) in autumn of 2003 indicated that pup-production was only slightly less, about 2% less, than the year before. In this area a decrease in pup-production was observed in rookeries on the South-Coast, but not on the West-Coast.

Preliminary analysis of the harbour seal data from aerial survey in summer 2003 gave population size about 10,000 (95% CL 5,500 – 16,500), and a proportional annual change of -0.05 (SE 0.005) during the period 1980-2003. A total of eight surveys have been done in that period.

Cetaceans

The minke whale research programme

In 2003, research on marine mammals was mostly confined to the research programme on minke whales initiated that year (including non-lethal components of the programme s.a. aerial surveys. Other ongoing projects have therefore been delayed. The overall programme assumes a catch of 200 minke whales spread over the Icelandic continental shelf area during May-September and is thus still in an early stage of the sampling phase. For most of the studies based on dissection of sampled animals it is premature to present, even preliminary, results based on only 18% of the total sample. Samples collected for most of the sub-projects have already been analysed or are at a final stage of laboratory analysis. For some projects requiring complex set-up for chemical analysis (pollution, genetics) it was considered unfeasible to start the laboratory work until more samples are available. The status of analyses for the different sub-projects of the minke whale research programme in general is given in IWC SC/56/O10 and for stomach contents in NAMMCO SC/12/IN/4.

The status of different sub-projects of the programme is discussed under the representative section below.

Feeding and energetics

Diet composition

The contents of different stomach compartments were measured and samples taken from all animals sampled in 2003. Preliminary results from the samples taken in 2003-2004 will be presented in 2005.

Energetics

Measurements of blubber thickness and girth dimensions were taken from all animals sampled in 2003 in accordance with the original programme. Laboratory analysis of the energetic density of tissues, important for energy storage, is underway.

Seasonal variations in distribution

The shipboard sighting survey was conducted by one research vessel in a joint cetacean, redfish and plankton survey in the area southwest of Iceland in the period 4 to 30 June 2003. Sighting rates from the shipboard survey in June were similar to the

2001 survey in July (Gunnlaugsson *et al.* 2004), generally higher for toothed whales but lower for baleen whales (Pike *et al.* 2004a) except for humpback whales which showed a somewhat wider distribution.

The experimental aerial sighting survey carried out in the Faxaflói area south west off Iceland in September 2003 was in cooperation with the Greenland Nature Institute. The primary goal was to get a comparison between the sightings identified by observers on the aircraft that has been used in surveys in near shore Icelandic waters and aerial photographs taken from another aircraft flying at slightly higher altitude (Witting and Pike 2004a, b; Witting 2004).

In 2004 aerial sighting surveys were carried out in the spring (Pike *et al* .2004b), summer and autumn (SC/12/19) as a part of series designed to investigate seasonal distribution of minke whale around Iceland. The design implemented in the NASS-2001 survey (Pike and Víkingsson 2002) was adopted using the cue-counting procedure and minke whale as the target species. However, since roughly half the flying time used in the 2001 survey was available in each survey, effort was substantially decreased in most blocks.

<u>Stock structure</u>

Genetics

Laboratory work on genetic samples collected in 2003 is underway. Meaningful analysis of the results with respect to stock structure awaits further sampling.

Telemetry

One minke whale was instrumented with a satellite tag in October 2003. No signals were received. In August and September 2004 attempts will be made to instrument up to 10 minke whales with satellite transmitters, in accordance with the original programme.

Other methods

Morphometric measurements were taken from all sampled minke whales. The potential use of pollutants and other chemical signals will be examined in accordance with the original plan when results from those analyses are available from a larger sample.

<u>Parasites and pathology</u>

Full veterinary autopsy was performed on 5 animals in 2003 and 6-9 animals will be examined in the same way in 2004. All animals were healthy with only minor focal parasitic skin lesions, mild to moderate liver fluke infestation and moderate to heavy nematode burden in the glandular stomach. However, as in other sub-projects, final interpretation remains to be completed, when more samples are available. The following pathological analyses have been conducted on samples from animals caught in 2003.

<u>Haematology and serology</u>

EDTA-blood samples from 20 animals and blood smears from 31 animals were collected and analysed from animals caught in 2003. The EDTA-blood was examined for the following hematological parameters: haemoglobin, haematocrit (PCV), white blood cell count (WBC). The blood smears were examined under a microscope and a white blood cell differential count was performed. Preliminary results show no haematological abnormalities. However, final interpretation remains to be completed.

Urinalysis

Serum samples have been analysed for electrolytes (Na+, K+, Cl-, Mg++, Ca++), creatinine, urea, uric acid, pH and osmolality (SC/56/O 11). Blood and urine samples were obtained from 16 minke whales in 2003 (four non-pregnant females, 12 males). The animals weight was derived from their length, which gave mean weight (standard deviation) of 4,571 kg (1337). Na^+, K^+, Cl^-, Mg^{++}, Ca^{++}, creatinine, urea and uric acid were measured in blood and urine, as well as pH and osmolality. Utilising allometry of creatinine in relation to body weight and the serum and urinary concentrations of creatinine the average urine volume was predicted to be 214 L/day. From this volume and the known water content of the ingested food the average daily food ingestion was estimated to be about 280 L. This is considerably greater volume than reported earlier by most workers. Energy calculations suggest considerable heat loss as the metabolic rate is over three times that of an equally heavy terrestrial mammal. Concentrations of electrolytes in urine are compatible with the fact that the minke whale is a piscivorous animal and are quite different from those of the krill eating fin whale. The high sodium and magnesium levels in urine suggest some sea water ingestion (SC/56/O 11)

Histology

Tissue samples from major organs of 33 animals caught in 2003 were fixed in formalin and processed with routine methods and tissue slides were stained with hematoxeosin. The slide were examined under a microscope. A preliminary histological examination showed focal superficial dermatitis due to parasitic infestation in few animals, and mild to moderate cholangiohepatitis in liver samples from few animals that were heavily infested with liver flukes. No apparent pathological changes were found in other organs.

Microbiology

A total of 118 bacteriological samples from 26 animals caught in 2003 were collected and analysed. Preliminary results of cultures from blood and major organs of these animals were negative with respect to pathogenic bacteria. However, final interpretation and further diagnostic work remains to be completed.

Virology

Faeces samples:

In 2003, 72 samples of intestinal contents from different anatomical parts of the intestinal tract from 23 animals were collected for virological research. If any virus-like particles are found by electron microscopy examinations, virus isolations attempts will be made in cell culture lines from whales. Collection of intestinal contents will continue in 2004.

Peripheral blood leukocyte cells (PBLC):
DNA has been isolated from buffy coat of EDTA or citrate stabilised blood samples. For this, blood samples from 18 whales were sampled in 2003 and sampling continues in 2004.

Morbillivirus detection:
Organ samples from the respiratory tract and the spleen have been collected and frozen at -80°C. These samples will be used in RT-PCR for morbillivirus detection.

Biological parameters
Gonads from all animals caught in 2003 (13 females and 23 males) have been analysed for sexual maturity for both sexes and reproductive history for females. Analysis of growth layers in earplugs and of amino acid racemisation in eye lenses is near complete for the samples taken in 2003.

Pollutants
Of the 36 samples collected in 2003, 7 animals have been analyzed for mercury in muscle tissue and 5 animals have been analysed for dibenzo-p-dioxins, dibenzofurans, dioxin-like PCBs and marker PCBs in blubber. The remaining analyses as detailed in the original programme will be completed when a larger sample is available. Some of these will be done in laboratories outside Iceland. Interpretation and diagnostic work with reference to biological parameters, trophic status, body condition and geographical variation awaits further chemical analysis of a larger sample size.

2.4 Other laboratory activities

Strandings
Laboratory work on material sampled from stranded and by-caught cetaceans was continued. This includes determination of age, reproductive status, diet and screening for morbillivirus. Blood samples from stranded animals have been screened for morbillivirus antibodies at the Institute for Pathology, University of Iceland. Other samples were stored at the MRI.

Analyses of abundance and trends
Analysis of data collected during the NASS-2001 sightings survey is being coordinated through a special working group under the Scientific Committee of NAMMCO. Estimates of abundance and/or trends of fin, blue, minke, humpback, long-finned pilot, northern bottlenose, and sperm whales as well as *Lagenorhynchus* dolphins have been discussed by the working group. Abundance estimates for minke whales were submitted to the IWC Scientific Committee 2003 meeting (SC/55/NAM2, SC/55/NAM3). New analytical methods have been applied to data on minke and humpback whales from NASS-2001 in cooperation with the Research Unit for Wildlife Population Assessment in St Andrews, Scotland (Borchers 2003, Burt *et al.* 2003).

Modelling
An assessment of the East Greenland-Iceland fin whale in a sub-stock model with mixing based on marking data (Gunnlaugsson 2003) was presented to a NAMMCO

Scientific Committee Working Group on minke and fin whales in 2003 (Gunnlaugsson 2003).

3. CATCH DATA

Pinnipeds
Catch figures for 2003 are 416 harbour seals (405 pups and 11 1+ animals, 502 grey seals (253 pups and 249 1+ animals), 2 hooded seals, 2 bearded seals, 2 ringed seals and 1 harp seal. Norwegian sealers were issued a permit but have not reported any catches of harp or hooded seals inside the Icelandic EEZ for 2003.

Cetaceans
Direct catches (commercial, aboriginal and scientific permits) for the calendar year 2003

Species	Type of catch	Area/stock	Males	Females	Total landed	Struck and lost
Minke	Scientific	CIC	23	13	36	1

4. BY-CATCH DATA

Reporting of marine mammal by-catch in the Icelandic fishery is mandatory. All fishing vessels are obliged to report catch and by-catch in logbooks. No observation scheme is carried out in order to evaluate the reliability of the system. The reporting is entirely based on the cooperation of the fishermen and is therefore voluntary in practice, most likely resulting in inadequate monitoring of marine mammal by-catch in the Icelandic fishery.

The procedure of reporting marine mammal by-catch via logbooks has been introduced specially by a letter and species identification guide sent to the gillnet fleet in 2002 and again with all new log books delivered to the fishermen since.

In 2003 a total marine mammal by-catch of 188 animals was reported from a total of 14 boats. In addition MRI received information of two humpback whales entangled in sink nets and one humpback whale entangled in a bottom trawl. This by-catch was not reported in logbooks.

Table 3. Marine mammals by-catch reported from Iceland 2003

Species		**Fishing gear**	**Number**
Common seal	*Phoca vitulina*	gillnet	12
Grey seal	*Halichoerus grypus*	gillnet	0
Harp seal	*Pagophilus groenlandicus*	gillnet	1
Ringed seal	*Phoca hispida*	gillnet	2
Hooded seal	*Cystophora cristata*	gillnet	0
Bearded seal	*Eringnathus barbatus*	gillnet	2
Harbour porpoise	*Phocoena phocoena*	gillnet	167

White beaked dolphin	*Lagenorhyncus albirostris*	gillnet	0
Unid. Dolphin		gillnet	3
Humpback whale	*Megaptera novaeangliae*	gillnet	3
Humpback whale	*Megaptera novaeangliae*	bottom trawl	1
Total			191

5. CETACEAN STRANDINGS IN 2003

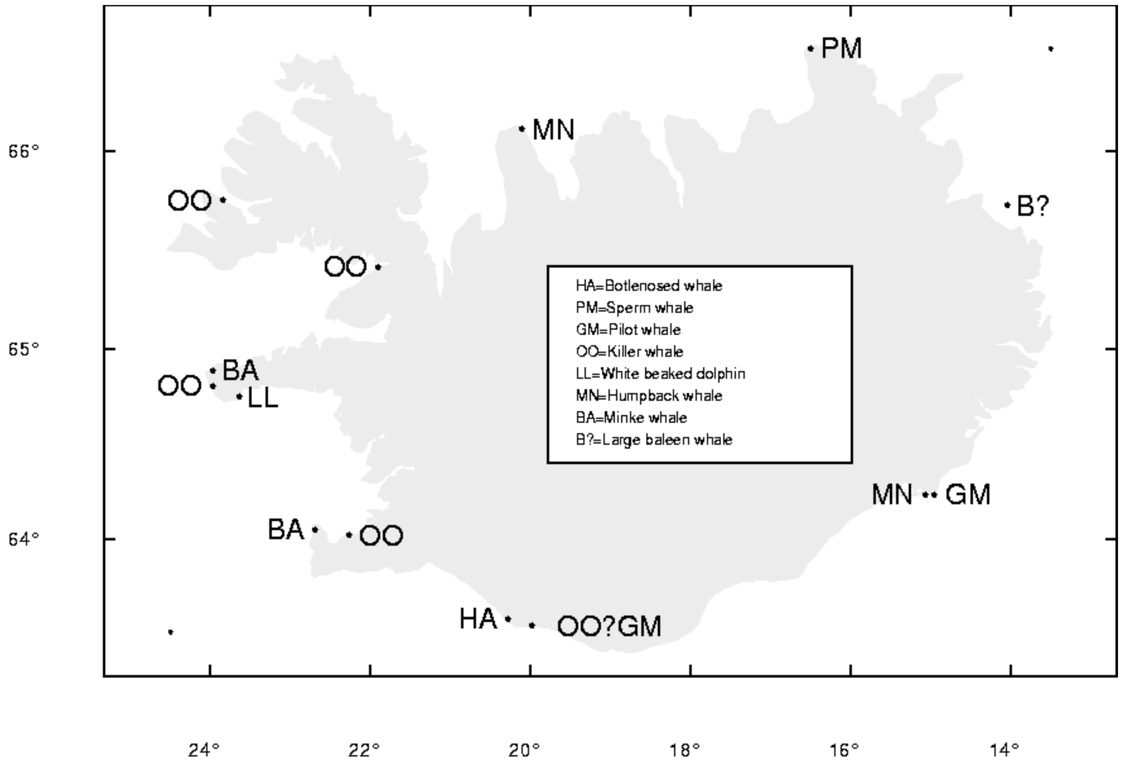

Table 4. Number of stranding by species in 2003 reported to the MRI

Species	**2003**
Killer whale (*Orcinus orca*)	4
White-beaked dolphin (*Lagenorhyncus albirostris*)	1
Northern bottlenose whale (*Hyperoodon ampullatus*)	2
Sperm whales (*Physeter macrocephalus*)	1
Long-finned pilot whale (*Globicephala melas*)	1
Unidentified toothed whale	1
Humpback whale (*Megaptera novaeangliae*)	2
Minke whale (*Balaenoptera acutorostrata*)	2
Unidentified large baleen whale	1
All	**15**

Table 5. Strandings 2003

Id	Species	Number	Sample	Date	Location
S0301	Pilot	1	-	09.01.03	Stokksnes
S0302	Minke	1	+	01.03.03	Rif Snæfellsnesi
S0303	Humpback	1	-	01.04.03	Austurfjara Hornafj
S0304	Killer	1	-	22.04.03	Bervík Snæfellsnes
S0305	WBD	1	-	25.04.03	Hellnar, Arnarstapi
S0306	Killer	1	+	01.07.03	Keilisnes, Vatnsleysustr.
S0307	Sperm	1	-	06.07.03	Núpskatla, Melrakkaslétta
S0308	Minke	1	+	21.07.03	Sandgerði
S0309	Large baleen	1	-	23.07.03	drifting in Héraðsflóa
S0310	Toothed	1	-	28.07.03	Vestur Holt undir Eyjafjöllum
S0311	Northern Bottln.	2	+	28.08.03	Krossfjara á Landeyjarsandi
S0312	Humpback	1	-	03.10.03	Hraun á Skaga
S0313	Killer	1	+	22.10.03	Vestfirðir
S0314	Killer	1	-	11.11.03	Gilsfjörður

6. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

The MRI brought forward recommendations by the NAMMCO WG on grey seals for more frequent survey counts and that the risk of continued catches be assessed. A precautionary TAC of 200 fin whales and 250 minke whales within the Icelandic EEZ was recommended by the MRI. These recommendations were based on recent assessment by the Scientific Committee of NAMMCO.

On request of the government of Iceland the MRI submitted a proposal for a two year feasibility study (IWC SC/55/O2-revised) at the IWC SC 2003 annual meeting, intended to strengthen the basis for conservation and sustainable use of cetaceans The programme calls for takes of 100 minke and fin whales and 50 sei whales each year.

The revised programme for minke whales was initiated as reported here. The programme for fin and sei whales is pending.

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Appendix 1. Provisional data on common minke whales caught as a part of a scientific programme in Icelandic waters in 2003 and 2004.

Sample ID	Date	Latitude N	Longitude W	Area	Body length (m)	sex
B0301	18.08.03	64°59	22°55	1	5,20	male
C0301	18.08.03	63°49	22°08	10	7,76	male
A0301	20.08.03	66°00	21°13	2	8,02	male
C0302	22.08.03	63°19	18°48	9	7,70	male
A0302	23.08.03	66°04	22°48	2	7,97	female
B0302	23.08.03	64°23	22°45	1	6,93	male
C0303	24.08.03	64°09	15°41	9	8,40	female
A0303	25.08.03	65°55	19°36	4	7,54	male
C0304	25.08.03	64°13	15°12	9	7,82	female
A0304	26.08.03	66°10	19°16	4	5,08	male
B0303	27.08.03	63°50	22°49	10	8,45	male
A0305	28.08.03	66°27	15°45	5	7,42	female
C0305	28.08.03	64°16	14°47	8	7,78	male
A0306	29.08.03	66°15	14°39	6	7,39	male
A0307	30.08.03	66°12	14°39	6	7,77	male
B0304	30.08.03	64°36	22°51	1	6,92	male
A0308	31.08.03	66°36	17°29	3	6,97	male
B0305	31.08.03	65°04	24°13	1	8,61	female
C0306	03.09.03	65°47	14°07	6	7,29	male
C0307	06.09.03	65°46	14°14	6	7,30	female
C0308	08.09.03	64°10	15°37	9	8,10	female
A0309	09.09.03	66°06	22°45	2	8,20	female
A0310	12.09.03	65°39	21°27	2	8,09	female
B0307	15.09.03	64°13	22°39	1	7,75	male
A0311	16.09.03	66°10	18°40	4	5,26	female
C0309	16.09.03	64°12	14°57	8	8,40	female
C0310	18.09.03	63°49	21°58	10	7,60	female
C0311	19.09.03	63°50	21°16	10	7,62	male
B0308	22.09.03	64°33	22°46	1	6,03	male
C0312	24.09.03	63°57	16°15	9	8,09	male
A0312	25.09.03	66°17	15°36	5	7,74	female
B0309	25.09.03	64°51	24°05	1	7,18	male
B0310	26.09.03	64°58	23°42	1	7,50	male

Sample ID	**Date**	**Latitude N**	**Longitude W**	**Area**	**Body length (m)**	**sex**
B0311	28.09.03	65°07	24°05	1	7,72	male
B0312	28.09.03	65°00	23°54	1	7,71	male
A0313	30.09.03	65°40	21°34	2	5,67	male
B0401	04.06.04	64°27	22°31	1	8,36	male
B0402	08.06.04	64°39	22°45	1	7,74	female
C0401	09.06.04	64°04	16°03	9	6,85	male
A0401	10.06.04	65°39	21°25	2	7,8	female
C0402	11.06.04	64°09	15°35	9	7,45	female
C0403	14.06.04	65°13	13°32	6	7,12	female
A0402	15.06.04	65°39	21°23	2	7,93	female
B0403	15.06.04	64°15	22°57	1	7,64	male
B0404	16.06.04	64°11	23°24	1	7,78	male
B0405	18.06.04	63°59	23°04	1	7,16	male
B0406	20.06.04	64°24	23°31	1	7,27	male
A0403	22.06.04	66°30	19°48	3	8,58	female
A0404	22.06.04	66°30	19°48	3	8,4	female
B0407	22.06.04	63°49	23°11	1	8,13	male
A0405	26.06.04	65°53	19°35	4	7,61	female
B0408	28.06.04	64°10	22°58	1	6,84	female
B0409	03.07.04	63°41	16°57	9	7,37	male
B0410	03.07.04	63°47	16°32	9	7,92	male
C0404	03.07.04	64°00	15°50	9	5,02	female
C0405	03.07.04	64°00	15°40	9	7,93	male
A0406	04.07.04	65°30	21°03	2	8,19	female
B0411	04.07.04	64°12	14°53	8	8,53	female
C0406	04.07.04	64°13	14°59	8	8,35	female
C0407	04.07.04	63°58	16°16	9	6,34	female
B0413	05.07.04	63°48	16°34	9	8,52	female

Appendix 2. Temporal and spatial distribution of the sampled minke whales in 2003 and 2004 and the provisional plan for takes in 2005 – 2006.

Area	**May**	**June**	**July**	**August**	**Sept./ Oct.**	**Total**
2003						
Area 1				4	6	10
Area 2				2	3	5
Area 3				1		1
Area 4				2	1	3
Area 5				1	1	2
Area 6				2	2	4
Area 8				1	1	2

Area 9				3	2	5
Area 10				2	2	4
Total 2003	**0**	**0**	**0**	**18**	**18**	**36**
2004						
Area 1		8				8
Area 2		2	1			3
Area 3		2				2
Area 4		1				1
Area 5						
Area 6		1				1
Area 8			2			2
Area 9		2	6			8
Area 10						
Total 2004	**0**	**16**	**9**	**0**	**0**	**25**
2005						
Area 1		3	4	3		10
Area 2		1	2	1		4
Area 3		1	2	1		4
Area 4			1			1
Area 5		1	2	1		4
Area 6		1	3	2		6
Area 8			1			1
Area 9		2	4	2		8
Area 10			1			1
Total 2005	**0**	**9**	**20**	**10**	**0**	**39**
2006						
Area 1	5	6	8	7		26
Area 2	1	4	3	2		10
Area 3	1	1	2	1		5
Area 4	1	3	4	3		11
Area 5		1	2	1		4
Area 6		3	2	2		7
Area 8	1	4		2		7
Area 9	4	8		7		19
Area 10	5		6			11
Total 2006	**18**	**30**	**27**	**25**	**0**	**100**
Grand total 2003-2006	**18**	**55**	**56**	**53**	**18**	**200**

4.4
NORWAY - PROGRESS REPORT ON MARINE MAMMALS IN 2003

Sidsel Grønvik, Tore Haug & Nils Øien

1. INTRODUCTION

This report summarises the Norwegian research on pinnipeds and cetaceans conducted in 2003. The research was conducted at the University of Tromsø: the Department of Arctic Biology (UIT-AAB) and the Norwegian College of Fishery Science (UIT-NFH), the Norwegian School of Veterinary Science, Department of Arctic Veterinary Medicine in Tromsø (NVH-IAV), the Institute of Marine Research (IMR), the Norwegian Polar Institute (NP), the National Veterinary Institute (VI), the University of Oslo, Zoological Museum (UIO-ZM) and Origo Miljø as, Stavanger (OM).

2. RESEARCH

2.1 Species and stocks studied

Pinnipeds

- Harp seals *Phoca groenlandica* - Greenland and Barents seas
- Hooded seals *Cystophora cristata* - Greenland Sea
- Harbour seals *Phoca vitulina* - Svalbard, Norwegian coastal waters
- Grey seals *Halichoerus grypus* - Norwegian coastal waters
- Ringed seals *Phoca hispida* - Svalbard
- Ross seal *Ommatophoca rossi* - Weddell Sea
- Leopard seals *Hydrurga leptonyx* – Weddell Sea
- Steller sea lion *Eumetopia jubatus* – North Pacific Ocean and Okotsk Sea
- Walruses *Odobenus rosmarus* - Svalbard

Cetaceans

- Sperm whales *Physeter macrocephalus* - Northeast Atlantic
- Minke whales *Balaenoptera acutorostrata* - Northeast Atlantic
- Fin whales *Balaenoptera physalus* - Northeast Atlantic
- Humpback whales *Megaptera novaeangliae* - North Atlantic
- Bowhead whale *Balaena mysticetus* - Arctic
- Killer whales *Orcinus orca* – Northeast Atlantic
- White whales *Delphinapterus leucas* - Svalbard

2.2 Field work

Pinnipeds

Anatomical and physiological studies of hooded seals from the Greenland Sea stock were conducted in connection with a research cruise with FF "Jan Mayen" in the Greenland Sea between 23 March and 3 April, 2003. Two adult female and four new-born hooded seals were used in studies of the vascular arrangement in the front flippers, in connection with ongoing studies of thermoregulatory aspects of diving in this species. Another eight weanling hooded seals were live captured and brought back to the Department of Arctic Biology (AAB), for later use in studies of the ability of seals to tolerate hypoxia (oxygen shortage) during diving (UiT-AAB).

Studies of age- and sex composition, body condition and feeding ecology were performed on harp seals invading the coast of North Norway in March. (IMR)

Abundance estimation using aerial photographic surveys was performed for harbour seals in South and Mid Norway in August (i.e. the moulting period, methodology based on total counts). Additionally, to be able to adjust the estimates for animals not hauled out during the surveys, the haul-out behaviour of the species was investigated on a special location in Vesterålen in July-August. (IMR, NFH-UIT)

Abundance estimation (using pup counts) and sampling of biological material for studies of breeding biology (including tagging of pups), in particular the temporal distribution of births, stock identity and feeding ecology were performed for grey seals in ship-borne surveys in Mid and North Norway in October - December. (IMR)

The biology and ecology of grey seals (demography, condition, diet, reproduction, genetics, pollutants, virus infections) were studied in ship-borne surveys conducted in North Norway in March. (IMR, NFH-UIT)

Material to assess demographic parameters was collected from the Norwegian grey and harbour seal hunt. (IMR)

In Rogaland County, breeding harbour seals were surveyed in Lysefjord in June and moulting harbour seals in August. Grey seal pups were tagged in the Kjør area in December. (OM)

Tracking of polar bears to study predation on ringed seals in Storfjorden, Svalbard was performed as part of a larger climate-related programme studying relations between snow and ice, polar bears and ringed seals. An aerial survey of ringed seals during the moulting season was conducted in June, covering most fjords on Spitsbergen. Samples of 90 ringed seals were collected to study the population dynamics, diet, parasites, pollutants and general health assessment in April - late May in various fjords on Spitsbergen. Studies of haul-out behaviour of ringed seals during the moulting period in Kongsfjorden were conducted in May - July. A study was conducted based on counting hauled out ringed seals in addition to continuous recordings of behaviour of 24 ringed seals with VHF transmitters. The deployment of 11 satellite transmitters on ringed seals in Storfjorden during July was part of a larger climate-related programme studying relations between snow and ice, polar bears and ringed seals.

Satellite transmitters were deployed on 10 adult walrus males in the Tusenøyane area, Svalbard, early August. In addition blubber and blood samples were collected from these animals for studies of pollutants, diets and for a general health assessment. (NP)

IMR vessels and coastguard vessels have collected incidental observations of marine mammals. Recorded data include date, position, species and numbers.

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

During the period 3 July to 12 August 2003 a sighting survey was conducted with two vessels covering the Greenland Sea and the waters around Svalbard. This was the second year of the new 6-year programme 2002-2007 to cover the northeast Atlantic to provide a new abundance estimate of minke whales every sixth year as part of the management scheme established for this species. During the survey biopsy samples were collected from several whale species (white-beaked dolphin, humpbacks, fin whales and a blue whale), and fluke photos were taken of humpback whales. Instrumentation of one minke whale with a VHF tag for collecting dive time information was also conducted off Spitsbergen, and the whale followed for about 24 hours. Satellite tags were applied on one fin whale and one humpback whale, but no signals were received. (IMR)

Work to develop an electronic monitoring system to independently monitor the activities of the Norwegian minke whale vessels started in 2001. The work continued with field experiments in 2003 and a new prototype was successfully tested on four whaling vessels during the whaling season (NVH-IAV).

In August/September mapping of whale distributions was conducted during 0-group fish/ecosystem surveys in the Barents Sea by having dedicated whale observers on board, who collected information following line transect protocols. (IMR)

2.3 Laboratory work

Pinnipeds
Pictures from aerial photographic surveys aimed to estimate harp seal pup production in the Greenland Sea have been analysed. (IMR)

Data on age and body condition and stomach samples of harp and hooded seals taken in scientific operations in pack ice areas in the Greenland Sea are being analysed. (IMR, NFH-UIT)

Demographic data from harp and hooded seals taken in commercial catches and from the Norwegian coastal grey and harbour seal hunt are being analysed. (IMR)

Data on age and body condition and stomach samples from grey seals taken for scientific purposes in North Norway are being analysed. (IMR, NFH-UIT)

Databases containing recapture information and incidental observations of marine mammals have been updated. (IMR)

Initial studies of the hypoxia tolerance of nervous tissue from hooded seals were conducted in collaboration with Dr. J.M. Ramirez of Department of Organismal Biology and Anatomy, University of Chicago. We hypothesise that the central nervous system of diving mammals (which are regularly exposed to hypoxic conditions in connection with long duration diving) display a higher tolerance to hypoxia than does corresponding nervous tissue from non-diving mammals. If this proves to be correct, we plan to conduct follow-up studies in order to elucidate the cellular mechanisms underlying this comparative difference in neuronal hypoxia sensitivity. Experiments were conducted using an in vitro set-up in which electrophysiological activity is recorded in thin slices of cerebral cortex or medulla from these animals. (UiT-AAB).

NVH-IAV has conducted studies on isolation of bacteria of the genus *Brucella pinnipediae* from tissue samples of Greenland Sea hooded seals, serum chemistry profiles on ringed seal and Atlantic walrus, genetic analysis of parapox virus from Weddell seal and serologic screening for selected virus infections in polar bears at Svalbard.

An inventory of scientific collections of Steller sea lions is made. The project is performed in cooperation between UIO-ZM and Memorial University, Newfoundland, and University of British Columbia, Vancouver. The project was partly funded by North Pacific Marine Science Foundation. (UiO-ZM)

Cetaceans

Stomach content samples from minke whales have been analysed using traditional methods where the original biomass of prey items is reconstructed based on remaining hard parts in the contents. (IMR)

Tissues sampled for stock identity studies of minke whales have been archived and analysed using DNA techniques. (IMR)

NVH-IAV has conducted studies on serum chemistry profiles of apparently healthy white whales from Svalbard.

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

Databases containing incidental observations of marine mammals have been updated. (IMR)

2.4 Other work

Pinnipeds

The history and current status of harp and hooded seal management have been compiled and presented. (IMR)

An experiment to compare methodology and results of age determination readings of harp seal teeth by Norwegian and Russian readers has been conducted. (IMR)

Preliminary assessment of status and data requirement for abundance estimation of grey seals have been done. (IMR)

Data on foraging habits of harp and hooded seals taken in scientific operations in pack ice areas in the Greenland Sea have been analysed and presented. (IMR, NFH-UIT)

Results from analyses of fatty acid profiles in blubber material from harp seals collected in the northern Barents Sea have been presented. (IMR, NP)

Data on the distribution and diving behaviour of Greenland Sea harp seals have been subjected to final analyses and submitted for publication. (UiT-AAB)

Previously collected data on the seasonal distribution and diving behaviour of Ross seals and leopard seals (tagged in the pack ice off Queen Maud Land, Antarctica in 2001) have been further analysed. (UiT-AAB)

Sighting data for Antarctic pack-ice seal species have been analysed in collaboration with Dr. Michael Cameron of National Marine Mammal Laboratory/NOAA, Seattle, U.S.A. (UiT-AAB)

Data on the haul-out behaviour of Ross seals, as collected by use of satellite telemetry in 2001, are currently analysed in collaboration with Dr. Peter Boveng of National Marine Mammal Laboratory/NOAA, Seattle, U.S.A. (UiT-AAB)

Cetaceans

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

A study of trauma and its consequences caused by the currently used weapons and ammunition in the Norwegian hunt for minke whales, with special emphasis on the central nervous system to assess the time for occurrence of insensibility and death in hunted minke whales, was concluded in October 2003. The results were compiled in a thesis and presented for defence of the degree of Doctor Medicinae Veterinaria (NVH-IAV)

NVH-IAV has been engaged in cooperative work with scientists, whale hunters and managers of whaling in Norway, Iceland, Greenland, USA (Alaska) and Russia to improve the weapons and gears used for the hunting of whales. The Department has also been engaged in preparation of user's manuals for whale hunters and in planning and performance of workshops on whale killing methods in NAMMCO and IWC.

2.5 Research results

Pinnipeds

Aerial surveys to assess the status of the Greenland Sea population of harp seals were conducted during their whelping period 14 March to 6 April in 2002. Fieldwork included participation of a Canadian scientist with substantial experience from similar surveys in the Northwest Atlantic. One fixed-wing twin-engined aircraft (stationed in Constable Point, Greenland, but permitted also to use the Jan Mayen island as base) was used for reconnaissance flights and photographic surveys along transects over the whelping patches. A helicopter, stationed on and operated from the applied research vessel (R/V"Lance"), assisted in the reconnaissance flights, and subsequently flew visual transect surveys over the whelping patches. The helicopter was also used for other purposes, such as age-stageing of the pups to assess the temporal distribution of births. Three breeding patches (A, B and C) were located and surveyed either visually and/or photographically. Results from the staging flights suggest that the majority of harp seal females in the Greenland Sea whelped between 16 and 21 March. The calculated temporal distribution of births was used to correct the estimates obtained for Patch B, whereas no multiplier was considered necessary for Patch A. No staging was performed in Patch C – the estimate obtained for this patch may, therefore, be slightly negatively biased. The total preliminary estimate of pup production, including visual survey of Patch A, both visual and photographic surveys of Patch B, and photographic survey of Patch C, was 98,777 (SE 20417), giving a coefficient of variation for the survey of 20.7%. Adding the obtained Greenland Sea pup production estimate to recent estimates obtained using similar methods in the northwest Atlantic (in 1999) and in the Barents Sea / White Sea (in 2002), it appears that the entire North Atlantic harp seal pup production is of a magnitude of at least 1.4-1.5 million animals per year. It is recommended that comprehensive aerial surveys needed to provide estimates of current pup production should be conducted periodically (every 5 years), and that efforts should be made to ensure comparability of survey results. Therefore, the fieldwork in the Greenland Sea included participation by a Canadian scientist with substantial experience from similar surveys in the Northwest Atlantic. Also, the subsequent analyses of images from the photographic surveys included participation of Canadian and Russian scientific personnel with experience from similar analyses from harp seal surveys in the northwest Atlantic and White Sea, respectively. (IMR)

To enable an assessment of the ecological role of harp and hooded seals throughout their distributional range of the Nordic Seas (Iceland, Norwegian, Greenland Seas), a project was initiated in 1999 by members of the NAMMCO Scientific Committee. The project pays special attention to the period July-February (i.e., between moulting and breeding), which is known to be the most intensive feeding period for both harp and hooded seals. To provide data, seals were collected for scientific purposes on expeditions with R/V"Jan Mayen", conducted in the pack ice belt east of Greenland in September/October 1999 and 2002 (autumn), July/August in 2000 (summer), and February/March in 2001 (winter). Results from analyses of stomach and intestinal contents from killed seals revealed that the diet of both species in this particular habitat was comprised of relatively few prey taxa. Pelagic amphipods of the genus *Parathemisto* (most probably almost exclusively *P. libellula*), the squid *Gonatus fabricii,* the polar cod *Boreogadus saida,* the capelin *Mallotus villosus*, and sand eels *Ammodytes* spp were particularly important. Although their relative contribution to the diet varied both with species and sampling period/area, these 5 prey items constituted

63-99% of the observed diet bio-mass in both seal species, irrespective of sampling period. The obtained results suggest that the ecology and distribution of the observed prey species can be related to known predator distribution and diving behaviour. Hooded seal diets appeared to be particularly characterised by squid *G. fabricii* and polar cod, but pelagic crustaceans (amphipods and krill) were important for harp seals. When the relative intestinal prey composition were compared quantitatively among co-occurring harp and hooded seals, differences were observed, which suggest different foraging depths of the two seal species. Studies of diving behaviour of harp and hooded seals in the Greenland Sea have revealed that both species usually perform more shallow dives during summer than during winter, and that hooded seals dive to deeper waters than harp seals in both periods. Except for the youngest stages, which may occur in the upper water layers during summer, the major hooded seal prey *G. fabricii* has a typical mesopelagic distribution with occurrence mainly at depths greater than 400 m. This is in contrast to the distribution of the major food of harp seals: the observed krill and amphipod species are usually confined to the more upper water layers (< 200m depth). (IMR)

Fatty acid profiles and lipid bio-markers from 20 harp seals were used to investigate their foraging ecology in the northeastern Barents Sea. High level of the *Calanus* bio-markers 20:1n9 (mean 14,6 %) and 22:1n11 (mean 6.5%) were recorded together with typical dinoflagellate markers 22:6n3 (mean 6.5%) and C18PUFA (mean 5.5%). Based on analyses of the fatty acid profile by Principal Component Analysis (PCA) the importance of polar cod and the pelagic amphipod *Parathemisto libellula* in harp seal diets was confirmed. The high level of dinoflagellate and *Calanus* bio-markers indicates that harp seal fatty acids originate mainly from these plankton organisms. (IMR, NP)

A joint Norwegian-Russian age-reading experiment on harp seal teeth was conducted in Tromsø with participation of one age reader from Russia (SevPINRO) and two age readers from Norway (IMR). Readings of known age teeth suggested a general tendency to overestimate age by 1 year or more in the age classes 5-11 years while the age of older animals tended to be overestimated. The results suggested differences between readers in both accuracy and precision, but these were not found to be statistically significant. Overall the study indicates that age estimates of harp seals should be treated as probability distributions rather than point estimates even in the youngest age classes. Adequate description of the probability distributions and the effects of having different readers can only be achieved by repeating the experiment with a much larger sample size. (IMR)

A model for a historical assessment of Barents Sea harp seals has been developed. The model has been applied within the context of the ICES WGHARP but needs some further refinements that are scheduled to be completed in 2004. (IMR)

Anatomical studies of vascular structures in the front and hind flippers of hooded seals have revealed an abundant vascularization, including extensive counter-current vascular heat exchange structures, which have not been described in detail before. This vasculature primarily serves thermoregulatory purposes and is probably involved in the observed (and apparently physiologically controlled) decreases in body core temperature that are typically observed in connection with long duration dives in phocid seals. Previous documentation of changes in brain and arterial temperatures of hooded seals in connection with experimental diving support this notion. (UiT-AAB)

The initial studies of the hypoxia tolerance of nervous tissue from hooded seals suggest that cerebral cortical and medullary slices from these seals do, indeed, display a higher tolerance to hypoxia, than do similar preparations from non-diving mammals (e.g. mice). These preliminary findings will be confirmed in a more comprehensive study starting in 2004, which will also involve initial attempts to elucidate the cellular mechanism(s) responsible for this difference in hypoxia sensitivity. (UiT-AAB).

Final analyses of data from the satellite tagging study of adult Greenland Sea harp seals that was completed in May 2000 have revealed that a large proportion of the tagged seals migrated into the Barents Sea in mid-July, to return in late autumn/winter, thus sharing feeding grounds with the Barents Sea stock of harp seals for a considerable part of the year (4-5 months). Moreover, diving behaviour data show that the seals display both diurnal and seasonal variations in diving depths, with dives being much deeper in winter and at day-time, than in summer and during night-time. Further information is given in the full paper that was published in *Polar Biology* early in 2004 (UiT-AAB)

Preliminary results from surveys aimed to assess the abundance of grey seals in Norway in September-December 2001-2003 indicated a possible increasing trend in population size. (IMR)

On 3rd December, 34 out of 35 grey seal pups were tagged on Kjør in Rogaland, and additionally 85 adult grey seals were observed in the area. (OM)

Result from a ship-borne survey of harbour seals in Lysefjord in Rogaland County 25th June, revealed an observed breeding population of 90 adults and 32 pups. Three pups were tagged (OM).

A ship-borne moulting survey in Lysefjord on the 22nd August revealed 49 harbour seals. (OM)

Cetaceans

A new estimate for Northeast Atlantic minke whales based on the survey data collected over the six-year period 1996-2001 has been approved by the IWC Scientific Committee for use in the RMP. The estimate indicates a more westerly distribution pattern compared to earlier surveys, however, no specific cause of this has been revealed.(IMR)

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

Analyses of minke whale stock structure based on the established DNA register were presented and discussed at the annual meeting of the IWC Scientific Committee. Mitochondrial DNA indicates differences which maintain the separation between the Central and Eastern Medium Area. Within the Eastern Area, there was little or no evidence supporting a difference between EC and the surrounding waters and this Small Area was therefore included in a Norwegian Sea area. There was some evidence for a separate Small Area in the eastern Barents Sea, and a moving of the northern boundary of the North Sea Small Area southwards to 62ºN. (IMR)

Abundance estimates for fin, sperm and humpback whales based on the synoptic 1995 survey have been provided. (IMR)

Data from ecosystem surveys along the Barents Sea shelf edges are being worked up to elucidate habitat and prey selection by fin, sperm and minke whales, as well as *Lagenorhynchus* species. (IMR)

Data from seven killer whales instrumented with satellite tags in 2000 and 2001 are being worked up to describe movement patterns, home ranges and dive behaviour. (IMR)

Substantial changes have occurred in the Barents Sea ecosystem over the past 30 years, the most conspicuous being related to the rises and falls of stocks of the two dominant pelagic shoaling fish species: capelin and herring. Based on data from annual studies, effects of these ecological changes on the diet and food consumption of minke whales have been assessed for the whole period 1992-2003. Following a collapse in the capelin stock in 1992/1993, minke whales foraging in the northern Barents Sea apparently switched from a capelin-dominated diet to a diet almost completely comprised of krill. The second half of the 1990s saw a clear improvement of the capelin stock, and the species was again observed on the whale diet in the northern areas in 2000. In the southern area of the Barents Sea, capelin has been observed to be preyed upon by minke whales increasingly after 1995. In this area, also gadoids and, more importantly, krill and herring, are the food items of interest for the whales. The southern region of the Barents Sea includes important nursery areas for the Norwegian spring spawning herring. Good recruitment to this stock gives strong cohorts (e.g., 1991, 1992 and 1998) and large numbers of adolescent herring (0-3 years old) which serve as the main minke whale prey in the area. Recruitment failure with subsequent weak cohorts (e.g., 1993-1997) seems, however, to reduce the availability of adolescent herring to such an extent that minke whales switch to other prey items such as krill, capelin and, to some extent, gadoid fish. In the North Sea (first sampled in 2001), the whale diet appears to be dominated by sand eels and mackerel. The annual changes in prey abundance and whale body condition, measured as girth and blubber index, were weakly correlated. Apparently, however, immature animals and adult females seemed to be in better condition in years with good abundance of immature herring in the southern Barents Sea. (IMR)

The scientific whaling under special permit and subsequent establishment of a routine sampling scheme during commercial whaling operations have yielded a time series

(1992-2003) which permits assessment of spatial, seasonal and year-to-year variations in diets, of foraging behaviour, of prey selectivity, and of the total annual consumption by the minke whales. The collected data have also permitted multi-species modelling exercises with minke whales involved. The dietary composition of the northeast Atlantic minke whales varies considerably both in space and time, presumably due to geographic differences in the distribution and abundance of potential prey. The whales exploit a multiplicity of species, and sizes, of fish and crustaceans. In general, they find capelin, herring and, occasionally, krill more preferable than other prey, which may have several contributory explanations such as mobility, schooling behaviour, prey refuge use and other anti-predator responses. Apparently, minke whales switched to other prey in years of low densities of herring and capelin, thereby reducing the mortality of these two fish species. Although results from the multi-species modelling exercises should be taken as tentative, they all point in the same direction, i.e., that minke whale abundance may affect important fisheries. They suggest that, for the Barents Sea, it is possible to make predictions regarding ecosystem changes, following a specific management manipulation or change in the ecosystem, that are accurate within an order of the actual response. Recent attempts to include minke whale consumption of herring in the model used to assess Norwegian spring spawning herring have shown marked reduction in perceived herring stock size compared with standard “non whale” assessment.

The results given demonstrate the usefulness of performing ecological investigations over a range of scales. The minimum requirement of data for both the small, medium and large-scale investigations is information on the relative diet composition of the predators. To put the large-scale results in an ecological perspective, one needs information about population size and structure, and large-scale information about the resource base. More detailed small-scale studies of prey selection must, however, be supported with resource mapping studies which occur concurrently and synoptically with the sampling of whale diet data. (IMR)

Based on tissues collected for scientific purposes during Norwegian and Greenland whaling operations in 1998, questions concerning minke whale stock identity were addressed in a joint Greenland-Norwegian programme. The methods applied included analyses of DNA, organochlorines, heavy metals, stable isotopes and fatty acid signatures. The results, which are now being published, indicate some sub-structuring of minke whales within the entire study area, e.g., with animals from the North Sea possibly being different from animals taken elsewhere in the northeast Atlantic. (IMR)

3. ONGOING (CURRENT) RESEARCH

The whale survey programme continues in 2004 the North Sea area has been covered. Instrumentation of minke whales with VHF radio tags to study diving behaviour will be conducted in the Lofoten area in cooperation with FFI. The experiments will include exposure to low frequency sonars to see possible effects on minke whale diving behaviour. Collection of whale observations during the Barents Sea ecosystem surveys will continue. (IMR)

Anatomical and physiological studies of hooded seals from the Greenland Sea stock were conducted in connection with a research cruise with FF "Jan Mayen" in the Greenland Sea between 21 March and 7 April, 2004. Fifteen adult female and 6 new-born hooded seals were killed and used on board for various scientific purposes: Physiological studies of the tolerance to hypoxia of central nervous tissue from this deep-diving species were conducted using 9 of these animals. The studies were conducted in collaboration between Drs. A.S. Blix and L.P. Folkow of Department of Arctic Biology (AAB), University of Tromsø (UiT) and Dr. J.M. Ramirez of Department of Organismal Biology and Anatomy, University of Chicago. We found that the central nervous system of diving mammals (which are regularly exposed to hypoxic conditions in connection with long-duration diving) displays a higher tolerance to hypoxia than does corresponding nervous tissue from non-diving mammals. We are currently conducting follow-up studies in order to elucidate the cellular mechanisms underlying this comparative difference in neuronal hypoxia sensitivity. Experiments were conducted using an in vitro set-up in which electrophysiological activity was recorded in thin slices of cerebral cortex or medulla from these animals.

Gut contents were collected from four of the adult females, for microbiological studies of naturally occurring antibiotica resistency in the gut microflora of arctic seals (in collaboration with the Institute of Pharmacy (IP), University of Tromsø). Analyses continued in laboratories at AAB and IP. Results are not yet available.

The heads of four animals (all pups) were fixed in formalin for later detailed studies of the anatomy and histology of the pinniped pineal gland, in collaboration with Dr. Morten Møller of the University of Copenhagen (UoC).

Samples of various tissues were collected from all the harvested animals, for studies of the prevalence of *Brucella pinnipediae* and *anti-Brucella* antibodies, in collaboration with Section of Arctic Veterinary Medicine, Norwegian School of Veterinary Sciences.

Yet another 9 weanling hooded seals were live-captured and brought to the Department of Arctic Biology (AAB), for later use in various physiological studies of these seals (UiT-AAB).

4. CATCH DATA

Sealing

Three Norwegian vessels participated in the commercial harp and hooded seal catches in the West Ice (the Greenland Sea), whereas one vessel participated in the harp seal hunt in the East Ice (the southeastern Barents Sea) in 2003. All quotas were permitted taken as weaned pups subject to prescribed conversion factors between pups and 1+ animals. Table IV.I shows the Norwegian catches of harp and hooded seals in 2003. These catches represent only fractions of the quotas: In the West Ice only 15% of the harp seal quota and 34% of the hooded seal quota were taken. In the East Ice the total result based on both Russian and Norwegian catches was 36% of the quota recommended by the Joint Norwegian-Russian Fisheries Commission.

Table IV.1. Norwegian catches of harp and hooded seals in 2003. 1+ means one year old or older seals.

Catching area:	*The West Ice*			*The East Ice*		
Species	Pups	1+	Total	Pups	1+	Total
Harp seals	161	2,116	2,277	2,343	2,955	5,298
Hooded seals	5,206	89	5,295			

Whaling

After a temporary suspension, the traditional small type Norwegian minke whaling was again permitted in 1993 and quotas were implemented based on the Revised Management Procedure (RMP) developed by the International Whaling Commission's (IWC) Scientific Committee. 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 (coded ES), (2) the eastern Norwegian Sea and the central and Northeastern Barents Sea (EB), (3) the Lofoten area (EC), (4) the North Sea (EN) and (5) the western Norwegian Sea-Jan Mayen area (CM). Table IV.2 shows the number of minke whales taken by area in the 2003 season. During the annual IWC/SC meeting in 2003 a revision to this Small Area division was made which will take effect for catch reporting from 2004 onwards. The new revision separates the earlier EB area into one Barents Sea component (EB) and one Norwegian Sea (EW) component, the latter will now also include the earlier EC area. The North Sea northern boundary is moved southwards to 62ºN.

Table IV.2. Quotas and catches of minke whales in 2003 by management area as defined in RMP.

2003	*Management area*					
Small-type whaling	EB	EN	ES	EC	CM	Total
Catch	329	131	150	16	21	**647**
Quota	330	179	150	15	37	711

5. BY-CATCH DATA

Introduction

The Directorate of Fisheries operates a set of observers on board commercial fishing vessels. In 2004 these observers were instructed to also report by-catches of marine mammals. A computer programme for recording and reporting fishing effort, target species catches and by-catches of fish was modified to incorporate species of marine mammals. An evaluation of the effectiveness of this system is scheduled by the end of 2004. This evaluation includes a consideration of required observer coverage for marine mammal by-catch monitoring.

In 2004 IMR has made contracts with a limited number of coastal gillnetters to obtain detailed records of their fishing effort, target species catches, and by-catches of marine mammals. The effectiveness of this procedure is also scheduled for evaluation by the end of 2004, and before any decision is made on continuing this effort

6. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

Sealing

Advice on the management of harp and hooded seals is based on deliberations in the ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP). At its most recent meeting in the fall of 2003, WGHARP assessed West and East Ice harp seals and West Ice hooded seals. The management agencies requested advice on "sustainable" yields for these stocks. "Sustainable catch" as used in these yield estimates for seals means the catch that is risk neutral with regard to maintaining the population at its current size within the next 10 years. Population assessments were based on a new population model that estimates the current total population size using the historical catch data and estimates of pup production. These estimates are then projected into the future to provide a future population size for which statistical uncertainty is provided for each set of catch options. There are several significant differences between the current model and the one used for the previous assessment (in 2000). The previous model used only two age classes (pups and 1+ animals), while the new model included 20 age classes. Information about age composition in catches is available from age estimations from annual rings in canine teeth. Work carried out following the previous assessment, including discussions on and recommendations from the Workshop to Develop Improved Methods for Providing Harp and Hooded Seal Harvest Advice, indicated that the earlier model was less appropriate than a model with a full age structure. The same population dynamic model was used for all three of the northeast Atlantic populations, but with stock specific values of biological parameters. The inclusion of a full age structure into the model was an improvement from previously used estimation programmes. In general the new model gives lower catch options than previous models. This is due to uncertainty in, in some cases also complete lack of, updated relevant data for the assessed stocks.

Based on the assessments performed by WGHARP, the ICES Advisory Committee on Fishery Management (ACFM) provided advice on quotas for the 2004 season. The recommended sustainable TACs were set as follows: Harp seals in the East Ice 45,100 1+ equivalents, harp seals in the West Ice 8,200 1+ equivalents. If pups are to be taken, 2.5 and 2 are equivalent to 1 one year old or older seal for the two stocks respectively. Hooded seals were regarded more data-poor (no abundance estimates after 1997) than the two harp seal populations and required a more risk adverse management approach. Using the Potential Biological Removal approach for this purpose, a catch level of 5,600 hooded seals (of all ages) was recommended. Traditionally, both Russia and Norway have participated in the sealing operations in the West Ice and the East Ice and have, therefore, allocated quotas on a bilateral basis in negotiations in the Joint Norwegian-Russian Fisheries Commission. However, the

Russians cancelled their sealing operations in the West Ice in 2001. The Norwegian shares of the 2004 quotas will be 8,200 harp seals (1+) and 5,300 hooded seals (all ages) in the West Ice (the total quotas in this area) and 10,000 harp seals (1+) 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 from the 1996 season onwards, and weaned pups can now be taken.

In 1996 new regulations for the "sustainable" hunt of coastal seals as well as compulsory catch reports were introduced. Quotas have been set based on the available information on abundance and allocated along the coast according to abundance within counties (common seals) or regions (grey seals). The total 2003 quotas (increased substantially by the Norwegian Ministry of Fisheries in comparison with previous years when set quotas generally followed recommendations based on scientific advice) were 1,186 grey seals (25% of current abundance estimate) and 949 harbour seals (13% of current abundance estimate). Of this, 383 grey seals (32% of the quota) and 582 harbour seals (61% of the quota) were taken. The 2004 quotas are kept at exactly the same levels as in 2003.

Whaling

At the IWC Annual Meeting in 1992, Norway stated that it intended to reopen the traditional minke whaling in 1993. So far, IWC has accepted the RMP developed by its Scientific Committee as a basis for future management decisions but has not implemented the procedure. The Norwegian Government therefore decided to set quotas for the 1993 and following seasons based on 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 for the northeast Atlantic and the Jan Mayen area in 2003 was set to 711 minke whales (Table IV.2). This number also included quotas not taken earlier in the quota period, which started in 2001. The catch quotas are set for each of five management areas, and allocated on a per vessel basis with some over-regulation, which means that there is also some competition between vessels for the total quota. The basic catching season was from 12 May to 31 August. All the participating vessels had inspectors on board to survey the whaling operation.

RMP essentially sets a 5-year block quota where animals not taken a particular year may be transferred to later years within the block. At the annual meeting of the IWC/SC in 2003 a new abundance estimate (80,500 minke whales for the Northeastern stock area and 26,700 minkes for the Jan Mayen block) based on the data collected in the period 1996-2001 was approved. These estimates were used in new RMP calculations which resulted in a total quota of 670 minke whales for 2004 and each of the following four years. The Small Area allocation of this total quota is: EB 170, EW 153, ES 113, EN 89 and CM 145.

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SECTION 5 – ADDRESSES

5.1 DELEGATES AND OBSERVERS TO THE FOURTEENTH MEETING OF THE COUNCIL

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To October 2004
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In the interim period (October - March) Ms Charlotte Winsnes held the position of Acting General Secretary

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