

NAMMCO/4/4

NAMMCO/SC2/Report

North Atlantic Marine Mammal Commission

Report of the Second Meeting of the Scientific Committee¹

Reykjavik, 23-26 November 1993

¹ The report of the NAMMCO Scientific Committee should not be quoted without prior consultation with the Secretary of NAMMCO.

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Report of the Second Meeting of the NAMMCO Scientific Committee

Reykjavik, 23-26 November 1993

The Scientific Committee met at the offices of the Fisheries Association of Iceland in Reykjavik on 23 November and reconvened on Friday 26 November. The meeting was attended by members of the Scientific Committee, invited experts and the staff of the Secretariat. The list of participants is contained in Appendix 1.

1. Chairman's welcome and opening remarks

The Chairman, Jóhann Sigurjónsson, welcomed members and invited participants to the meeting, in particular the two new members Aqqalu Rosing-Asvid and Jógvan Martin Grástein. On behalf of the Committee he thanked the two outgoing members, Finn O. Kapel and Bogi Hansen. He noted the advantage of maintaining a relaxed and open atmosphere in the Committee, but underlined the importance of applying self-criticism in the work ahead. He also noted the importance of having the staff of the Secretariat present as *ex-officio* non-voting members.

2. Adoption of Agenda

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

3. Arrangements for meeting

Kate Sanderson was appointed as rapporteur.

The Committee decided on the order in which agenda items would be dealt with and the time schedule for the meeting. The Secretary explained the practical arrangements for the meeting, which included an invitation to participants from the Ministry of Fisheries of Iceland to an informal dinner on the evening of 23 November.

4. Presentations of invited participants

Randall R. Reeves, Hudson, Quebec, presented a paper to a joint session of the Scientific Committee and the Working Group on Management Procedures. The paper, entitled "National, Bilateral and Multilateral Approaches to Managing the Exploitation of Small Cetaceans" (SC-WG/MP1/1), was especially prepared by R. Reeves for the Scientific Committee, together with one of its members, Mads P. Heide-Jørgensen. The paper presented a review of national, bilateral and multilateral regimes for the management of small cetaceans, with particular reference to the North Atlantic. Three main categories of small cetacean takes were defined - directed killing, by-catch and live capture, all of which, according to the authors, should be taken into account throughout the stock's range in management for effective conservation. The paper concluded that no single management regime will be appropriate for all management contexts and outlined a number of elements which were considered crucial to an acceptable management regime. An abstract of the paper is contained in Appendix 4.

Dan Goodman, senior policy adviser in the Department of Fisheries and Oceans, Canada, also presented a paper to the joint session of the Scientific Committee and the Working Group on Management Procedures. The paper, entitled "The Role of Science in the Management of Seals" (SC-WG/MP1/4), described the role of science in the management of hunts of harp and hooded seals in Canada. It was noted that the reasons for management have changed from conservation for direct

commercial harvest to consideration of controlling populations because of their impacts. At the same time, however, the role of science has become less clear, management objectives for controlling populations have not been properly formulated, and public policy issues related to these new approaches to marine mammal management have not been resolved. An abstract of the paper is contained in Appendix 5.

These presentations are also referred to under section 9.1 of this report (see also the Report of the Working Group on Management Procedures - Appendix 7).

5. Cooperation with other organisations

5.1 ICES

The Chairman reported that no formal agreement had yet been made with ICES, but that NAMMCO had forwarded several requests for advice to ICES, which concerned long-finned pilot whales, harp and hooded seals, marine mammal interaction with fish and shrimp, contaminant burdens in marine mammals, the development of multi-species approaches to management, and the pathways of radioactive material from northern Scotland in the marine environment and marine mammals.

ICES was dealing with these matters in its various study and working groups, which included the Study Group on Long-Finned Pilot Whales, the Study Group on Seals and Small Cetaceans in European seas, the Joint ICES/NAFO Working Group on Harp and Hooded Seals and the Multi-Species Working Group.

It was noted that in receiving and incorporating NAMMCO requests into its work, ICES had shown its recognition of and willingness to cooperate with NAMMCO.

The Chairman reported that ICES was examining how it would deal with marine mammals in the future, and it was agreed that continued cooperation with ICES was important.

5.2 IWC

The Committee noted that a reciprocal observer relationship had been established between the IWC and NAMMCO. It was also noted that the IWC Scientific Committee had made specific mention of cooperation with NAMMCO at its last meeting in Kyoto. The Committee agreed to seek an exchange of information with the IWC Scientific Committee.

5.3 NAFO

There were no reports on specific relations between NAFO and the Scientific Committee, other than the matter of NAMMCO's request for advice on harp and hooded seals which had been passed on to both the NAFO and ICES Secretariats for consideration in the ICES/NAFO Joint Working Group on harp and hooded seals.

6. Review of available documents and reports

6.1 Documents submitted

Documents and reports available for the meeting were reviewed. These are listed in Appendix 3.

The report reviewed under Agenda item 6.3 is treated under point 9 of this report, and reports under 6.4, 6.5 and 6.7 are treated in this report under point 10.

6.2 National progress reports

National progress reports submitted to the meeting by the Faroe Islands, Greenland, Iceland and Norway are listed in Appendix 3.

6.3 Report of the ICES Study Group on Seals and Small Cetaceans in European Seas, Cambridge, March 1993

The Report of the ICES Study Group on seals and small cetaceans in European Seas (ICES: C.M. 1993/N:3) was summarised by Nils Øien.

The Study Group had reviewed current knowledge of the status of harbour, ringed and grey seals, as well as several small cetaceans species, namely harbour porpoise, bottlenose dolphin, common dolphin and *Lagenorhynchus spp.* The grey seal population at Orkney, Hebrides and the Scottish mainland is estimated to be 78,700 and has increased nearly 10% since 1990. Several of the harbour seal populations suffered heavy mortalities, up to 60%, during the 1988 epidemic caused by the phocine distemper virus, but seem to be stable or recovering. The ringed seal population in the Baltic seems at present to be stable at c. 5,000 individuals, but this is only a small fraction of the estimated 300,000 thought to have been there around 1900. The decline was attributed originally to over-hunting, but more recently to female sterility due to the effects of high contaminant levels.

Today, few estimates of abundance for small cetaceans within the Study Group area are available, but for the North Sea area an international survey (SCANS) is planned for 1994. For harbour porpoises in the North Sea, concern has been expressed about the effect of high contaminant levels, disturbance, changes in food availability, and by-catches, but at present the Study Group found it difficult to assess their health status. Much time was devoted to the by-catch problem associated with many fisheries, and how to document these. Several case-specific examples indicated that it is possible to obtain detailed and reliable information on by-catches using an observer scheme and directed surveys. Approaches to reduce incidental takes of marine mammals include modification of fishing gear so it is more easily detected, time/area restrictions and area closures.

7. Update of "List of Priority Species"

The Scientific Committee began its work in 1992 with the preparation of a Preliminary List of Priority Species of relevance for NAMMCO. This was presented to the Council in Tromsø in January 1993 in the preliminary report of the Scientific Committee.

At the first meeting of the Committee in January 1993 it was agreed that an additional section on the bottlenose dolphin (*Tursiops truncatus*) should be included, to be drafted by Dorete Bloch. The draft addition on *Tursiops truncatus* is included as Appendix 6, together with corrected versions of Tables 4 & 5 of the List of Priority Species. It was agreed that Committee members would review these additions by correspondence before their final inclusion in the List.

The List had originally been designed for general reference and as a tool for the Council. At the January meeting it had also been agreed that the List of Priority Species should be updated at regular intervals. The Committee discussed the intended function of the List and the frequency with which it should be updated.

The Committee reconfirmed the need to update the List as new data becomes available. Two year intervals were suggested, and it was also suggested that the forum of Scientific Committee meetings could be used simultaneously to review the List and incorporate whatever new data might be available.

The format of the List was discussed, and it was suggested that the Council may wish to have it produced in the format of a reference handbook for general use, available in all relevant languages, and including a multi-lingual name list of all species covered.

8. Impacts of marine mammals on the marine ecosystem

This item was also dealt with at the first Scientific Committee meeting in Tromsø in January, when it was noted that NAMMCO's request for advice on the ecological role of marine mammals had been forwarded to ICES, where it was being dealt with in the ICES Multi-Species Working Group. In its last report to the Council, the Committee had stated that it was not possible to provide substantial answers to these questions in the near future, but that the Scientific Committee would be following research and developments in multi-species approaches closely.

Since January, the report of the ICES/NAFO Joint Working Group on Harp and Hooded Seals has become available, and the Committee noted that these questions were also being addressed with reference to these two seal species. The Chairman informed the meeting of a forthcoming joint ICES/NAFO Symposium in 1995 on the role of marine mammals in the marine ecosystem.

It was agreed that there was a need for observations of food and feeding habits of all marine mammals, which should be kept in mind by scientists in all NAMMCO countries. It was noted that studies of the ecological role of marine mammals were indeed conducted in all NAMMCO countries and specific reference was made to the Norwegian Marine Mammal Research Programme, which has this as one of its main objectives. It was agreed that these issues should be kept on the agenda at future meetings.

9. Development of management procedures

Upon request from the Council, the Scientific Committee established a Working Group on Management Procedures with the following terms of reference:

"to review management procedures in general, including to review the main systems that are developed in various fora and provide an assessment of their parameters on the basis of how they would be applied in individual cases."

The Working Group on Management Procedures met on 24 November and its Chairman, Nils Øien, presented the findings of the Working Group to the Committee. The full report of the Working Group on Management Procedures is contained in Appendix 7.

9.1 Status of development

The Scientific Committee reviewed the report of the Working Group regarding the procedures and objectives currently applied for management of marine mammals in the North Atlantic and elsewhere. This included discussion of the papers presented under Agenda item 4 at the Scientific Committee meeting by the invited speakers, Randall R. Reeves and Dan Goodman (see point 4 above), as well as discussion on the development of the Revised Management Procedure (RMP) by the IWC Scientific Committee. An outline of these discussions is contained in points 5.1 - 5.2 in the Working Group report (Appendix 7).

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.

Regardless of this, it was noted that the RMP could be an appropriate starting point in some management cases. A paper by Butterworth (SC-WG/MP1/3) considered by the Working Group contained suggestions in relation to this for different management situations. The question was raised as to whether the RMP or a similar procedure would be desirable in every case relevant to NAMMCO.

9.2 *Future work*

The Scientific Committee then discussed the possible future tasks of the Working Group, based on the conclusions of the report presented.

The question was raised as to whether NAMMCO could assume a more active role in the development of management procedures. In the light of this, and of the behaviour of the RMP, further development of an RMP-like procedure was considered a possibility for future work.

It was further noted that the Working Group on Northern Bottlenose and Killer Whales had suggested modelling of northern bottlenose whale population development and that this could potentially be a task for the Working Group on Management Procedures to carry out. However, this would also require a refinement of the terms of reference for the Working Group (see also under point 10.2.2).

The Committee agreed that these matters would be considered by its Chairman in consultation with the members of the Committee in the light of whatever further decisions may be made by the Council.

10. **Marine mammal stocks, status and advice to the Council**

10.1 *Long-finned pilot whales*

10.1.1 Review of status

The Scientific Committee decided at its first meeting in January 1993 to base its advice on North Atlantic long-finned pilot whales (*Globicephala melas*) on the report from the ICES Study Group on Long-Finned Pilot Whale. The report of the study Group, which met from 30 August - 3 September 1993, was presented to the Committee by Geneviève Desportes.

The terms of reference of the ICES Study Group on Long-Finned Pilot whales are to:

- "a) conduct an evaluation of the status of long-finned pilot whales in the North Atlantic (i.e. population size and trends, population dynamics parameters), including the importance of behavioural factors and accounting for multispecies interactions;
- b) identify key information gaps and critical long-term information work."

Population identity and seasonal movements were analysed with reference to available data based on distributional, genetic, morphological and other evidence. Based on distributional evidence, it was not possible to confirm a distinction between populations in the North Atlantic due to the gap in survey coverage south of Greenland.

Analysis of morphological differences between the Faroe Islands and Newfoundland pointed to two separate populations, although further analysis of the data was required. Genetic evidence, on the other hand, was not inconsistent with the hypothesis of a single North Atlantic stock, but more data was required before this could be substantiated.

Studies of pollutant loads and parasites in pilot whales from the Faroes indicated that the schools studied could be classed into three different groups. This pointed to feeding differences and therefore varying distribution ranges for different schools, thus indicating that there is no resident Faroese population.

Comparisons of isotopes between eastern and western populations suggested a difference in long-term diet of the schools sampled. Differences were also noted between the Faroes and Iceland based on an examination of patterns of dentine and cement deposition and mineralization in teeth.

It could be concluded that there was no resident stock around the Faroes, and there was no evidence to indicate any genetic isolation. If the morphological evidence is accepted, there could be more than one stock in the North Atlantic. This would, however, still leave the question of boundary identification unresolved.

Analyses of social structure and behavioural patterns were discussed in relation to the differences in mean pod size between schools observed in sighting surveys and those from the Faroese coastal catch. This raised questions as to the biological significance of such differences. The need to determine what constitutes a pod, given the differences recorded between the largely offshore sightings survey data and the coastal Faroese catch data, was considered important, in particular in terms of estimating population.

An abundance estimate was available for the eastern Atlantic based on the NASS 1987 and 1989 surveys. However, estimates from the western side of the Atlantic based only on sightings along the coasts of Newfoundland and Labrador, and a complete survey west of 42°W was recommended. Problems were associated with estimated trends in abundance, both in the eastern and western North Atlantic.

A great deal more data were available on population dynamics parameters but more work still needs to be done on reproductive rates before this can be used in terms of population modelling.

There was not a lot of information available on multi-species interaction and further study is required.

10.1.2 Advice on the effects of the Faroese drive hunt on the stock

The Committee concluded, based on the findings of the ICES Study Group on Long-Finned Pilot Whales, that an evaluation of the status of long-finned pilot whales in the North Atlantic could not as yet be provided. Further refinement of some of the available data was required, in particular the items outlined in 10.1.3. below.

10.1.3. Future work

Based on the report of the ICES Study Group, the Scientific Committee identified the need for further work in the following areas:

Population dynamics parameters:

- reanalysis of data and methods for estimating calving intervals and survival rates.

Population size:

- reanalysis of sightings data to evaluate the proximity of other schools to primary sighting and analysis of average sighted group size at varying distances from coastlines;

Population identity:

- review of the potential value of different methods for detecting genetic variability;
- comparison of morphometric data from mass strandings on Cape cod and data from the locations to detect population differences;
- development of satellite tagging methodology;
- design of an appropriate study to detect ranges of movement of individual groups of whales;
- comparison of the carbon and nitrogen isotope ratios between the three groups of schools which are distinguished on the basis of pollutants and parasites.

Multispecies interaction:

- review of information on the status of stocks of prey species.

Modelling:

- estimation of potential rates of population increase and evaluation of the impact of uncertainty in these parameters on this estimation.
- development of population models to evaluate historic population trajectories.

Other long-term work was also identified, including the coordination of methodologies and coverage of future sightings surveys throughout the range of the species.

It was noted that the ICES Council had decided that the Study Group was to continue its work in 1994 by correspondence with the aim of holding a meeting in 1995. Concerns were raised about possible delays this may cause in addressing the requests forwarded by the Council. While the Scientific Committee recognizes the substantial progress made by the ICES Study Group, the Committee urges the Council to help ensure that the necessary preparations will be carried out so that work in the Study Group may be expedited as soon as possible.

10.2 *Northern bottlenose whale*

10.2.1. Review and advice on status

The Chairman of the Working Group on Northern Bottlenose and Killer Whales, Tore Haug, presented the findings of the Working Group to the Scientific Committee with regard to northern bottlenose whales (*Hyperoodon ampullatus*). The Report of the Working Group, which met 25 November, is contained in Appendix 8. With regard to northern bottlenose whales, the Working Group had as its terms of reference to:

"undertake an assessment of the status of the northern bottlenose whale (*Hyperoodon ampullatus*) stock in the North Atlantic."

Available information on the catch history in the North Atlantic was reviewed. It was noted that there has been no local hunting of bottlenose whales in either Greenland or Iceland. The Faroes had conducted a limited-scale coastal drive fishery of the bottlenose whale, as well as a limited-scale offshore catch. Records dating from at least as early as the seventeenth century indicate a total of 738 bottlenose whales taken to date in the Faroes, either as directed catches or strandings.

The Norwegian catches of bottlenose whales, including catches in distant waters, were quite substantial in earlier years, and had been conducted during two main periods. The first was from 1882

to the 1920s, during which a total of c. 60,000 bottlenose whales were taken. In the second period, from the 1930s to 1973, a total of 5,800 bottlenose whales were taken.

That a decline in catches off the Faroes coincided with a decline in the Norwegian bottlenose fishery may point to a single stock in the eastern North Atlantic.

Biological parameters were also reviewed. There was some data from Norway and Labrador, no whaling having been conducted in the latter area when sampling began. Samples taken in Iceland for age at sexual maturity and pregnancy rates had been from a stock with a long history of exploitation. There was an indication of differences between samples, which might suggest a lack of exchange of animals between these areas.

The Scientific Committee concluded that it was unable at this stage to reach any firm conclusions on stock identity, ie the existence of one or several stocks of bottlenose whales in the North Atlantic.

Some modelling results of catch series were presented to the Scientific Committee and indicate that from an initial size of approximately 100,000 animals, a stock of approximately 60,000 animals remained in 1976. Due to time constraints, however, the Committee was unable to evaluate and discuss these results in depth.

An estimate of abundance of 5-6,000 animals was derived from analysis of Faroese and Icelandic data from the NASS 1987 survey. Given that this was a surface estimate with no corrections made for diving animals, the Scientific Committee agreed that a reasonable estimate of bottlenose whale abundance in the North Atlantic would be in the tens of thousands.

The Scientific Committee was not at this stage able to present results of an assessment, and no management advice could therefore be offered. It was noted in general, however, that this crude estimate of the population size implied that total removals from the stock over the past 15 years (approximately 1 whale per year) represented an exploitation rate of less than 0.1%.

10.2.2 Future work

The following were noted as priorities for future research on northern bottlenose whales:

- a) compilation of catch data, with a yearly breakdown by sex and areas, including Scottish material;
- b) examination of catch history including effort data in Norway, Faroes and Scotland;
- c) analysis of Norwegian morphometric data and collection of similar data for the Faroes (and other areas, if possible);
- d) collection of tissue samples for analysis of genetic material in relation to stock identity and for pollutant studies;
- e) collection and analysis of dive times and behaviour to be incorporated in sightings survey analysis; and
- f) stomach analysis should be conducted whenever possible.

The Scientific Committee noted the specific tasks outlined above for future research on the northern bottlenose whale, and discussed the Working Group's suggestion of exploring the possibilities of modelling population trajectories using catch series and abundance estimates. It was noted that modelling techniques had been greatly refined since the 1970s, when such modelling would not have been possible. Although it was acknowledged that there was not a great deal of data to include in a model, it was nevertheless considered a worthwhile exercise. The main preparatory work involved in undertaking such population modelling could be done through the Working Group on Management

Procedures prior to a subsequent meeting of the Working Group on Northern Bottlenose and Killer Whales. However, the Scientific Committee also noted that initiation of such a project would ultimately depend on whatever specific management objectives for the species were determined by the Council.

10.3 *Killer whales*

10.3.1 Review of status

The Chairman of the Working Group on Northern Bottlenose and Killer Whales, Tore Haug, presented the findings of the Working Group with regard to killer whales (*Orcinus orca*). The Committee based its deliberations on this species on the report of the Working Group which is contained in Appendix 8. The terms of reference of the Working Group were to:

- "- advise on stock identity for management purposes;
- assess abundance in each stock area;
- assess effects of recent environmental changes, changes in food supply and interactions with other marine living resources in each stock area."

10.3.2 Advice

The Scientific Committee could not report any conclusive findings on stock identity although local aggregations with long-term site fidelity may provide provisional management units.

In the light of this, there was no conclusive data on stock abundance, while the Committee was able to review available data on abundance in different areas. Sightings surveys off Norway in 1989 gave an abundance estimate of 7,000 (95% c.l. 3,400-14,400) in the northern North Sea and eastern Norwegian Sea towards Bear Island. Surveys conducted in 1987 by Icelandic and Faroese vessels (Icelandic/Faroese and adjacent waters) gave a combined estimate of 6,600 (CV=0.32) with a lower 95% bound of 3,900. Abundance in Norwegian coastal waters not otherwise covered by sightings surveys was estimated from questionnaires and provided an estimate of 1,500 killer whales. Few observations have been recorded from West Greenland, so no abundance estimate was available, despite considerable survey effort since 1984, which would suggest that the species is not abundant in this area.

The Committee reviewed ecosystems and habitat considerations with regard to killer whales. Data on feeding ecology was reviewed. In Norwegian coastal waters the main prey of the killer whale is herring, although other species such as squid, cod and some seabirds are also recorded. In the Faroes, while the main diet of the killer whale diet is fish (including mackerel, herring, and halibut), other marine mammals (seals and whales) as well as a variety of seabirds also form part of the diet. Off Iceland, herring and halibut seem to be the most important food items, although these observations are quite limited in time and space. In Greenland the diet of killer whales is dominated by marine mammals, in particular narwhals.

The only detected effect of environmental change on killer whale stocks is from Norwegian waters. The collapse of the herring stock at the end of the 1960s resulted in changes in the migration pattern of young and adolescent herring, which remained in the coastal waters and fjords rather than migrating into the Norwegian Sea as they had done previously. Coinciding with this there was an observed reduction of abundance of killer whales in the Norwegian Sea, but increased occurrence of the species in coastal and inshore waters of Norway since the early 1970s. Other than this, no environmental effects on the stock, such as the effects of pollution, has yet been documented.

It was noted that the Working Group had addressed the questions forwarded from the Council based on available data. Having identified the shortcomings in the available data, and the research priorities for future work, it was acknowledged that more comprehensive answers could be provided at a later stage.

10.3.3 Future work

The following were noted as priorities for future research on killer whales:

- a) the continuation and expansion of photo-identification studies;
- b) the continued documentation of vocal dialects;
- c) the comparison of Norwegian and Icelandic photo-ID databases;
- d) tissue sampling for genetic analysis with regard to stock identity;
- e) satellite tracking to detect the range of movement of individuals and groups of whales;
- f) the establishment of a central photo-ID catalogue;
- g) the full registration and reporting of Greenland catches and their comprehensive sampling;
- h) further studies of feeding ecology; and
- i) studies of pollutant effects on killer whale stocks.

The Scientific Committee noted that further work on killer whales in the Working Group on Northern Bottlenose and Killer Whales was not necessary until some or all of these priority research requirements had been met, which could then provide more thorough answers to the questions forwarded from the Council.

10.4 *Harp seals*

10.4.1 Review of status

After giving a review of the historical background for international cooperation on harp and hooded seal management, Finn Kapel presented the Report of the recent meeting of the Joint ICES/NAFO Working Group on Harp and Hooded Seals (ICES: C.M. 1994/Assess:5). Acting on a request from the Norwegian Government, the Working Group was only asked to make assessment for the Greenland Sea stocks, but did review information on other stocks as well.

10.4.2 Requests from the Council

The request for advice from the Council regarding harp (and hooded) seals was as follows:

- "- 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."

Concerning distribution, tagging and satellite telemetry studies indicate that there is a widespread migration of young harp seals across the North Atlantic, but no exchange of breeding animals between stocks has been demonstrated.

For the Greenland Sea stock of harp seals, pup production was estimated based both on visual and photographic surveys carried out in 1991 (55,300, 95% c.l. 44,500-68,500), and on updates of mark-recapture experiments (57,800, 95% c.l. 46,000-69,000). The results were discussed by the ICES/NAFO Working Group and the mark/recapture estimate was chosen as the best one for use in the following assessments. Using the same model as in previous meetings, stock and catch projections were carried out for three scenarios of catch composition, all of which were selected to stabilise the population at this present level (Table 3.2.1 in C.M. 1994/Assess:5).

ACFM, the Advisory Committee on Fisheries Management of ICES, dealt with the ICES/NAFO Working Group report at its meeting in early November and followed the recommendations of the Working Group, based on the chosen point estimate of pup production, in giving advice to the Norwegian Government on the Greenland Sea harvest. Regarding the catch options for the White Sea and the NAFO areas, the Scientific Committee did not at present have available material to advise on assessment.

Data on feeding were steadily being compiled for both the northwest and northeast Atlantic, but less so for the Greenland Sea. The ICES/NAFO Working Group pointed to the need for greater knowledge of the status of prey species. As well, the basis for multi-species interaction modelling was still far from satisfactory. The ICES/NAFO Working Group noted that two symposia related to these questions were planned for 1994 and 1995. These were a symposium on the biology of marine mammals in the Northeast Atlantic to be hosted by the Norwegian Marine Mammal Research Programme in Tromsø, November-December 1994, and a NAFO/ICES symposium on the role of marine mammals in the marine ecosystem scheduled for September 1995 in Dartmouth, Canada.

10.4.3 Future work

The ICES/NAFO Working Group identified a series of research items to be carried out by national laboratories.

In the Committee's discussion on the report of the ICES/NAFO Working Group, it was pointed out that it was not likely that there would be new data forthcoming to update the present assessment of the harp seal stock in the Greenland Sea.

For the White Sea stock, it was hoped it would be possible to reassess the Russian data, but these were not presently available in a sufficiently detailed form.

Assessment of the Northwest Atlantic harp seal stock was possible based on work carried out by scientists in Canada. The results could be evaluated by the ICES/NAFO Working Group upon request from Canada or another Party.

10.5 *Hooded seals*

10.5.1 Review of status - see under 10.4.1 above.

10.5.2 Requests from the Council

Concerning stock discreteness the situation for hooded seals is similar to that noted for harp seals (cf 10.4.2).

For the Greenland Sea stock of hooded seals, no estimate of present pup production or population size was available, and the ICES/NAFO Working Group concluded that it was unable to provide scientific advice on catch levels for 1994.

ACFM noted this conclusion, but stated that catches equal to the average catches since 1983 were not likely to cause a decrease in population size. The Scientific Committee shared this view.

Assessments were not carried out for the Northwest Atlantic stocks of hooded seals.

10.5.3 Future work

For the West Ice/Greenland Sea a survey of hooded seals is planned by Norway to take place in March/April, 1994, and an assessment would have to await the results of this survey.

For the Newfoundland stock of hooded seals the situation is similar as for harp seals (see 10.4.3).

There is no new information on the Davis Strait breeding patch and it is not likely that a new survey of the patch will be carried out in the near future.

10.6 *Atlantic walrus*

In order to address the request for advice received from the Council on the Atlantic walrus (*Odobenus rosmarus rosmarus*), the Scientific Committee had aimed to review the report from the Walrus International Technical and Scientific Committee (WITS). A final adopted report from the January 1993 meeting of WITS was however not yet available for review. Since no other relevant material on this species was available, the Scientific Committee agreed that it was not in a position to provide any advice at this stage.

The Committee decided to postpone further discussions on this species until it had some material in hand. However, it noted with some concern and drew the Council's attention to its dependence on sources that were not readily available when needed.

11. **Planning of the North Atlantic Sightings Survey**

The Council decided at its third meeting in July 1993 that a North Atlantic sightings survey be conducted in 1994 or 1995 under the auspices of the Scientific Committee. The Council requested the Scientific Committee to plan joint cetacean sighting surveys in the North Atlantic by coordinating national research programmes.

The Scientific Committee considered this to be a major and very significant task to carry out, and noted that Council members had committed themselves and their available resources to the project. It was further necessary to determine the specific timing of the survey, area coverage and species priorities.

11.1 *Timing*

The Scientific Committee discussed the question of whether the survey should be conducted in 1994 or 1995. Upon request the Chairman received information on the planned SCANS survey (Small Cetacean Abundance in the North Sea) from its project coordinator, Phillip S. Hammond. That survey will be carried out by several North Sea countries from 27 June to 26 July 1994. The Committee felt it would be desirable to conduct its survey in connection with the SCANS survey. However, this was considered difficult for some member countries, including Greenland where priority was being given

to beluga and narwhal research in 1994 and funds had already been allocated. It was also pointed out that Norway had already begun planning for a 1995 survey and it was considered necessary to have more planning time in order to ensure the most effective results.

The Committee therefore decided that the survey should be planned for 1995 to be conducted in the period between June and August so as to be compatible with earlier NASS surveys as well as next year's SCANS survey.

11.2 Coverage

It was agreed that the survey should cover the major areas of the North Atlantic, including the western side. It was noted that the participation of non-member North Atlantic countries such as the UK, France, Spain, USA and Canada was important for a comprehensive coverage.

Species coverage was also discussed, and the particular species of interest to each NAMMCO member country were outlined as follows:

Faroes -	pilot whales and bottlenose whales, bottlenose dolphins, white-beaked and Atlantic white-sided dolphins;
Greenland -	minke and fin whales;
Iceland -	minke, fin, and sei whales;
Norway -	minke whales

11.3 Future work

The Scientific Committee agreed to establish a Working Group to plan the sighting survey for the summer of 1995. Finn Larsen was elected as Chairman, and other members are Geneviève Desportes, Aqqalu Rosing-Asvid, Mads Peter Heide-Jørgensen, Þorvaldur Gunnlaugsson, Jóhann Sigurjónsson, and Nils Øien. It was agreed that additional Working Group members could be appointed at a later stage.

The terms of reference for the Working Group were agreed upon as follows:

- 1) to plan a large-scale cetacean sighting survey in the North Atlantic;
- 2) to identify priority species and define main areas to be covered;
- 3) to properly define the organisation and survey techniques necessary for the particular target species;
- 4) to make recommendations, where necessary, for the involvement of external expertise to ensure the best possible basis for an effective survey;
- 5) to suggest efforts to involve other North Atlantic states in the survey to ensure the best possible coverage of the North Atlantic.

The Committee also agreed to recommend to the Council that non-member North Atlantic countries be encouraged to participate in the survey in order to ensure the widest and best possible coverage.

The Scientific Committee agreed that the Working Group should aim to meet as soon as possible, preferably in conjunction with the Council meeting in Tromsø, February 1994, in order to draw up the major lines and begin involving the necessary outside expertise.

12. Work plan and working procedures 1993/1994

12.1. Scientific Committee

The Committee discussed the timing and frequency of future meetings. The Secretary indicated that now that the Commission was properly established, Council meetings would now be held on an annual basis. The next meeting of the Council was planned for late February, 1994. It was considered important that there be enough time between the Scientific Committee meeting and the Council meeting to enable Council members to acquaint themselves thoroughly with the findings of the Scientific Committee.

Late November was considered to be an appropriate time to hold meetings, both in advance of Council meetings when these are held in the spring, and after the field work of the summer and ICES meetings held in September/October.

The Committee also discussed the possibility of holding meetings by electronic media (e-mail). The Committee asked the Secretariat to investigate the possibilities of using such communication with members of the Scientific Committee, and of establishing a standard way of conducting business by such a network.

12.2 Working Groups

The Committee discussed whether it was preferable to hold Working Group meetings in conjunction with the Scientific Committee. It was nevertheless agreed that if this were to be the case, then Working Groups must be given sufficient time in which to finalise their reports for presentation to the Scientific Committee. This implied meetings of at least two days duration. The frequency of meetings of Working Groups would depend on the amount of work that needed to be done.

12.3 Scientific Committee budget

The Secretary reported that the annual NAMMCO budget for 1993 designated DKR 390,000 for use by the Scientific Committee (190,000 for invited experts and 200,000 for projects). It was further reported that c. 125,000 of this had been used so far in 1993, all of which has been used in connection with invited experts.

The Committee underlined the importance for the Scientific Committee of having its own budget within the overall NAMMCO budget.

12.4 Contract studies and invited participants

The Scientific Committee discussed the question of the funding of contract studies and invited participants. Two proposals for funding had been received from the Secretariat. These were briefly discussed, but the Committee agreed that it would not use its resources to fund unsolicited projects. Rather it would use its budget to support especially developed and requested projects and contract studies which were specifically aimed at or necessary to further the work of the Committee and its Working Groups.

12.5 Data requirements and establishment of Scientific Committee database

The Scientific Committee considered the report of the Working Group on Inspection and Observation, and noted the Working Group's questions concerning the minimum data which could be collected by inspectors and/or whalers. The Committee discussed this in some detail but was unable to draw up

any guidelines due to the fact that this can only be done on species and/or stock basis, where in addition one would need to know the management framework in each case and the actual procedure that one would aim at using for generating the management advice.

However, in the light of the fact that some catches may be taken before such aspects have been defined and decided upon, the Committee agreed that certain minimum data requirements could be identified that were likely to be of importance for any procedure to be applied. These include: position and date of catch and length and sex of animal. For the time being the Committee recommended that such information be included in the National Progress Reports submitted to the Scientific Committee.

The possibility of storing, computerizing and validating catch data in the Secretariat was discussed. The Committee requested the Secretariat to begin considering how to establish a database in the Secretariat with particular reference to those species of marine mammals that may need to be considered with respect to management advice in the near future.

12.6 Other items

While considering the effectiveness of the Committee's deliberations during meetings of short duration (e.g. during two-day meetings little time can be allocated for reading documents) the question of distribution of papers and documents in advance was discussed. No requirements on this are stipulated in the Scientific Committee Rules of Procedure. The Committee felt that if meetings are to be of short duration in the future, amendments of the Rules of Procedure in this regard should be considered. However, as pointed out by the Secretary, according to the Rules of Procedure the title of documents to be presented at Scientific Committee and Working Group meetings should be received by the Secretariat no fewer than 10 days prior to the meeting, and this practice should be adhered to as far as possible.

The format and content of National progress reports was briefly discussed. The Committee felt that reports presented at any given time should be more up-to-date than was the case this year (covering 1992 only). Also the view was expressed that the content of the reports should be more designed to meet the needs of the Committee. As indicated under item 12.5 above, the Committee agreed that relevant data on catch operations should be included in the National Progress Reports. It was agreed that further consultations on this should take place between the Secretariat and the Chairman before the next meeting.

13. Publications

Although time constraints did not allow detailed discussions on this item, the Chairman drew attention to the importance of openness in the work of the Committee as stipulated in its Rules of Procedure, where it is stated that the "Committee shall aim to have all key scientific papers relevant to its work published in a recognized international scientific journal." Several suggestions were made as to how to deal with this, such as publication of special issues, submission of selected papers to other journals such as the ICES Journal of Marine Science or a publication of a special NAMMCO journal of marine mammal science. Such matters would have important financial implications and would also to some degree be a prestige matter for the organisation, so it was not felt necessary to make any recommendations at this stage. It was agreed that the matter should be drawn to the attention of the Council and further considered by the Committee in the near future.

While the Committee stressed that its report should be made available to the outside world through the Secretariat, and the publication aspect of the report was thus in a way taken care of, it was agreed that due to the nature of the papers by the two invited participants at this meeting, and with their

approval, their papers (in a revised form if necessary) should be made available to the members of the Management Committee and the Council at its February meeting in Tromsø.

14. Any other business

On behalf of the Greenland Fisheries Research Institute, Copenhagen, Finn Larsen extended an invitation to host the next meeting of the Scientific Committee. The Committee expressed its appreciation for the invitation and referred it to the Chairman to decide upon in consultation with the Secretariat.

15. Adoption of report

It was agreed that the report of this meeting should be adopted by correspondence, although a draft of most of the substantive matters had been circulated by the end of the meeting. This procedure was completed on 22 December, 1993.

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Agenda

1. Chairman's welcome and opening remarks
2. Adoption of agenda
3. Arrangements for meeting
 - 3.1 Appointment of rapporteurs
 - 3.2 Meeting procedure and time schedule
 - 3.3 Meeting facilities
4. Presentations of invited participants
5. Cooperation with other organisations
 - 5.1 ICES
 - 5.2 IWC
 - 5.3 NAFO
6. Review of available documents and reports
 - 6.1 Documents submitted
 - 6.2 National progress reports
 - 6.3 Report of the Working Group on Management Procedures
 - 6.4 Report of the Working Group on Northern Bottlenose and Killer Whales
 - 6.5 Report of the ICES Study Group on Long-finned Pilot Whales, Copenhagen, September 1993
 - 6.6 Report of the ICES Study Group on Seals and Small Cetaceans in European Seas, Cambridge, March 1993
 - 6.7 Report of the Joint NAFO/ICES Working Group on Harp and Hooded Seals, Copenhagen, September 1993
 - 6.8 Report of the Walrus International Technical and Scientific Committee (WITS), Winnipeg, January 1993
7. Update of "List of Priority Species"
8. Impacts of marine mammals on the marine ecosystem
 - 8.1 Status of knowledge
 - 8.2 Advice to the Council
 - 8.3 Future work
9. Development of management procedures
 - 9.1 Status of development
 - 9.2 Future work
10. Marine mammal stocks, status and advice to the Council
 - 10.1 Long-finned pilot whales
 - 10.1.1 Review of status
 - 10.1.2 Advice on the effects of the Faroese drive hunt on the stock
 - 10.1.3 Future work
 - 10.2 Northern Bottlenose Whales
 - 10.2.1 Review and advice on status
 - 10.2.2 Future work
 - 10.3 Killer Whales
 - 10.3.1 Review of status
 - 10.3.2 Advice on: (i) stock identity; (ii) abundance by area; (iii) effects of environmental changes or changes in food abundance; (iv) ecological interactions
 - 10.3.3 Future work

- 10.4 Harp Seals
 - 10.4.1 Review of status
 - 10.4.2 Advice on: (i) stock sizes and distribution; (ii) pup production; (iii) sustainable yields under varying options of age composition in the catch; (iv) catch options in the White sea, Barents Sea, Greenland Sea, and NAFO areas; (v) effects of environmental changes or changes in food abundance; (vi) ecological interactions
 - 10.4.3 Future work
- 10.5 Hooded Seals
 - 10.5.1 Review of status
 - 10.5.2 Advice on: (i) stock sizes and distribution; (ii) pup production; (iii) sustainable yields under varying options of age composition in the catch; (iv) catch options in the greenland Sea and NAFO areas; (v) effects on environmental changes or changes in food abundance; (vi) ecological interactions
 - 10.5.3 Future work
- 10.6 Atlantic Walrus
 - 10.6.1 Review of status
 - 10.6.2 Advice on: (i) stock identity, (ii) abundance by area; (iii) long term effects of present levels of removals on stocks; (iv) effects of environmental changes (i.e. disturbance, pollution) and (v) of changes in food supply
 - 10.6.3 Future work
- 11. Planning of North Atlantic Sightings Survey
 - 11.1 Timing
 - 11.2 Area coverage
 - 11.3 Future work
- 12. Work plan and working procedures 1993/1994
 - 12.1 Scientific Committee
 - 12.2 Working Groups
 - 12.3 Scientific Committee budget
 - 12.4 Contract studies and invited participants
 - 12.5 Data requirements and the establishment of NAMMCO SC database
 - 12.6 Other items
- 13. Publications
- 14. Any other business
- 15. Adoption of report and closing of meeting

List of documents

National progress reports

NAMMCO-SC/2/ProgRep-Norway - Progress Report (1992) from Norway.

NAMMCO-SC/2/ProgRep-Iceland - Progress Report (1992) from Iceland.

NAMMCO-SC/2/ProgRep-Faroes - Progress Reports (1992 and 1993) from the Faroe Islands.

NAMMCO-SC/2/ProgRep-Greenland- Progress Report (1992) from Greenland.

Council documents

NAMMCO/WG-IO/Report 1993 - Report of the NAMMCO Working Group on Inspection and Observation, Copenhagen, 21-22 September 1993.

Background documents

Hammond, P. & Heimlich-Boran, S., Small cetacean abundance in the North Sea (SCANS), Sea Mammal Research Unit, Cambridge.

ICES: C.M. 1993/N:3 - Report of the Study Group on Seals and Small Cetaceans in European Seas, Cambridge, England, 31 March - 2 April 1993.

ICES: C.M. 1993/N:5 - Report of the Study Group on Long-Finned Pilot Whales, Copenhagen, 30 August - 3 September 1993.

ICES: C.M. 1994/Assess:5 - Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, Copenhagen, 15 - 21 September 1993.

National, Bilateral and Multilateral Approaches to Managing the
Exploitation of Small Cetaceans

Randall R. Reeves & Mads P. Heide-Jørgensen

ABSTRACT

Regimes for managing exploitation of small cetaceans were reviewed. Three levels of authority were considered: national, bilateral and multilateral (including both regional and international). The taking of small cetaceans falls into three main categories: directed killing, fishery by-catch and live-capture. For effective conservation of a given stock, it is necessary to manage all three types of taking (as well as human activities that degrade the animals' habitat) throughout the stock's range. Complexity derives from the fact that many stocks move across national boundaries or into international waters and are subjected to more than one category of taking.

Of the 14 states whose national programs have been examined here, less than half were found to have well defined, actively pursued management regimes. In most cases the regime consisted of a prohibition of deliberate taking, with special exemptions for aboriginal harvests and fishing by-catches, and some kind of permit system for live-capture and research takes. Five countries (Japan, Greenland, Faroe Islands, Canada and the United States) were found to have directed fisheries for small cetaceans. Only two examples of bilateral management were identified, and both involved shared stocks of monodontids hunted by Inuit. There were also few examples of multilateral management that went beyond agreement to share information and work towards vaguely defined conservation goals.

The difficulty of developing a scientifically sound, politically acceptable management regime is clear from this review. It is concluded that no single regime will be appropriate for all management contexts. The crucial elements of an acceptable regime are: (1) well defined and generally agreed management goals, (2) a credible scientific research and monitoring program, with direct links to management decision-making, (3) legitimacy (usually stemming from inclusive membership in decision-making bodies), (4) incorporation of a precautionary principle into the management process and (5) provision for flexibility and quick response to new knowledge and unanticipated developments in the status of stocks (e.g. massive die-offs).

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The Role of Science in the Management of Seals

Dan Goodman

Abstract

The paper gives a brief description of the role of science in the management of the hunt for harp and hooded seals in Canada. It is suggested that as the situation has changed from managing a harvest of seals for conservation and direct economic and social benefits, the role of science has become less clear. This is due to the fact that the objectives of managing populations of marine mammals because of their possible impacts on fisheries have yet to be clearly formulated, and because the acceptability of controlling populations of marine mammals is a public policy issue, not an issue of resource management based on science.

Scientists are consequently faced with new challenges in investigating marine mammal/fisheries interactions. Scientists must go beyond the task of providing the scientific basis for management alternatives, and work together with fisheries managers to develop a framework for managing seals within the theoretical constructs of multi-species management, optimum yield and political resolution of opposing objectives. The prominent role of public policy in these issues also presents science with the challenge of explaining its findings in a manner understandable to the public. In the broadest sense, science also includes the fields of economics and social science, fields in which further analyses of issues related to marine mammal interactions with fisheries are needed, and which should be considered by the fishery managers when examining alternative management goals and strategies.

Draft update of "List of Priority Species"

Bottlenose dolphin (*Tursiops truncatus*) and corrected versions of Tables 4 & 5.

10. Bottlenose dolphin (*Tursiops truncatus*)

General distribution

Global distribution in tropic to temperate waters. Not found in arctic waters. The observations made during the North Atlantic Sightings Surveys in the summers of 1987 and 1989 revealed distribution ranging northeast to northern Norway and far south and southwest of Iceland.

National interests

- *Jurisdictions (EEZs)*: Faroe Islands (F), Norway (N), (and UK, Ireland, Denmark).

- *Exploitation*: Exploited in the Faroe islands since the Norse settlement. The bottlenose dolphin is taken in single species schools or mixed with schools of pilot whales. Catch statistics are incomplete and sporadic until 1986, but indicate irregular yearly catches of 0-200 animals. The catch records are kept at the Faroese Museum of Natural History in Tórshavn.

Indirect catches in fishing gear are reported from the Mediterranean Sea and the western North Atlantic, but these are insufficiently documented.

- *Interactions*: The main prey of the bottlenose dolphin is gregarious squid and fish. This dolphin species is able to take fish caught on hooks and in nets and thus comes into direct conflict with both inshore and offshore fisheries.

Stock identity

Divided globally into two main forms, a coastal and an offshore form. Animals in the northeast Atlantic appear to be larger in size than their northwest Atlantic counterparts, but it is unknown how many geographic forms exist across the North Atlantic.

Stock size and status

Few population estimates have been made for the North Atlantic. The Icelandic/Faroese NASS-87 and NASS-89 surveys located 12 and 24 schools respectively, mainly in the southern part of the survey area, but analysis of the data is not yet complete. The Mediterranean population is estimated at less than 10,000 animals, and the size of the population along the northeast USA coast is estimated at 10,000 - 13,000 animals.

Management regimes

The bottlenose dolphin is listed in CITES Appendix II, and the North and Baltic Sea populations are listed in CMS Appendix II, but the NAMMCO agreement is the only existing one on research, management and conservation of this species in the area.

Research

The question of distinction between inshore and offshore populations in the northeast Atlantic needs careful examination. Analyses of data from the NASS surveys in 1987 and 1989 will add to the limited information available on stock abundance.

Table 9. Catches of bottlenose dolphins in the North Atlantic in the period 1970-1992.

Year	Faroe Islands	Italy/France/ Spain
1970		
1971		
1972		
1973		
1974		
1975		
1976		
1977		
1978		
1979		
1980		9
1981		17
1982		>10
1983		11
1984		
1985		1
1986		3
1987	1	
1988	11	6
1989		
1990		
1991	88	
1992		

Sources: Faroese whaling statistics at the Museum of Nat. Hist., Tórshavn and *Rep. int. Whal. Commn.*: National progress reports.

As amended

Table 4. Published data on direct (D) and indirect (I) catch of Atlantic white-sided dolphins and white-beaked dolphins (in parenthesis).

Year	D/I	Canada	Greenland	Iceland	Faroes	Norway
1972	D					
	I					
1973	D					
	I					
1974	D					
	I					
1975	D					
	I					
1976	D	(x)	1		44	
	I					
1977	D	(x)	34			
	I					
1978	D	(x)	1			
	I					
1979	D		8			
	I					
1980	D		11			
	I					
1981	D		5			
	I					
1982	D		1			
	I					
1983	D				10	
	I					
1984	D					
	I					
1985	D		(13)		32	
	I					
1986	D				185	
	I					
1987	D				76	
	I					
1988	D				603	
	I					
1989	D				6	
	I	1		(1)		
1990	D				55	
	I			(4)		
1991	D					
	I					
1992	D				44	
	I					

Sources: *Rep.int.Whal.Comm* : National Progress Reports; D. Bloch.

As amended

Table 5. Catches of killer whales by Norway, Greenland, Faroe Islands and Iceland during 1973-1988.

Year	Catches			
	Norway	Greenland	Faroe Isl.	Iceland/*
1973	1	0		
1974	6	2		
1975	2	1		
1976	0	0		3
1977	7	11		6
1978	64	0	31	8
1979	221	0		6
1980	52	2		5
1981	13	1		6
1982	protected	1		5
1983		0	11	3
1984		5		5
1985		0		0
1986		16	protected	0
1987				4
1988			1	

* Removals in connection with live-capture fisheries.

Table 9. Catches of bottlenose dolphins in the North Atlantic in the period 1970-1992.

Year	Faroe Islands	Italy/France/ Spain
1970		
1971		
1972		
1973		
1974		
1975		
1976		
1977		
1978		
1979		
1980		9
1981		17
1982		>10
1983		11
1984		
1985		1
1986		3
1987	1	
1988	11	6
1989		
1990		
1991	88	
1992		

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	I					
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	I					
1974	D					
	I					
1975	D					
	I					
1976	D	(x)	1		44	
	I					
1977	D	(x)	34			
	I					
1978	D	(x)	1			
	I					
1979	D		8			
	I					
1980	D		11			
	I					
1981	D		5			
	I					
1982	D		1			
	I					
1983	D				10	
	I					
1984	D					
	I					
1985	D		(13)		32	
	I					
1986	D				185	
	I					
1987	D				76	
	I					
1988	D				603	
	I					
1989	D				6	
	I	1		(1)		
1990	D				55	
	I			(4)		
1991	D					
	I					
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	I					

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1980	52	2		5
1981	13	1		6
1982	protected	1		5
1983		0	11	3
1984		5		5
1985		0		0
1986		16	protected	0
1987				4
1988			1	

* Removals in connection with live-capture fisheries.

North Atlantic Marine Mammal Commission

Report of the Scientific Committee Working Group on Management Procedures¹

Reykjavik, 24 November 1993

¹ This report of the NAMMCO Scientific Committee Working Group on Management Procedures should not be quoted without consultation with the Secretary.

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Report of the Scientific Committee Working Group on Management Procedures

Reykjavik, 24 November 1993

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1. Chairman's welcome and opening remarks

The Chairman, N. Øien, welcomed the participants (Appendix 1) and referred to the presentations and discussions the previous day in the Joint session of the Scientific Committee and the Working Group on Management Procedures on the management of seals and small cetaceans (SC-WG/MP1/1 and SC-WG/MP1/4).

2. Adoption of agenda

The Chairman mentioned the question of data requirements raised in the report from the NAMMCO Working Group on Inspection and Observation (SC/2/WP6). He suggested that an item 7 - "Data requirements" be included in the Agenda to cover this subject. The Agenda was adopted as amended in Appendix 2.

3. Appointment of rapporteur

M.P. Heide-Jørgensen was appointed rapporteur.

4. Review of available documents and reports

Four documents were submitted to the Working Group and these are listed in Appendix 3. The report from the NAMMCO Working Group on Inspection and Observation (SC/2/WP6) was also considered.

5. Procedures and objectives currently applied for management of marine mammals in the North Atlantic and elsewhere

5.1 *Pinnipeds*

5.1.1 North Atlantic

Goodman summarised Canadian management of harp and hooded seals and stated that during the period 1961-1982 with commercial seal harvesting there were clear management objectives related to conservation of the stocks and socio-economic benefits to sealers. The present situation is that the increasing harp seal and grey seal stocks interact with fisheries by consumption of fish. Grey seals are also vectors for the spread of sealworm (also known as codworm, *Pseudoterranova decipiens*). As we move from managing seals for direct benefit to managing seals because of possible impacts on fisheries, it is important to note that management objectives have not been articulated.

Kapel added that for the East Atlantic stocks of harp and hooded seals previously well defined management goals existed. One of the objectives was to maximize the output for the sealing industry. Nowadays, management objectives are not specified.

No active management of seal hunting is conducted in Greenland. Apart from local rules, the only restriction is that one is required to be a permanent resident in Greenland to be allowed to hunt seals.

Since the collapse of the seal skin markets in the 1970s and subsequent catch reductions, no well-defined management plan for harvesting of Icelandic seals exists. However, in Iceland there are some protected areas. A system for promoting sealing was introduced in 1982 for grey and harbour seals, but has only been in effect for grey seals since 1990. The system is financed by the fishing industry in order to keep seal stocks stable or to reduce the stocks. The main incentive for these actions is an alleged economic loss due to fish consumption by the seals and the problems caused by sealworm infestation. These concerns have also triggered a substantial amount of seal research, including regular censuses of grey and harbour seals and feeding studies.

In the North Atlantic there are obvious problems with sealworm infestations, but although grey seals are identified as the final main hosts for sealworm, no simple relationship has been demonstrated between the numbers of grey seals and the rates of infestation.

In Norway coastal seals (harbour seals and grey seals) are protected in southern Norway, whereas some hunting is allowed in northern Norway. Grey seals from the United Kingdom make feeding migrations to southern Norway. In northern Norway a grey seal population centered on the Kola Peninsula is shared with Russia.

The Faroe Islands host a small population of grey seals and hunting is permitted, but catches are very small.

5.1.2 Other areas

No complete survey of seal management outside the North Atlantic was available for the meeting but information from selected areas was briefly discussed.

Butterworth (SC-WG/MP1/3) offered some information on South African fur seals. If harvested on a large scale this population would be managed on a Replacement Yield basis.

In the Antarctic, the Convention for the Conservation of Antarctic Seals under the Antarctic Treaty explicitly recognizes that harvesting of seals should be regulated such that the levels of Optimum Sustainable Yield are not exceeded. The quotas are reviewed in the light of scientific assessments and the regulations include protection of species, closing of seasons, seal reserves and sealing methods. At present, however, no commercial harvesting of seals takes place in the Antarctic.

5.2 *Cetaceans*

5.2.1 North Atlantic

i) Small cetaceans

A review of management of small cetaceans was presented in SC-WG/MP1/1. In general, few countries have established well defined management goals. However, in most countries small cetaceans are protected from direct exploitation whereas bycatches seem to be a more widespread problem. Few North Atlantic countries have programs for small cetaceans with well defined management objectives.

Greenland has recently responded to a detected decline in abundance of belugas wintering off West Greenland. The new regulations restrict the size of vessels involved and the number caught per day. Although not clearly stated, these regulations aim at achieving sustainability of present catches. Well defined management goals may emerge as the process of regulating beluga hunting develops.

In Canada, Inuit have constitutionally protected rights related to hunting that include narwhals and belugas. Land-claim agreements establish co-management boards responsible for the development and implementation of management regimes for these species. The interaction between the Nunavut Wildlife Management Board and the Canada-Greenland Joint Commission on the Conservation and Management of Narwhals and Belugas is at present uncertain.

At present there is no organised fishery for small cetaceans in Iceland. As with other marine resources, Iceland has a management regime involving licensing, specific review of stocks and the ability to issue quotas and other regulatory measures that would apply to any directed fisheries for cetaceans.

The Faroe Islands regulate the hunting of pilot whales by restricting the areas where whales may be driven and by closing the drive fishery in specific areas when local needs for pilot whale meat are satisfied. No other specific management goals are defined.

Reeves & Heide-Jørgensen (SC-WG/MP1/1) conclude that the goals of small cetacean management need to be well defined. Management regimes should be supported by credible scientific monitoring programs, they should have legitimacy, and should include precautionary elements.

ii) Large cetaceans

Commercial harvesting

Schweder reviewed the development of the Revised Management Procedure (RMP) in the Scientific Committee of the International Whaling Commission (IWC).

The predecessor of the RMP was the New Management Procedure (NMP), which was first used in 1976. Under the NMP, individual whale stocks were classified as either Protected Stocks (PS), Sustained Management Stocks (SMS) or Initial Management Stocks (IMS). The catch limit was zero for Protected Stocks, 90% of MSY for Initial Management Stocks and was set according to a linear function for Sustained Management Stocks. Stocks were classified on an annual basis. The NMP proved to be difficult to use. The main problem was that procedures for estimating the key parameters (depletion level and MSY rates) were unspecified and the scientists had difficulty reaching agreement. The gap between no whaling (PS classification) and whaling (IMS classification), when measured using these estimated parameters, was narrow. Thus, disagreements within the IWC Scientific Committee about classification could not be avoided.

This difficulty of applying the NMP was part of the background for the moratorium on commercial whaling decided in 1982, and it provided an impetus for the decision to develop a Revised Management Procedure (RMP). The RMP was developed during the period 1987 to 1992. Five different teams of scientists worked independently to construct and develop a management procedure for baleen whales. The criteria for evaluating the alternative procedures, as established by the Commission, were: i) stability of catch limits, ii) low risk of depleting stocks below some chosen level, iii) high continuing yield from the stock.

The developers met twice a year. Intersessionally they improved and ran simulations to test their procedures. At the meetings simulation results and procedures were compared, and new simulation trials were designed. Since varying amounts of uncertainty surround the population dynamics and current status of all stocks of baleen whales which might be subject to commercial whaling, priority was given to the risk-related criterion and to the robustness of the procedure. Robustness was understood as the ability to prevent unintended depletion in a diversity of scenarios, with respect to the state of nature and to the quality of available methods for assessing it. The diversity of scenarios was supposed to span a range of plausible situations. This is an innovative approach to accounting for uncertainty in a management context, and may provide a precedent for future work with management procedures in NAMMCO and elsewhere.

Of the five procedures, the Bayesian procedure developed by Cooke was selected as the best by the IWC Scientific Committee, and it was adopted in principle by the IWC in 1991. This procedure consists of a simple model for the population dynamics of the stock, prior distribution for the key parameters, and a rather drastic method of downweighting the abundance data. The procedure requires data on historic catches as well as abundance data collected at 5-year intervals. The downweighting of incoming data is done by multiplying the coefficient of variation by four. This results in a procedure which, although robust, 'learns' slowly.

In addition to Cooke's catch limit algorithm the RMP includes methods aimed at addressing multi-stock situations. By subdividing the area into small areas and setting catch limits for each small area, the risk associated with uncertainty is reduced.

To provide resolution in comparing the five management procedures during simulation trials, three tuning levels were chosen. For a non-exploited stock with $MSY_{rate}=1\%$, the mean stock size (over the 100 replicates) after 100 years of management should be 60%, 66% and 72% of carrying capacity, respectively, for the three levels of tuning. At its 1991 meeting, IWC decided to use the 72% tuning level and a 54% internal protection level. Selection of the 72% tuning level is in contrast to the 66% level, which the Scientific Committee had in mind. This decision caused the procedure to result in substantially lower catch limits, with a marginal gain with respect to depletion.

In 1993 the Scientific Committee unanimously advised the Commission that development of the RMP was completed and that it could be implemented for North Atlantic and Southern Hemisphere minke whales. The Commission, however, did not accept this recommendation.

During the discussion following Schweder's summary, it was pointed out that the RMP is too conservative for highly productive stocks. For such stocks the long term equilibrium stock level will be much higher than the MSY level; some simulations suggest 93%, others suggest even higher levels. This must be regarded as under-utilization of a whale stock. Also, it was noted that relatively small improvements are gained from surveys, and that there are almost no possibilities for including other information.

While the tuning of the procedure could be changed, e.g. by modifying MSY rates, that would only marginally improve the 'learning' ability of the procedure. Specifically Magnusson mentioned that there was limited incentive to conduct high-quality sighting surveys. The RMP was developed with an emphasis on robustness and it must be concluded that when risk reduction is given priority, performance on the other criteria will necessarily be sacrificed, especially the size of continued yields.

SC-WG/MP1/2 presents a sample application of the RMP to compute hypothetical catch limits for minke whales in the North Atlantic Central Area. Catch cascading resulted in higher catch limits than the total of separate calculations of catch limits for each small area. Catch limits derived for the North

Atlantic Central Area using a 66% tuning level, with catch cascading, were similar to catches in the early 1980s. However, allocation of the hypothetical catch limits to the four 'small areas' was markedly different from the distribution of the historic catches.

Aboriginal harvesting

Management of aboriginal harvesting of baleen whales within the IWC is subject to a management procedure somewhat similar to the management procedure of 1976 (NMP). The main difference is that catches are permitted on stocks that are below 54% of carrying capacity but above a certain minimum level as long as the catches are set at levels which will allow the stock to move towards the MSY level. The objectives forming the basis for this procedure are: (i) to ensure that the risks of extinction to individual stocks are not seriously increased by subsistence whaling; (ii) to enable aboriginal people to harvest whales in perpetuity at levels appropriate to their cultural and nutritional requirements subject to the other objectives; (iii) to maintain the status of whale stocks at or above the level giving the highest net recruitment and to ensure that stocks below that level are moved towards it, so far as the environment permits.

In Canada there has been no recent aboriginal harvesting of baleen whales with the exception of one bowhead whale in 1991. However, Inuit land-claim agreements and the constitution provide the right to such harvests subject to conservation.

5.2.2 Other areas

Examples of management regimes for small cetaceans outside the North Atlantic were given in SC-WP/MP1/1. The foregoing discussion of the RMP and aboriginal harvesting also applies to areas outside the North Atlantic.

6. Future work in defining objectives and development of procedures for marine mammal stocks/species relevant to NAMMCO

The Working Group discussed the need for future work to define management objectives for North Atlantic marine mammals. Clear management objectives need to be expressed before management procedures can be developed. No single management procedure would cover the variety of management situations that involve North Atlantic marine mammals.

In relation to this point, several items were raised and discussed. Among these, it was suggested that NAMMCO may prefer to assume an advisory and evaluative role. In this case management for species and areas would be developed on a national basis following national initiatives. The function of NAMMCO's Scientific Committee would then be to critically examine whether the proposed management schemes are in accordance with sound scientific principles. In this context, the importance of coordinating attitudes and management schemes for shared stocks was mentioned.

The application of the RMP for some management situations was discussed, and SC-WG/MP1/3 was presented by Schweder in the absence of the author. SC-WG/MP1/3 recommends that the development method used for constructing the RMP and the conceptual framework of the procedure itself comprise an advantageous overall approach. The paper offers specific recommendations as to further developments, and it states that the catch limit algorithm of the Cooke procedure provides a good basis from which to start the development of any management procedure, particularly because of the fundamental simplicity of the algorithm.

The Working Group agreed that the RMP was appropriate as a starting point for some cases of management. The guidelines put forth in SC-WG/MP1/3 could be useful in the development of management procedures for some of the North Atlantic marine mammals. On the other hand it was mentioned that a different tuning of the RMP may be needed and that in some cases radical changes are necessary, for example to improve the procedure's ability to react to new data.

From the discussion it was evident that there are several cases where the RMP would not prove ideal, or be of little use at all. One example is the situation where proper management procedures are not needed because catches are insignificant compared to the stock size. Also the problem of reducing codworm infestations by reducing the grey seal stocks may require a management approach different from the RMP.

Because of the variety of problems involving North Atlantic marine mammals, it was emphasized throughout the discussions that case-specific situations, including guidance on management objectives, need to be presented before management procedures can be developed.

7. Data requirements

No exhaustive list of data requirements could be developed during this meeting as this depends on the species concerned and their management. However, independent of this it was recommended that data on catches, preferably specified to areas and sex, should continue to be collected as a minimum.

8. Other business

The future of the Working Group was discussed and guidance from the Scientific Committee was desired on this question. It was recognised that without specific requests and guidance on objectives it would be difficult to develop management regimes for any particular species or case-specific situation.

The Working Group had no suggestions for further approaches on this issue and referred the matter to the Scientific Committee.

9. Adoption of report

The report was adopted by correspondence in December 1993.

References

Director General of IUCN, 1993 - Note by the Director General on Guidelines for the Ecological Sustainability of Nonconsumptive and Consumptive Use of Wild Species.

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List of documents

SC-WG/MP1/1 - Reeves, R.R. and Heide-Jørgensen, M.P., National, Bilateral and Multilateral Approaches to Managing the Exploitation of Small Cetaceans

SC-WG/MP1/2 - Baldursson, F.R., Alternative Applications of the RMP to Central North Atlantic Minke Whale.

SC-WG/MP1/3 - Butterworth, D.S., On Some Aspects of Marine Mammal Management Procedures.

SC-WG/MP1/4 - Goodman, D., The Role of Science in the Management of Seals.

NAMMCO/WG-IO/Report 1993 - Report of the NAMMCO Working Group on Inspection and Observation, Copenhagen, 21-22 September, 1993.

North Atlantic Marine Mammal Commission

Report of the Scientific Committee Working Group on Northern Bottlenose and Killer Whales¹

Reykjavik, 25 November 1993

¹ This report of the NAMMCO Scientific Committee Working Group on Northern Bottlenose and Killer Whales should not be quoted without consultation with the Secretary.

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**Report of the Scientific Committee Working Group
on Northern Bottlenose and Killer Whales**

Reykjavik, 25 November 1993

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Report of the Scientific Committee Working Group on Northern Bottlenose and Killer Whales

Reykjavik, 25 November 1993

1. Terms of reference

The Chairman, Tore Haug, welcomed participants (listed in Appendix 1) and gave a brief account of the rationale for the Working Group and its terms of reference for this meeting. Following a request from the Council of NAMMCO, the Scientific Committee of NAMMCO decided to establish a Working Group on Northern Bottlenose (*Hyperoodon ampullatus*) and Killer Whales (*Orcinus orca*) at its January 1993 meeting in Tromsø. The request from the Council resulted in the following terms of reference for the present meeting, where the WG is requested to:

for the northern bottlenose whale -

- undertake an assessment of the status of the northern bottlenose whale (*Hyperoodon ampullatus*) stock in the North Atlantic;

and for the killer whale (*Orcinus orca*) -

- advise on stock identity for management purposes;
- assess abundance in each stock area;
- assess effects of recent environmental changes, changes in food supply and interactions with other marine living resources in each stock area.

2. Adoption of agenda

The Agenda as contained in Appendix 2 was adopted.

3. Appointment of rapporteur

Geneviève Desportes was appointed rapporteur.

4. Review of available documents and reports

The documents listed in Appendix 3 were presented briefly by their authors.

The Chairman also noted that a paper (Faucher and Whitehead) on the live study of northern bottlenose whales in Canadian waters was available for information.

5. Northern bottlenose whales

5.1 *Stock identity*

In 1976 the Scientific Committee of the IWC decided that "in the absence of clear evidence to the contrary, the bottlenose whale throughout the North Atlantic should be regarded as one stock" (Anon 1977).

It was noted that apparent feeding aggregations existed in the Davis Strait, the Denmark Strait and the Norwegian Sea although these did not necessarily provide evidence of separate stocks.

Regional differences in age at sexual maturity provided by paper SC-WG/NBK1/5 could indicate a low mixing rate of animals between the different feeding areas.

Some insight on stock identity might come from morphometric analysis of existing Norwegian material. Genetic analysis might also help provide some understanding of stock identity, and it was noted that a few tissue samples are being kept in the Faroes and Iceland.

The group was unable at this stage to reach a conclusion on stock identity, i.e., to decide on the existence of one or more stocks of bottlenose whales in the North Atlantic.

5.2 *Catch history*

There has been no local hunting of bottlenose whales in Greenland in this century. A total of five animals were taken by whaling vessels in 1950 and 1958 (SC-WG/NBK1/2). This might reflect low abundance but also the low esteem in which bottlenose products are held in Greenland.

There has been no commercial hunting of bottlenose whales by Icelanders while the catch history off Iceland by Norwegians is documented in paper SC-WG/NBK1/5.

Catch history data exist for Norway and the Faroes, although they are not of the same kind in both areas.

In the Faroes, both a limited-scale drive fishery and a limited-scale commercial offshore whaling have been conducted. Reports exist of offshore catches between 1894 and 1935 (SC-WG/NBK1/1). Catches were maximum 11 animals per year, totalling 92 animals, and occurred mostly between May and July. These are shown in Appendix 4, Table 1 (revised from SC-WG/NBK1/1). Reports of drive fishery catches and strandings exist mainly from 1709 to the present. The annual catch increased from 1820 and peaked in 1890, whereafter it declined and reached its lowest concurrently with the decline of the Norwegian catches. These catches are presented in Appendix 4, Figure 1 (from SC-WG/NBK1/1). Drive fishery catches peaked at the end of August and during the first half of September. A total of 646 bottlenose whales have been caught in the Faroes from 1584 up to and including 1993.

Scottish sealers and bowhead whalers took a total of approximately 1961 bottlenose whales from 1856 to 1974 including catches in both the Davis Strait and the Greenland Sea (Table 2, from SC-WG/NBK1/5). Of these, 1,787 were taken in the period 1877-1892.

Northern bottlenose whales have been hunted by Norwegian whalers in the North Atlantic during two separate periods (SC-WG/NBK1/5). During the first period, which lasted from 1882 to the late 1920s, a total of about 60,000 bottlenose whales were caught. The second period started with modern Norwegian whaling for small whales (mainly directed at minke whales) and commenced around 1930. Some bottlenose whales were included in the catches, and when the second period stopped in 1973, approximately 5,800 bottlenose whales had been caught in total. Figures 2-4 in Appendix 4 (from SC-WG/NBK1/5) show: the allocation of catch areas (fig. 2); the magnitude of catches (fig. 3); and the distribution of catches by area and time period (fig. 4).

5.3 *Estimation of abundance*

According to SC-WG/NBK1/5, modelling of catch series indicate that from an initial size of approximately 100,000 animals, a stock of approximately 60,000 animals remained in 1976. Due to time constraints the Working Group was unable to evaluate these results.

The Norwegian vessels made very few sightings of bottlenose whales during the NASS 1987 (Øien 1989), 1988 (Øien 1990) and 1989 (Øien 1991) surveys. This might reflect the fact that at the time of the survey, i.e. in July-August, the bottlenose whales have already left the area surveyed by Norwegian vessels. The Working Group noted that a southward migration out of the Norwegian Sea in mid summer could be inferred from historical catch data given in SC-WG/NBK1/1 and 5.

A direct estimate of abundance comes from analysis of the Icelandic and Faroese data from the 1987 NASS survey (Gunnlaugsson & Sigurjónsson 1990). Most of the sightings recorded on board Icelandic vessels (59 of 86, i.e. 69% representing 141 animals of 221 in total) were sighted between 4-20 July in the eastern part of the area, from Jan Mayen Ridge in the north, southward along the continental shelf edge east of Iceland towards the Iceland-Faroe Islands ridge to the Faroes in the South (i.e. in the area bounded by 70 N-58 N and 7-20 W) (Sigurjónsson, unpubl.). A surface estimate (no correction for submerged animals) of abundance gave 4,900 (CV=0.16) whales for the Icelandic survey vessels. An estimate for the Faroese survey vessel was 900 (CV=0.45) animals (Gunnlaugsson & Sigurjónsson 1990).

It was pointed out that the sightings estimate is undoubtedly seriously biased downwards due to the long dive time of the species. A correction for this might result in estimates 5-10 times higher on the assumption that the mean dive time is some 30 minutes (based on measurements from ten individuals given by Benjaminsen & Christensen 1979).

The Working Group agreed that an order of magnitude of some tens of thousands was a reasonable estimate for the North Atlantic population of bottlenose whales.

5.4 *Biological parameters*

Some limited data on biological parameters are available for Northern bottlenose whales. Paper SC-WG/NBK1/5 reviewed data on reproduction and age at sexual maturity of bottlenose whales caught in waters off both Iceland and Labrador. The gestation period lasts for about one year, pairing and calving take place at the end of the year, and there is a two-year breeding cycle. The length at birth is about 300cm. Both females and males become sexually mature between the ages of 7 and 9 years off Iceland, and between the ages of 8 and 12 years off Labrador. It was noted that the takes from Labrador are from a stock not previously exploited, while the takes from Iceland are from a stock that was heavily hunted in previous years.

A limited amount of data on reproductive parameters and growth will also become available from the Faroes.

5.5 *Assessment*

The Working Group was not able to conduct an assessment at this meeting. However, it was agreed that the possibilities of modelling population trajectories using catch series and estimates of abundance could be explored.

5.6 *Management advice*

No management advice based on a full assessment could be given. However, it was noted that a reasonable crude estimate of the population in the Northeast Atlantic was in the tens of thousands and that the total known removals from the population during the past 15 years represent less than 0.1% of the population.

6. **Killer whales**

6.1 *Stock identity*

The Working Group acknowledged that there was no conclusive evidence on stock identity of killer whales in the North Atlantic. There are some indications that killer whales exhibit aggregating behaviour which may provide useful independent units for management purposes. Some groups show long-term site fidelity and, although they are not present all year round in an area, come back year after year. Thus far no matches have been found between Icelandic and Norwegian photo-ID catalogues (SC-WG/NBK1/6 and 8). Most of the vocalizations are different between groups off Norway and groups off Iceland. However one group of Norwegian killer whales (out of 10 studied) has been shown to share a call with a group of Icelandic killer whales (SC-WG/NBK1/6).

6.2 *Stock abundance*

Since no conclusive data on stock identity could be put forward, it was considered preferable to discuss abundance in different areas. The Working Group had two types of recent abundance data available at the meeting, i.e. estimates based on sightings surveys and estimates based on questionnaire censuses conducted mainly on board fishing vessels in the coastal waters.

Sightings surveys conducted in the northern North Sea and the eastern Norwegian Sea northwards to Bear Island during July 1989 (SC-WG/NBK1/4) gave an estimate of 7,000 whales (95% c.l. 3,400-14,400). Surveys conducted during June-August 1987 by Icelandic survey vessels (Icelandic and adjacent waters) (SC-WG/NBK1/8) gave an estimate of 5,500 (CV=0.36) whales, while the survey conducted by and around the Faroe Islands provides an estimate of 1,100 (CV=0.62) whales. The two latter surveys combined gave an estimate of 6,600 whales (CV=0.32) with a lower 95% bound of 3,900 animals.

A questionnaire census conducted in the period 1982-1987 indicated a maximum of 1,500 killer whales in the near-coastal waters of Norway (Christensen 1988). This is compatible with the sightings survey results above since it pertains only to the coastal waters. A minimum of 284 killer whales were estimated from the questionnaire census at the herring grounds off Iceland

which seems rather low in light of the fact that a similar number of animals have already been photo-identified in the area (SC-WG/NBK1/8).

No abundance estimates are available for West Greenland. However, very few observations of killer whales have been recorded, despite considerable survey effort since 1984, suggesting that killer whales are not abundant in this area.

6.3 Ecosystem and habitat considerations

Killer whales in the North Atlantic are known to feed on squid, fish, birds and marine mammals.

Working paper SC-WG/NBK1/6 summarises the situation in Norwegian coastal waters: Herring (*Clupea harengus*) has been listed as the main type of prey of killer whales, at least in the coastal waters from Lofoten to Møre. Other known types of prey are squid, cod (*Gadus morhua*), little auk (*Alle alle*), eider duck (*Somateria mollissima*), northern fulmar (*Fulmarus glacialis*), and mackerel (*Scomber scombrus*) in the Lofoten area, bottlenose whales in Spitsbergen and seals at the Møre coast. Stomach samples and non-lethal studies show that killer whales feed on herring in the Lofoten and Vesterålen area in October-January. The type of prey consumed by killer whales in this area in June-August 1989-1993 has been identified during 15 encounters. In 13 of these encounters the prey was herring, once mackerel and once northern fulmar. Killer whales have been seen trying to catch a young harbour seal (*Phoca vitulina*) in Røst in Lofoten (without succeeding). The next day these whales were seen feeding on herring. The results indicate that herring is an important part of the prey also during summer months in northern Norway. This observation is supported by the fact that the summer distribution area of killer whales coincides well with the area where herring might be present, and that fishing boats often report the presence of herring in areas where killer whales are sighted.

Animals caught in Icelandic waters in 1967 contained remains of squid, fish (including herring) and seals (Jonsgård & Lyshoel 1970). According to SC-WG/NBK1/8, it is evident that at least part of the killer whale population around Iceland feeds on herring, but also halibut (*Hippoglossus hippoglossus*) (taken from longlines while these were hauled), and possibly also bottlenose dolphins (*Tursiops truncatus*) and long-finned pilot whales (*Globicephala melas*), as some reports indicate.

In Denmark a stranded whale was reported by Eschricht (1863) to include remains of 14 seals and 13 harbour porpoises (*Phocoena phocoena*). Seals (including grey seals (*Halichoerus grypus*)) and whales (including harbour porpoises, pilot whales and fin whales (*Balaenoptera physalus*)) are also reported (Bloch and Lockyer 1988) to have been consumed by killer whales in Faroese waters, where also seabirds (eiders, kittiwakes (*Rissa tridactyla*), guillemots (*Cepphus grylle*) and puffins (*Fratercula arctica*)) are taken. Bloch & Lockyer (loc.cit.) emphasise, however, that fish is probably the main food item for killer whales, and they list mackerel, herring, halibut and Greenland halibut (*Reinhardtius hippoglossoides*) (the two latter usually taken from gill-nets or longlines while these are hauled) as particularly important species.

In Greenland waters Eschricht (1863) listed porpoises, white whales (*Delphinapterus leucas*), bowhead whales (*Balaena mysticetus*), humpback whales (*Megaptera novaeangliae*), walrus (*Odobenus rosmarus*) and seals as known killer whale food items. Killer whales use almost all other species of whales and several species of seals as food items in Greenland, and sometimes fish and squid are also found (Heide-Jørgensen 1988). A killer whale diet comprising exclusively marine mammals is confirmed in working paper SC-WG/NBK1/3, in which narwhals are indicated to be of particular importance.

Before the collapse of the Norwegian spring-spawning herring stock at the end of the 1960s, the herring migrated between feeding areas in the Norwegian Sea (between Iceland and Jan Mayen) and spawning grounds on the coast of Norway. Young and adolescent herring dispersed along the coast, mainly of northern Norway and in the Barents Sea. It has been suggested that killer whale migrations depended largely on the herring migrations (Jonsgård & Lyshoel 1970). After the herring stocks collapsed, the herring no longer migrated into the Norwegian Sea, remaining instead in the fjords and coastal waters of Norway until maturity and spawning. This change in herring migration patterns may explain an observed reduction in killer whale abundance in the Norwegian Sea and a corresponding increase in abundance of the species in Norwegian coastal and inshore waters since the early 1970s (Christensen 1988).

Apart from the possible effect of changes in the herring stocks, the Working Group was not able, with its present knowledge, to identify other environmental changes that could be said to have had any possible effect on killer whales.

6.4 Management advice

There was no conclusive evidence on stock identity, although local aggregations with long-term site fidelity may provide provisional management units.

The remaining requests for advice on 'abundance in each stock area' and 'effect of recent environmental changes in the food supply, and interactions with other marine living resources in each stock area' are referred to paragraphs 6.2 and 6.3 respectively.

7. Other business: recommendations for future research

7.1 Northern bottlenose whales

The Working Group recommended the following as priorities for future research:

- a) compilation of catch data, with a yearly breakdown by sex and areas, including Scottish material;
- b) examination of catch history including effort data in Norway, Faroes and Scotland;
- c) analysis of Norwegian morphometric data and collection of similar data for the Faroes (and other areas, if possible);
- d) collection of tissue samples for analysis of genetic material in relation to stock identity and for pollutant studies;
- e) collection and analysis of dive times and behaviour to be incorporated in sightings survey analysis; and
- f) stomach analysis should be conducted whenever possible.

7.2 Killer whales

The Working Group recommended the following as priorities for future research:

- a) the continuation and expansion of photo-identification studies;
- b) the continued documentation of vocal dialects;
- c) the comparison of Norwegian and Icelandic photo-ID databases;
- d) tissue sampling for genetic analysis with regard to stock identity;
- e) satellite tracking to detect the range of movement of individuals and groups of whales;
- f) the establishment of a central photo-ID catalogue;

- g) the full registration and reporting of Greenland catches and their comprehensive sampling;
- h) further studies of feeding ecology; and
- i) studies of pollutant effects on killer whale stocks.

8. Adoption of report

The Working Group adopted the final report by correspondence in December 1993.

9. References

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5. Northern bottlenose whale
 - 5.1 Stock identity
 - 5.2 Catch history
 - 5.3 Estimation of abundance
 - 5.4 Biological parameters
 - 5.5 Assessment
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 - 6.4 Management advice
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List of documents

1. Documents presented at the meeting

SC-WG/NBK1/1 - Bloch, D. and Desportes, G., The Northern Bottlenose Whale in the Faroe Islands, 1584-1984.

SC-WG/NBK1/2 - Jensen, J. and Heide-Jørgensen, M.P., Bottlenose Whales, *Hyperoodon ampullatus*, in Greenland.

SC-WG/NBK1/3 - Heide-Jørgensen, M.P., A Note on Killer Whales in Greenland.

SC-WG/NBK1/4 - Öien, N., Abundance of Killer Whales (*Orcinus orca*) in Waters off Norway.

SC-WG/NBK1/5 - Christensen, I., The North Atlantic Bottlenose Whale (*Hyperoodon ampullatus*).

SC-WG/NBK1/6 - Similä, T., Present Knowledge and Research on Killer Whales in Norway.

SC-WG/NBK1/7- Vikingsson, G. and Sigurjónsson, J., Northern Bottlenose Whale (*Hyperoodon ampullatus*) -Availability of Data and Status of Research in Iceland.

SC-WG/NBK1/8 - Sigurjónsson, J. and Vikingsson, G., Availability of Data and Status of Research on Killer Whales (*Orcinus orca*) in Icelandic Waters.

2. Unpublished background documents

Faucher, A. and Whitehead, H., The bottlenose whales of 'The Gully', Final report for 1988-91 project for WWF- Canada, Toronto.

Reeves, R.R., Mitchell, E. and Whitehead, H., Current status of the northern bottlenose whale, *Hyperoodon ampullatus* (in press - *Canadian Field Naturalist*).

Tables and Figures

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Table 1 (Revised from SC-WG/NBK1/1)

Total annual numbers of bottlenose whales recorded in the Faroes from 1584 - 1993, and divided according to whether driven, found stranded, or hunted offshore.

Year	No. driven	No. dead	No. shot	Total	Year	No. driven	No. dead	No. shot	Total
1584	3			3	1803	2			2
1618	2			2	1807	1			1
1622	6			6	1814	2			2
1623	2			2	1815	1			1
1626	1			1	1816	5			5
1631	3			3	1817	4			4
1633	1			1	1819	7			7
1634	1			1	1821	3			3
1737	2			2	1822	3			3
1709	3	2		5	1825	2			2
1711	3	1		4	1826	6			6
1713	1			1	1829	2			2
1715	3			3	1830	2			2
1716	3			3	1831	2			2
1717		2		2	1833	2			2
1719	5	2		7	1834	2			2
1720	5			5	1835	8			8
1721	3			3	1836	2			2
1722		2		2	1838	2			2
1723	6			6	1839	7			7
1724		1		1	1841	5			5
1725	2			2	1842		1		1
1726	4			4	1843	3	1		4
1728	2	2		4	1844	2			2
1729	2			2	1845	6			6
1732	3			3	1846	5	1		6
1734	2	1		3	1847	3	1		4
1735	1			1	1848	1			1
1737	3			3	1849	2	1		3
1738	3			3	1850	4	1		5
1741	1			1	1851		1		1
1742		2		2	1852	6			6
1746	6			6	1853	14			14
1748	3			3	1855	6	3		9
1750	1			1	1856	6	1		7
1752	2			2	1857	5	1		6
1754	3			3	1858	6			6
1755		1		1	1859	3			3
1763		1		1	1860	9			9
1767	3			3	1861	12			12
1771		1		1	1862	6			6
1777	1			1	1863	8			8
1778	3			3	1864	13	1		14
1782	2			2	1865	2	2		4
1796	3			3	1866		4		4
1802		1		1	1867	2			2

Year	No. driven	No. dead	No. shot	Total
1868	10			10
1869	6			6
1870	6			6
1871	7			7
1872	12			12
1873	2			2
1874	16			16
1875	2			2
1876	9	1		10
1877	7			7
1878	3			3
1879	8	1		9
1880	11			11
1881	6	1		7
1882	14			14
1883	11	1		12
1884	7			7
1885	2			2
1886	9			9
1887	12			12
1888	23	6		29
1889		1		1
1890	4	1		5
1891	1	3		4
1892	7	2		9
1893	11			11
1894	7		5	12
1895	1		7	8
1896	19			19
1897	2	2		4
1898	2		4	6
1899	4	1		5
1900	6	2		8
1901	2			2
1902	4			4
1903	4		5	9
1904			6	6
1905	11		6	17
1906			11	11
1907	2	2	4	8
1908			1	1
1909	5		2	7
1910	3	1	4	8
1911			1	1
1913	2		8	10
1914			8	8
1915	1		2	3
1916			2	2
1918	2			2

Year	No. driven	No. dead	No. shot	Total
1920			8	8
1923			2	2
1926	3			3
1927	1			1
1928	2			2
1929	2			2
1930			2	2
1931	2		2	4
1934		1		1
1935	2		2	4
1937	5			5
1940	3			3
1942	1			1
1943	2			2
1946	4			4
1947	3			3
1954	1			1
1963	3			3
1964	3			3
1966	4			4
1967	3			3
1970	1			1
1974	4			4
1978	2			2
1981	3			3
1982	2	1		3
1988	3			3
1989	2			2
1992		2		2
1993	5			5
<hr/>				
Total	646	67	92	805

Table 2 (From SC-WG/NBK1/1)

Catches of bottlenose whales in the North Atlantic by nations other than Norway. (Note that some of the records from the Faroes include stranded animals (see Table 1)).

Year	Nation	No of bottlenose	Catch area	Sources
1856	UK (Scotland)	28	Frobisher Strait	4, 6
1877	"	10		1, 6
1878	"	9		1
1879	"	8		1, 6
1880	"	32		1, 6
1881	"	111		1, 6
1882	"	413		1, 6
1883	"	535		1, 4
1884	"	283	Greenland and Davis strait	1
1885	"	(55) 84	Jan Mayen and Davis Strait	1, 4
1886	"	23	Greenland	4
1887	"	20	Greenland and Davis Strait	4
1889	"	10	Greenland	4
1890	"	22		4
1891	"	3		5
1892	"	224		7
1905	UK (Shetland)	1		II (9), 2
1906	"	1		II (9), 2
1907	UK (Shetland & Hebrides)	2		II (9), 2
1909	UK (Shetland)	2		2, 8
1910	"	1		2, 8
1911	"	2		2, 8
1912	"	8		2, 8
1913	"	8 (7)		II (37), 8
1913	Iceland	2		II (32)
1913	Denmark (Faroe Islands)	8		II (37), 2

Year	Nation	No of bottlenose	Catch area	Sources
1914	Denmark (Faroe Islands)	8		II (38)
1916	"	1		II (39)
1920	UK (Scotland)	5		8
1920	Denmark (Faroe Islands)	8		II (40)
1923	"	2		II (41)
1925	UK (Scotland)	1		8
1950	Denmark (W. Greenland)	2		XXXV (21)
1953	Canada (Newfoundland)	1		XXXI (21)
1958	Denmark (W. Greenland)	3		XXXV (25)
1962	Canada (Nova Scotia)	40		LI (33)
1963	"	22		LII (34)
1963	Denmark (Faroe Islands)	3		LIII (33)
1964	"	3		LX (34)
1964	Canada (Nova Scotia)	6		LVII (34)
1967	"	5		LXI (32)
1970	Denmark (W. Greenland)	1		LXX (21)
Total	1856-1974	1961		

Sources: 1 = Norsk Fiskeritid. 1883-1924, 2 = Risting, 1922, 4 = Lubbock, 1937, 5 = Lindeman, 1899, 6 = Southwell, 1884, 7 = Mitchell, 1975, 8 = Thompson, 1928. International whaling statistics IWS are specified with volume no. in Roman numeral, and page no. in brackets.

Figure 1 (From SC-WG/NBK1/1)

Bottlenose whales in the Faroe Islands, 1709 -1993 (caught and found dead).

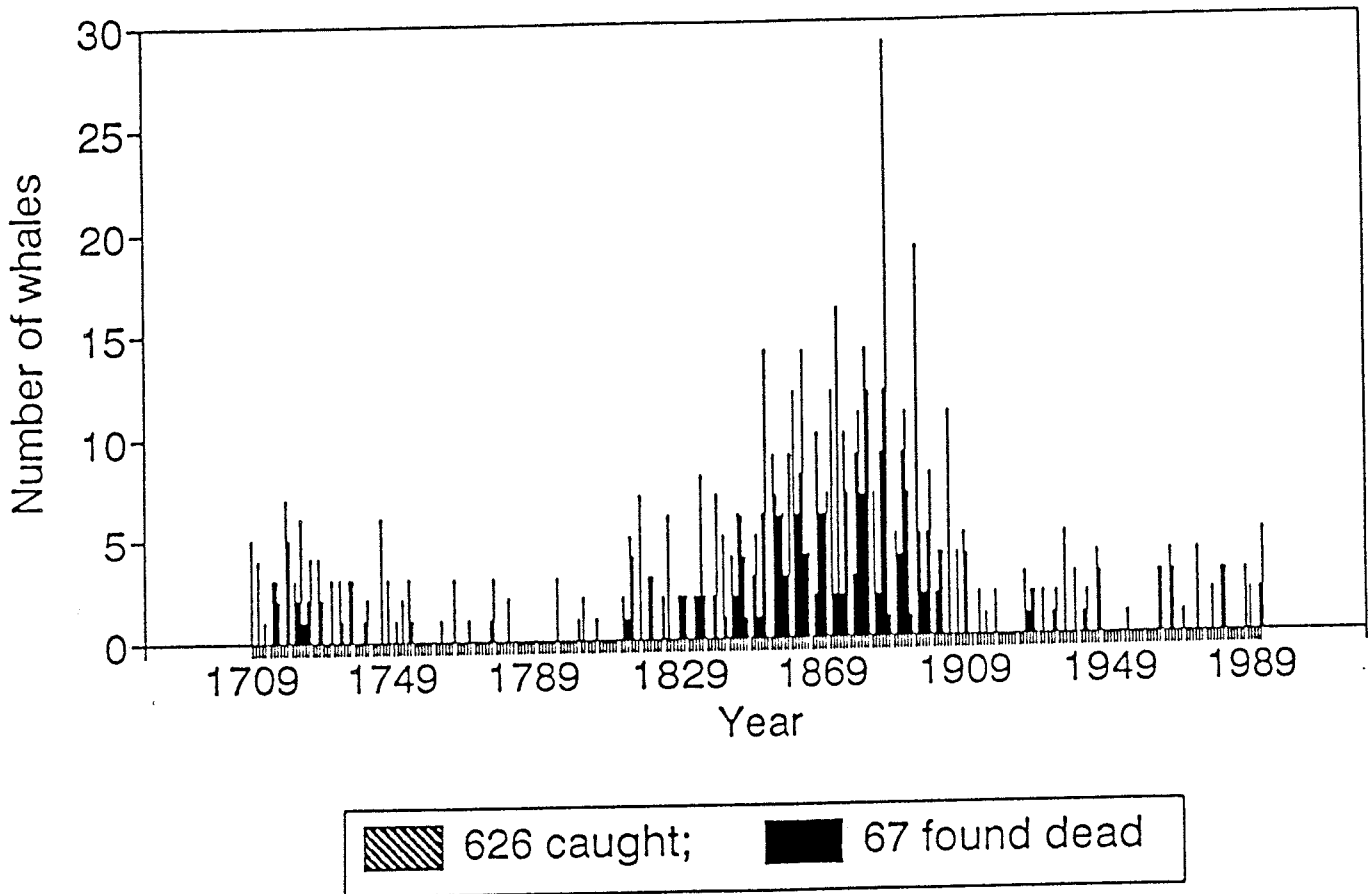


Figure 2 (from SC-WG/NBK1/5)

Position where bottlenose whales have been caught by Norwegian whalers in the period 1938-72. The number of whales taken at each position is indicated in the legend.

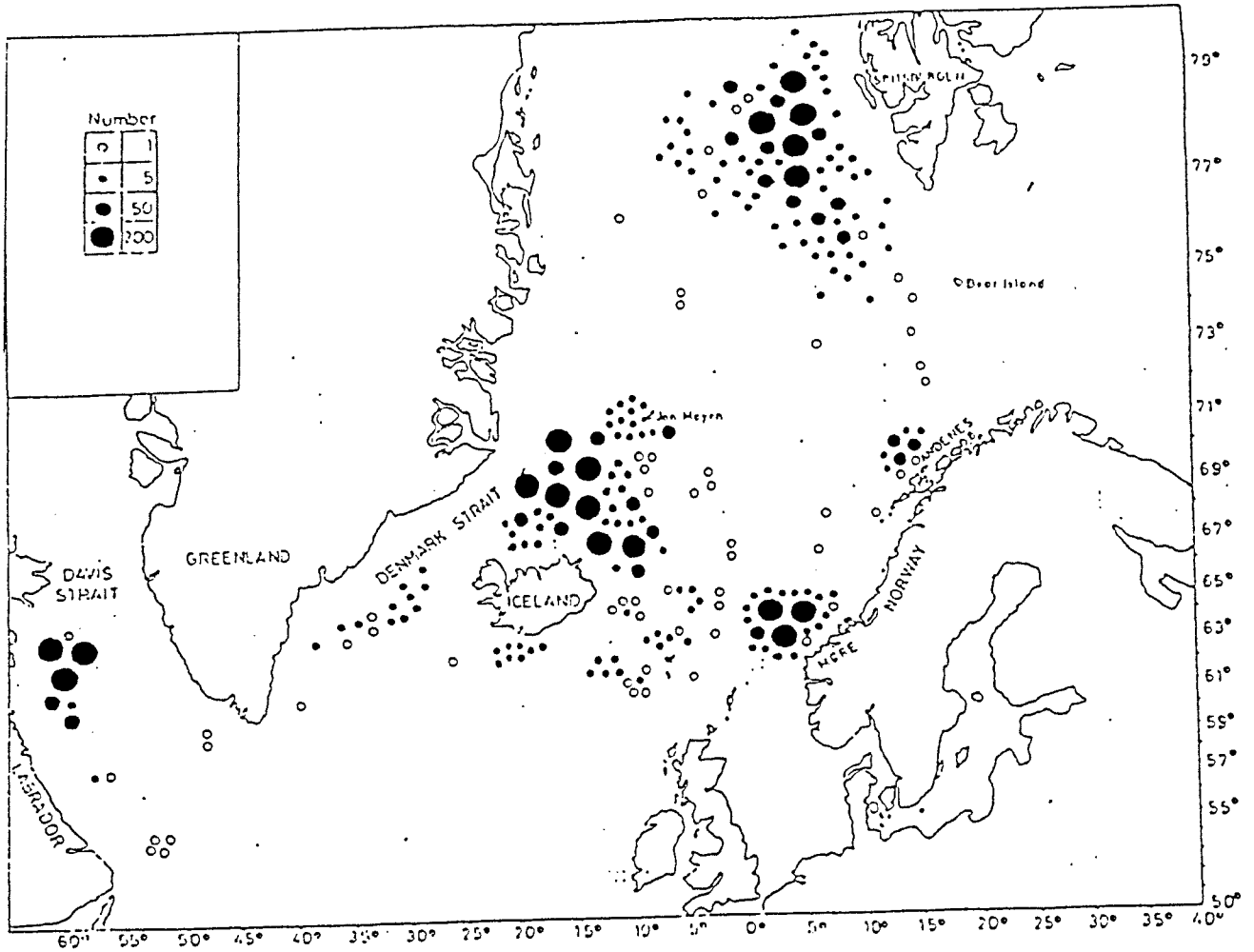


Figure 3 (from SC-WG/NBK1/5)

Norwegian catches of bottlenose whales 1882-1974 (—), the sealers share of total (.....) and the number of bottlenose whaling ships (-----).

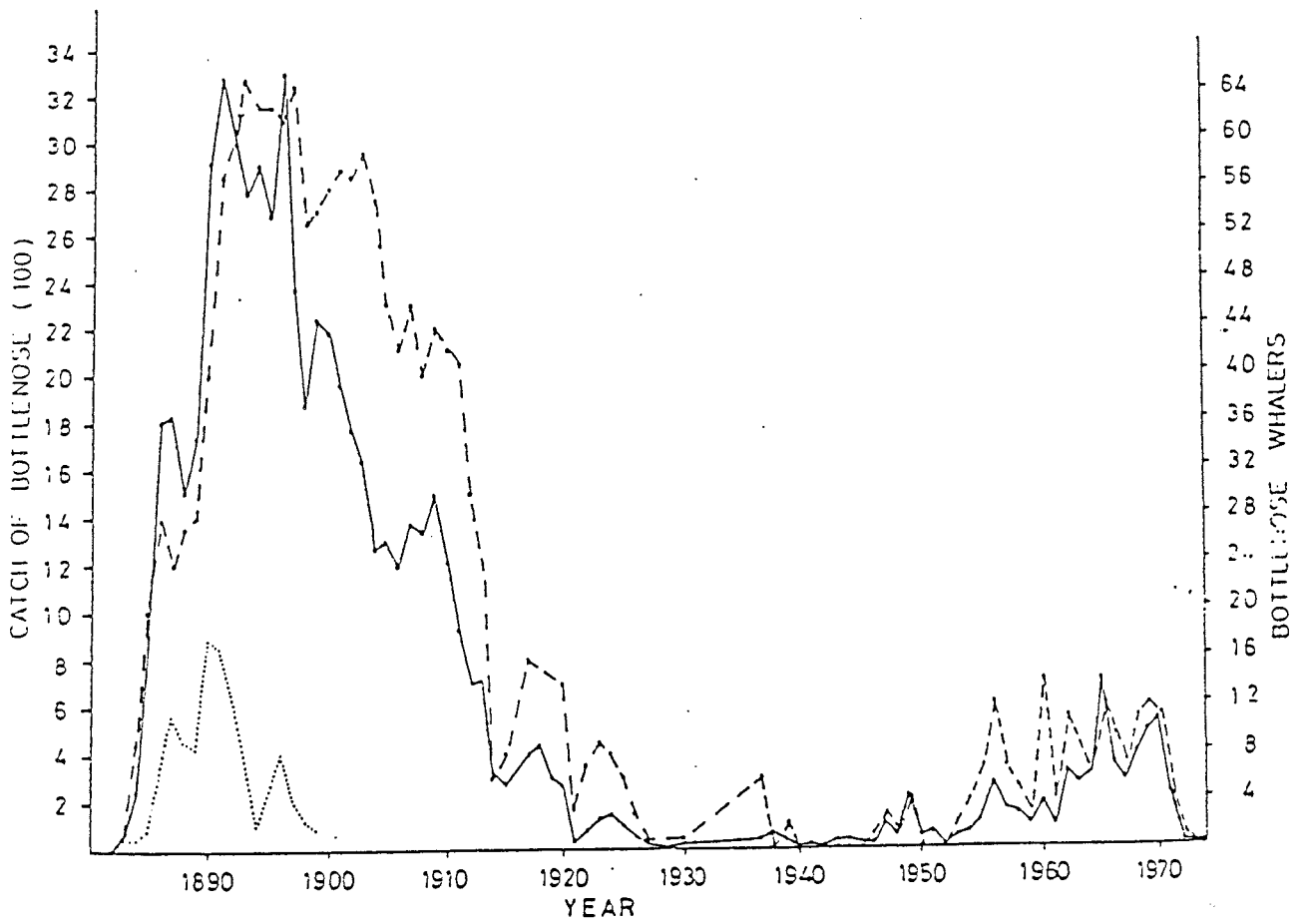


Figure 4 (from SC-WG/NBK1/5)

Number of bottlenose whales caught in the areas Iceland, Svalbard, Andenes and Møre in eight successive periods covering the season 1938-69.

