Northwest Atlantic Fisheries Organization

Serial No. N2632 **NAFO SCS Doc. 95/21**

SCIENTIFIC COUNCIL MEETING - SEPTEMBER 1995

Report of Scientific Council, Annual Meeting, 9–15 September 1995

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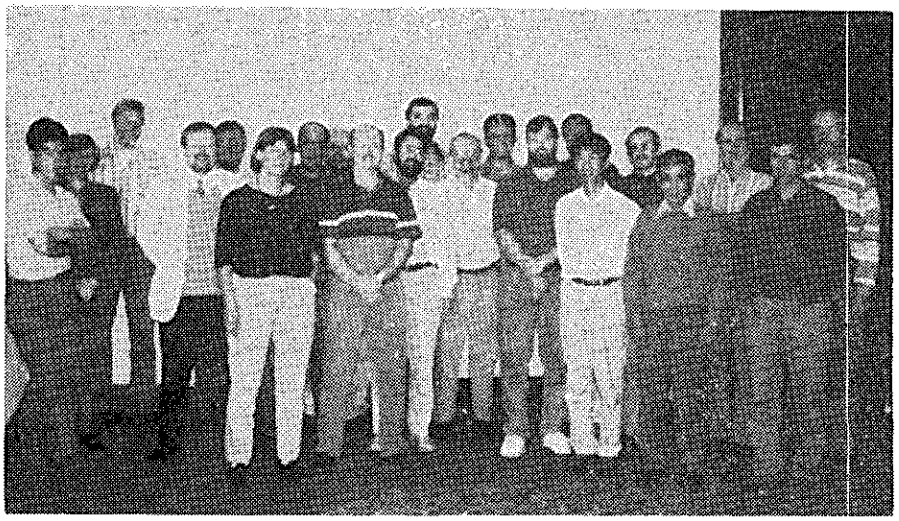

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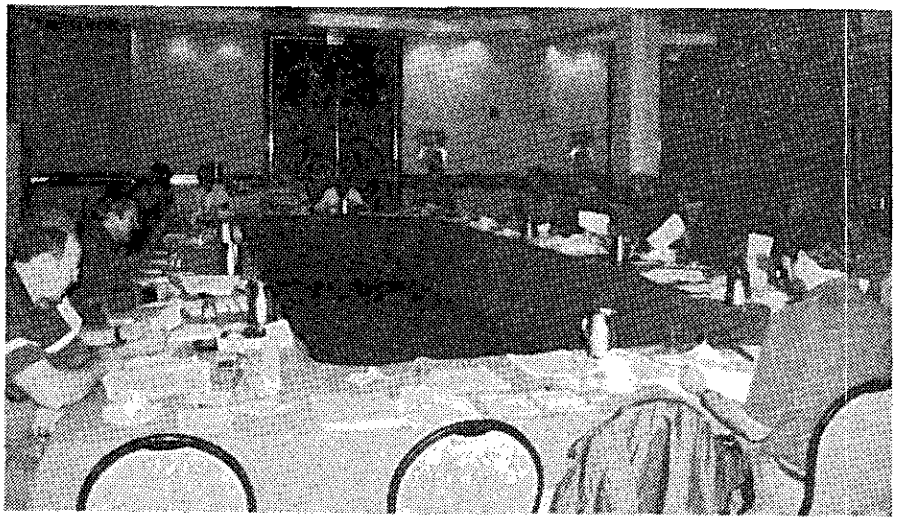


SCIENTIFIC COUNCIL IN SESSION, 9-15 SEPTEMBER 1995

COFFEE BREAK AT 17TH ANNUAL MEETING, SEPTEMBER 1995

REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, 9-15 September 1995

Chairman: H. Lassen

Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the Holiday Inn, Dartmouth, Nova Scotia, Canada during 9-15 September 1995. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (Denmark, Germany, Portugal, Spain and United Kingdom), Iceland, Japan, Russian Federation, and observers from the United States of America and ICES. The Executive Secretary and Assistant Executive Secretary were in attendance.

The Executive Committee met briefly before the opening to discuss the Plan of Work.

The opening session of the Council was called to order at 1005 hr on 9 September 1995.

The Chairman welcomed everyone to this 17th Annual Meeting. The Assistant Executive Secretary was appointed rapporteur. The Council welcomed F. M. Serchuk, National Marine Fisheries Service, Woods Hole, Massachusetts, USA and H. P. Cornus (EU-Germany), the ICES representative, as observers to this meeting.

The provisional agenda was considered, and Item VI was modified to take into account the request on research need for Greenland halibut and any other requests which could be forthcoming from the concurrent Fisheries Commission meeting. The Council **adopted** the modified agenda.

The session was adjourned at 1030 hr on 9 September 1995.

The Council reconvened briefly through 10-14 September 1995 particularly to address requests from the concurrent Fisheries Commission sessions and discuss various items in the agenda. These are reported in relevant sections below.

The concluding session was called to order at 0900 on 15 September 1995. The Council considered and **adopted** the Report of the Standing Committee on Fishery Science (STACFIS), the Report of the Standing Committee on Research Coordination (STACREC), and the Report of the Standing Committee on Publications (STACPUB) and then **adopted** the Scientific Council Report of this meeting.

The meeting was adjourned at 1006 hr on 15 September 1995.

The reports of the Standing Committees are appended as follows: Appendix I - Report of the Standing Committee on Fishery Science (STACFIS), Appendix II - Report of Standing Committee on Research and Coordination (STACREC), Appendix III - Report of Standing Committee on Publications (STACPUB). STACFEN was not in session during the Annual Meeting. The report of the Symposium on 'The Role of Marine Mammals in the Ecosystem' which was held immediately prior to this Annual Meeting is presented at Annex 1 of the Council Report, while Annex 2 gives the announcement of the 1997 Symposium on 'What Future for Capture Fisheries' and Annex 3 the List of Recommendations from this meeting.

Brief summaries of the Standing Committee Reports and other matters considered by the Scientific Council are given below in Sections II-X. The Agenda, List of Research (SCR) and Summary (SCS) Documents, and the List of Participants of this meeting are given in Appendix IV, V and VI, respectively.

II. FISHERY SCIENCE (see STACFIS report, App. I)

The Council noted that most of the matters referred to STACFIS were related to providing responses to requests from the Fisheries Commission. In particular, STACFIS addressed the assessment of Shrimp in Div. 3M, Minimum Landing Size Corresponding to a 130 mm Mesh for Greenland halibut, Area and the Seasonal Distribution of Juvenile Fish, and the Optimal Minimum fish size for protected species in Subareas 2+3. The complete report of STACFIS is given in Appendix I, while responses to the Fisheries Commission are given below under Agenda Item VI.

III. *AD-HOC* WORKING GROUP ON THE INTERRELATION BETWEEN HARP AND HOODED SEALS AND COMMERCIAL FISH STOCKS

This Working Group was established for this meeting alone to undertake matters related to the request from the Fisheries Commission on the Seal - Fish Interactions, particularly considering information presented at the Symposium on 'The Role of Marine Mammals in the Ecosystem'.

The Report of the Symposium is found at Annex 1 of this report.

The Working Group review of consumption of fish by seals, interactions between seals and commercial fish stocks, and assessment of effects on the seal stock of recent environmental changes or changes in food supply, were further considered by the Council, and are reported below under Agenda Item VI.8 as responses to a request from the Fisheries Commission.

IV. RESEARCH COORDINATION (see STACREC report, App. II)

The Chairman C. A. Bishop (Canada) was unavailable for this meeting after his retirement in July 1995, and the incoming Chairman D. Power (Canada) was requested by the Council to chair this meeting.

1. **Acquisition of STATLANT 21 data**

The Council noted that STATLANT data reports for 1994 had still not been received from several countries, and that data from USA were not likely to be available this year. The Council agreed with STACREC that the SCS document on provisional nominal catches for 1994 should not be compiled. The Council also agreed with the **recommendation** of STACREC, that NAFO Statistical Bulletin, Vol. 42 be completed as soon as possible when the STATLANT 21B data from EU-France and Norway for 1992 were clarified.

The Council noted the introduction of a new trawl gear into the shrimp fisheries in Div. 3M and the possible implications for the interpretation of fisheries data. The Council endorsed the **recommendation** of STACREC that the Secretariat take steps to modify the STATLANT 21B questionnaire to include this new twin trawl gear type used in the shrimp fishery, with a new gear code.

2. **Research Coordination for Greenland Halibut, Formulation of Research Proposal for Synoptic Survey**

The Council noted the STACREC research proposal and the potential benefits of such an exercise. The Council **recommended** that *Contracting Parties adopt the proposal and make every possible effort to ensure that a coordinated synoptic survey in the Convention Area is undertaken at the earliest practical opportunity.*

3. **Review of Research Documents**

The Council noted that three Research Documents not directly related to stock assessments and not considered by STACFIS, had been reviewed and reported on by STACREC.

4. **Publication of List of Fishing Vessels**

The Council noted the concerns of STACREC regarding the serious shortfalls in submission of the lists of fishing vessels in the NAFO area and agreed with the request of STACREC that the Secretariat investigate the background for the requirement for such a list and its usage in NAFO.

5. **National Research Reports for 1994**

The Council noted the receipt of the USA research report for 1994 and that until new auditing and allocation procedures currently being implemented in the USA are finalised, reported landings from the USA will not be available by NAFO Division. The Council agreed with STACREC on the importance of receiving catch statistics from the USA on a species/Divisional basis.

6. **Biological Surveys in the Regulatory Area**

The Council noted that while Contracting Parties are informed of proposed research activities in the Regulatory Area, the information is not always transmitted to the chairs of Scientific Council and its

Committees on a timely basis. Such information is of significant value to the Scientific Council. The Council endorsed the **recommendation** of STACREC that Contracting Parties planning research activities in the Regulatory Area, submit a summary of their research proposals , outlining the objectives and methods, to the Scientific Council.

7. **Redfish Ageing Workshop**

The Council noted that an ICES-sponsored workshop on ageing of *Sebastes* sp. is to be held in Bremerhaven, Germany on 4-8 December, 1995, and endorsed the **recommendation** of STACREC that a summary of the report of the workshop on ageing of *Sebastes* sp. be presented to the June 1996 Meeting of the Scientific Council.

V. PUBLICATIONS (see STACPUB report, App. III)

The Council received the STACPUB report and made specific note on the following items.

1. **Review of Publications**

While there had been satisfactory progress in many respects, the Council shared the STACPUB concerns regarding the very significant delays in publication of papers from the 1993 Symposium on 'Gear Selectivity/Technical Interaction in Mixed Species Fisheries'.

2. **Promotion and Distribution of Scientific Publications**

The Council acknowledged the considerable international interest in the results of the Symposium on 'The Role of the Marine Mammals in the Ecosystem'. It fully supported the proposal of STACPUB to advertise widely the Journal issue which will contain papers from this Symposium. The Council also supported the proposal for publishing in a Scientific Council Studies issue, the contributions from the *Ad-hoc* Working Group on Harp and Hooded Seals which met in June 1995.

VI. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS FROM THE FISHERIES COMMISSION

1. **Assessments**

The Council assessed the shrimp in Div. 3M. The results are presented below.

Shrimp in Division 3M

Background: The fishery for shrimp on Flemish Cap only began in April, 1993 although shrimp occurrence in the area has been known for many years.

Fishery and Catches: This multi-national fishery produced catches as follows:

Year	Catch (tons)
1993	27 000
1994	24 000
1995 (to 31 August)	23 000

The fishery was unregulated in 1993. Sorting grates were required in 1994.

Data: Catch, effort and biological sampling data were available from the trawlers of several nations. A time-series of biomass indices was produced from catches of shrimp taken in EU groundfish surveys in Div. 3M from 1988 to 1995. Biological samples of shrimp were also obtained during the surveys. Oceanographic data were obtained from Canadian surveys on Flemish Cap in the summers of 1993 and 1995.

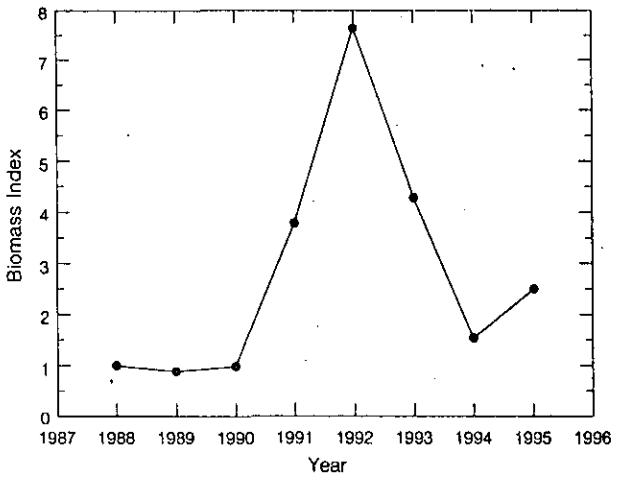
Assessment: No analytical assessment is available. Evaluation of the status of the stock is based on the interpretation of commercial fishery data (catch, effort and catch rates), the time series of research biomass indices and biological data from both sources.

Fishing Mortality: Unknown.

Recruitment: The 1988 year-class was strong, dominating in the surveys of the early-1990s and yielding high catch rates in the first year of the fishery. Year-classes produced since 1988 have been much weaker. The 1993 year-class dominated in the catches in 1995 but not in the survey.

Biomass: Only indices of biomass were available from the EU surveys. It is believed that these indices reflect the general changes in stock over time.

Biomass Index for 1988 = 1.



State of the Stock: The 1988 year-class has now passed through the population and no longer contributes significantly to the fishery. The continuation of an intensive fishery which now targets male shrimp as young as age 2 is undesirable and represents growth overfishing and may result in recruitment overfishing. The spawning biomass is now lower than it was in the early-1990s and may remain below its potential if younger male shrimp continue to be targeted before they have the opportunity to change sex.

Recommendations: If the stock produces only occasional strong year-classes, as occurred in 1988, the current exploitation pattern is unsatisfactory and reduces the potential yield from such year-classes.

If there is a stock/recruitment relationship, then the current exploitation pattern will result in recruitment overfishing.

Under either scenario, the current exploitation pattern is imprudent. In order to improve the exploitation pattern, the fishing mortality on male shrimp must be minimized.

In practice, with regard to the male year-classes which were the main target of the 1995 fishery, this implies a closure in 1996.

Special Comments: Redfish by-catches were high in 1993 and in 1994. In 1994, sorting grates with 28 mm bar spacings were required. Bar spacings were reduced to 22 mm in 1995 and by-catch levels were much lower. It is not clear, however, if the reduction was due entirely to the change in bar spacings.

Sources of information: SCR Doc. 95/100, 101, 102,103, 105, 106.

2. Responses to Requests on Fish Size and Landing Size

a) Minimum *Fish Size for* Greenland Halibut for 130 mm Trawl

The Scientific Council reviewed the data which were presented at its June 1995 and at its September 1995 meeting and concluded that a minimum landing size based on a L_{25} point on the selection curve would be between 30 and 35 cm dependent on, among other things, duration of the trawl haul. The Council noted that the minimum landing size corresponding to a 130 mm stretched mesh in the codend was 35 cm. The Council emphasized that this minimum size is far from optimal and discussed this problem further in a response to a request from Canada (see SCS 95/19 from June 1995 p. 56).

b) Minimum Landing Size

The Scientific Council has in recent years on several occasions discussed minimum landing sizes corresponding to a specified minimum mesh size in trawls.

For easy reference a resume of these answers are presented below together with some explanatory notes.

i) The minimum landing sizes in the NAFO Regulatory Area are established for control and enforcement reasons and are not based on biological arguments. Many fish being discarded will not survive. The entire process of being caught, brought onto deck, sorted and then released will often be so harmful that few or none of the fish survive. Key examples are redfish and pelagic fish, but also cod, Greenland halibut and, to a lesser degree, flatfish suffer significant losses.

ii) The Scientific Council advises a minimum landing size corresponding to the 25% retention length, that is the length where 25% of the fish which enter the codend will be retained by the meshes. The Council emphasized that these minimum lengths are based on the existing regulation mesh size and do not include biological considerations such as yield-per-recruit or size at first maturity.

iii) The calculated minimum landing sizes based on L_{25} corresponding to a 130 mm trawl mesh are:

Species	Minimum landing size (cm)
Yellowtail flounder	25
American plaice	25
Witch flounder	25[1]
Greenland halibut	35[2]
Cod	41
Redfish	

[1] By analogy to yellowtail flounder and American plaice
[2] Calculated at this meeting, see section above.

3. TAC for Greenland Halibut in SA 2 + Division 3K and Divisions 3LMNO

The Scientific Council reviewed the available survey information on the distribution of abundance of Greenland halibut and in particular the information available for Subarea 2 + Div. 3LMNO. No survey data were available for Div. 2GH since 1988 and data were very limited for depths beyond 1 000 m in Subarea 2 or beyond 732 m in Div. 3NO. Therefore no comprehensive abundance distribution map could be constructed.

The fisheries data were incomplete, not covering all areas of distribution and indices of abundance, e.g. catch rates were not comparable between vessel groups and areas.

The Council, in response to a request by the Fisheries Commission, has proposed a synoptic survey which would produce the necessary information (see below).

4. **Research Coordination for Greenland Halibut**

The Fisheries Commission at its September 1994 Meeting forwarded a request for a plan for coordinated research on Greenland halibut stating that:

"Noting the Scientific Council's recommendations for coordinated research on Greenland halibut, the fisheries Commission and the two Coastal States emphasize the urgency of acquiring information on the distribution and stock status. The Scientific Council is requested to pursue its coordinated efforts and member countries are urged to commit the necessary resources to the research."

The Council at this meeting responded with the following text:

"Research Coordination for Greenland Halibut, Formulation of Research Proposal for Synoptic Survey

In June 1993, the Scientific Council of NAFO recommended that consideration be given to the implementation of a collaborative RV trawl survey for Greenland halibut from Davis Strait to the Grand Bank and Flemish Cap. Until such a survey was conducted, it was thought that an adequate assessment of stock size and relative distribution was unlikely (NAFO Sci. Coun. Rep. 1994, p. 157). In June 1995, STACREC recommended that parties interested in such a synoptic survey meet and develop a plan.

At this meeting, the need for such a survey was considered in detail, and while recognizing that to undertake and complete a collaborative survey of this kind will require considerable commitment from Contracting Parties, STACREC formulated the following research proposal:

Survey Area

The proposed survey area would include the offshore stratified areas of Div. 0A and 0B, 1A to 1F, 2G to 2J, and 3K to 3O, a total of 16 NAFO Divisions encompassing some 260 000 square naut. miles, not including Div. 1EF. This does not include the areas inside the bays and fjords, as many of these areas are unstratified and/or untrawlable. Maximum depth in the stratification schemes used at present are 1 500 m for the areas north of Div. 3L, and about 1 460 m (800 fm) for Div. 3LMNO.

Objectives/Scope of Survey

The main objective of this multi-disciplinary survey would be to collect information on the abundance and distribution of fish and invertebrate species throughout the area. The key species is Greenland halibut, although data on other important species such as cod and shrimp would also be gathered.

Oceanographic data such as CTD/XBT profiles would be collected at each fishing station for comparison with data currently available in the archives. In addition, biological data (size and age compositions, maturity, food and feeding, etc.) would be collected from as many species as possible, to give as complete an overview of the ecosystem as possible. The survey would provide a vast amount of information currently unavailable for many species and areas. The sea-going activities of the project could be conducted every fifth year, providing a regular assessment of biotic and abiotic parameters in the northern NAFO Subareas.

The project should be proposed as part of the Global Ocean Observation System (GOOS) as Module 2 (Biological monitoring). Most contracting parties will take part in GOOS, which is a global program planned for the next few decades. Involvement of this NAFO survey project with GOOS will give it a higher international profile beyond NAFO, with data being provided both for NAFO and GOOS.

Benefits of a Synoptic Survey

There are several benefits in doing a multi-vessel synoptic survey of the area described above. Such a survey would provide a vast amount of abundance, distribution, and biological data for many species over their range of distribution from the Arctic to the Grand Bank. Another obvious benefit of a multi-vessel approach is the reduction in the time-span necessary to do the survey. At present, there are survey data collected for some stocks in this area from the period July to December. This makes combining survey estimates very risky, especially for a highly migratory animal such as Greenland halibut. A synoptic survey would also provide an opportunity to standardize fishing gears and practices as far as possible, reducing variability introduced to surveys by these factors. Some overlaps in coverage by the vessels used in the survey would allow potential differences in vessel fishing power to be evaluated.

Requirements for a Synoptic Survey

Area/Depths to be surveyed. To survey the zone with minimum coverage of 1 set per 250 sq. naut. mi., insuring at least 2 sets in all strata down to depths of 1 500 m, regardless of size, would require approximately 1 400 fishing stations.

Vessel days required. Assuming a rate of 8 sets per 24-hour day, 1 400 sets translates into about 200 fishing days. This allows around 15% down-time for bad weather, unsuccessful sets, avoiding untrawlable bottom, and gear repairs. Additional time would be needed for transit to and from the survey areas, and is not included in these estimates. Thus, a survey with 4 vessels could be done in about 50 calender days, and a survey with 5 vessels in about 40 calender days. The proposed time period would be September-October, to correspond to the mid-point of the range of available survey data from this area.

Vessel, gear and personnel requirements. Recognizing the scarcity of modern research vessels capable of fishing to 1 500 m, appropriate charter vessels would be sought. Each vessel must be capable of conducting deep sea fisheries research, and identically outfitted with the same fishing gear, net monitoring devices, and oceanographic equipment. The fishing and sampling protocols must be identical on each ship. This would facilitate subsequent analyses of the data and combination of abundance estimates from all areas.

A total of 8 scientific staff would be required for each vessel-day, for a total of 1 600 person-days of sea time for the project. Additional resources would be required for pre-cruise preparations and for post-cruise processing and analysis of samples and data, and presentation of results.

Planning/Coordination. Given the lead time necessary to arrange for vessel-time and to coordinate all aspects of such a survey, planning would have to start more than a year in advance. Thus the earliest time that this synoptic survey could be run is probably 1997. If a recommendation to proceed is obtained from the Fisheries Commission, as a first step, a scientific steering committee should be immediately established, followed by a planning meeting to establish scientists in charge of the project.

5. **Measures to Protect Juvenile Fish of Regulated Species**

The Scientific Council has in the past repeatedly discussed this question and identified some areas of the distribution of juvenile fish (e.g. nursery areas for American plaice and yellowtail flounder on the Grand Bank). There is recent work which has not yet been reviewed by the Council. Therefore the Council cannot at this time recommend precise areas or seasons which could be closed to protect juveniles specifically.

6. **Optimum Minimum Fish Sizes for Regulated Species**

The Council interpreted the reference to minimum fish size as minimum landing size. The Fisheries Commission in its request from its meeting of 7-9 June 1995 explicitly mentions the yield-per-recruit concept.

The optimum minimum size of a fish or a shellfish, however, can be defined in several ways:

- it should contribute to the reproduction potential of the stock
- the yield-per-recruit should be optimum
- the cost-per-yield unit should be minimum

The two last points can be seen under the constraint of a given fishing technology or could be discussed with variation in the fishing technology. The Scientific Council has no data available which allows it even in general terms to address the cost efficiency issue.

These definitions of optimal minimum sizes will in some cases give grossly different answers.

If for control purposes only one mesh size is allowed when bottom trawling in the NAFO area, then a 130 mm minimum mesh is a compromise corresponding to an optimum yield-per-recruit fishery for the traditional species - American plaice, yellowtail flounder, witch flounder and cod. The compromise takes into account the species mix in the fisheries.

7. Usefulness of a Minimum Mesh Size in the Capelin Fishery

Small pelagic fish are particularly susceptible to damage when passing through trawl meshes, to the point of not surviving. This may also be the case for capelin although it has not been demonstrated specifically for this species. Therefore any minimum mesh in the capelin fishery will reduce the catch without reducing the total mortality.

8. Analyses with Respect to the Interaction Between Seals and Commercial Fish Stocks

a) Report of the Symposium on 'The Role of Marine Mammals in the Ecosystem'

The joint NAFO/ICES Symposium on 'The Role of Marine Mammals in the Ecosystem' was hosted by NAFO Scientific Council during 6-8 September 1995, immediately preceding this Scientific Council Meeting. The Symposium had a wide international participation and there was significant expressed interests from the scientific community and public media. The Council judged the Symposium to be a valuable contribution to the scientific knowledge base on the role of marine mammals in the ecosystem. The Council congratulated the co-conveners, G. B. Stenson (Canada) and J. Sigurjónsson (Iceland), for the successful Symposium and extended a vote of appreciation for their hard work to make it the success it was.

The Council **adopted** the report of the Symposium as presented by the co-conveners. The report is at Annex 1 of this Scientific Council Report.

At its meeting in September 1994, the Fisheries Commission forwarded the following request to the Scientific Council:

> *"... a detailed report on the nature and extent of analyses that were tabled at the Symposium with respect to the interrelation between seals and commercial fish stocks....."*.

The Council accepted the following responses to the Fisheries Commission as prepared by the *Ad hoc* Working Group (Chairman - G. B. Stenson (Canada)), noting that relevant material from the report of the Symposium as prepared by the co-conveners was incorporated in this response.

Ecological role of harp and hooded seals in the Northwest Atlantic

Seal/Fisheries Interactions. Interactions between seals and commercial fisheries can be broadly categorized as follows 1) transmission of parasites, 2) operational interactions, or 3) competitive (predator/prey) interactions.

Harp and hooded seals do not appear to be important hosts for any parasites that compromise the quality of the commercial fish catch in the Northwest Atlantic (Brattey and Stenson, 1993).

Operational interactions include, damage to fishing gear, damage to the catch and incidental by-catch of seals in fishing gear. Anecdotal reports of damage to fishing gear and catches by harp and hooded seals have increased during the last decade. However, there was no quantitative data available to adequately address either of these issues. In Newfoundland waters, a substantial number of seals are caught in gill nets and offshore trawls. Similar data are not available for other regions.

Several contributions and discussions at the Symposium stressed the importance of using multispecies or ecosystem approaches for assessing effects of environmental changes, variation in food supply and possible competitive interactions between marine mammals and other living marine resources in a given area. Such models have been constructed to characterize the nature of seal/fisheries interactions in other regions (e.g. the Barents Sea and the Benguela Current system). However, multispecies models incorporating Northwest Atlantic harp or hooded seals have not been constructed, partly because the data for such a model are insufficient. Until such time as adequate data are available, the impact of seal predation on commercial fish species cannot be assessed. In the following paragraphs the state of knowledge and major deficiencies in available data are reviewed.

Food Consumption. To estimate food consumption by harp and hooded seals in the Northwest Atlantic, information on the diet composition, energy requirements and the number of seals in each area is necessary. Generalized energy requirements of the seals can be estimated although they may vary with season or condition of the seal. It should be noted that data on energy requirements are mainly from captive animals and that data from free ranging seals are few.

- **Harp Seals**

Estimates of the pup population and total population size of the Northwest Atlantic harp seals are considered reliable (NAFO SCS Doc. 95/16), and the general distribution and migration patterns are known. However, the seasonal distribution and abundance of harp seals in a particular area are not known. Without this information it is necessary to use assumptions to scale diet composition data in order to estimate food consumption in specific areas.

The species composition and seasonal variation in the diet of harp seals is fairly well known in some areas (coastal areas of Newfoundland and West Greenland), not as well documented in others (Gulf of St. Lawrence, offshore Newfoundland, Arctic Canada), and virtually unknown for offshore areas of Davis Strait-Baffin Bay.

The dominant fish species in the food of harp seals are capelin and Arctic cod (*Boreogadus saida*). A number of other fish species (e.g. Atlantic cod, herring and redfish) and invertebrates (squid, shrimps and pelagic crustaceans) have been found in seal stomachs, but they appear to play a minor role in the overall diet of harp seals in the Northwest Atlantic. The majority of fish consumed are 10-20 cm in length (NAFO SCR Doc. 95/95).

The consumption of Atlantic cod, capelin and Arctic cod was estimated using a simple bio-energetics model (NAFO SCR Doc. 95/95). The total estimated prey consumed by 4.8 million harp seals in the Northwest Atlantic in 1994 was 6.9 million tons. Almost half (46%) of the prey consumed were estimated to come from Arctic waters while 40% came from waters off eastern Newfoundland and the remaining 14% from the Gulf of St. Lawrence. Using a diet derived from the average of different diet estimates between 1982 and 1993, the annual estimated consumption by harp seals was 1.2 million tons (95% C.I. 750 000-1.7 million) of Arctic cod, 620 000 tons (95% C.I. 288 000-1.0 million) of capelin and 88 000 tons (95% C.I. 45 000-140 000) of Atlantic cod in eastern Newfoundland waters. In the Gulf of St. Lawrence, they consumed 445 000 tons (95% C.I. 208 000-727 000) of capelin and 54 000 tons (95% C.I. 14 000-102 000) of Atlantic cod. However, it should be noted that these estimates of consumptions are strongly influenced by the way in which diet data are incorporated into the model and changes can result in substantially different estimates of consumption. Also, the confidence intervals reported with these estimates do not account for all possible sources of uncertainty and should be considered underestimates of the total uncertainty (NAFO SCR Doc. 95/93). Therefore, these estimates should be considered preliminary and used with caution.

- **Hooded Seals**

The estimates of pup production and total population size of hooded seals in the Northwest Atlantic are less precise than those for harp seals (NAFO SCS DOC 95/16). The general distribution and migration pattern of hooded seals is reasonably well known, but as for harp seals, seasonal abundance in specific geographic areas is not known.

Much less is known about the diet of hooded seals. The limited information available suggests that some demersal and benthic species, such as Greenland halibut, redfish, Atlantic cod, wolffish and pandalid shrimps, may be the important components of the diet in some seasons and/or areas.

A preliminary analysis of the consumption by hooded seals in the Gulf of St. Lawrence was presented at the Symposium (Symposium Paper 3.18). The study indicated that although the number of hooded seals is much lower than that of harp seals, their role as predators on some commercially important fish species such as Greenland halibut may be important. Such calculations have not been done for other areas.

Effects of Environmental Changes. Since the late-1980s there has been a notable change in the seasonal distribution of harp seals in the Northwest Atlantic compared to information collected during the previous 40 years. In recent years seals have been arriving in Newfoundland waters earlier, and staying for a longer period of time. In addition, higher numbers have been sighted in

offshore areas and in areas traditionally not used. There is evidence that seals are also remaining longer in Greenland waters. Concurrent with these changes, there has been a decline in the reproductive potential and body condition of harp seals. The proportion of females pregnant has declined from 0.76 in the mid-1980s to 0.69 in the early-1990s and the age of sexual maturity in females has increased by approximately half a year (NAFO SCR Doc. 95/37). Juvenile females were found to be smaller-at-age and have slower growth rates than in the early-1980s. In addition, adult seals were in poorer condition (i.e. leaner) in 1992 than in the mid-1970s and early-1980s (NAFO SCR Doc. 95/42). Similar information is not available for hooded seals.

The decline in reproductive potential and body condition is likely related to the increase in abundance of seals and/or changes in prey availability (Symposium Paper No. 1.3). The changes in distribution may be due directly to the extensive ice cover observed during the early-1990s, increases in range associated with larger populations, or indirectly due to changes in prey availability. The distribution and abundance of capelin and Arctic cod, two of the main prey of harp seals, changed notably since the mid-1980s. During the same period, changes in the relative importance of the two species in the diet were observed. Decreases in water temperature may have contributed to the changes in prey distribution.

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SJARE, B., G. B. STENSON, and W. G. WARREN. Summary of female harp seal reproductive parameters in the Northwest Atlantic. *NAFO SCR Doc.*, No. 37, Serial No. N2546, 9 p.

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WORKING GROUP ON SEALS. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. *NAFO SCS Doc.*, No. 16, Serial No. N2569, 40 p.

b) **Research Needs**

At its September 1994 Meeting the Fisheries Commission also requested the Scientific Council to provide "*.... recommendations on research needed to quantify further....* " *the interrelation between seals and commercial fish stocks.* The Council endorsed the following report on research needs as prepared by the *Ad hoc* Working Group.

One of the recurring themes at the Symposium was that an integrated ecosystem approach must be adopted to effectively study interactions between marine mammals and commercial fisheries. In order to build the required models for harp and hooded seals in the Northwest Atlantic the following information is required:

- Adequate estimates of abundance and distribution of all fish species in the age/size range preyed upon by seals.
- The abundance, distribution and feeding habits of other predators in the system.
- Quantitative information on the seasonal distribution of both seal species.

Once a model is constructed, sensitivity analyses should be carried out to identify future data requirements. It is apparent that in order to have confidence in the results of the model, the following will be among the additional information required:

- Precise estimates of the total population of hooded seals and current estimates for harp seals.
- Seasonal and geographic variation in the diets of both species.

- An understanding of the seasonal changes in energy requirements of seals.
- Data on the seasonal energy density of different prey species.

The ecosystem models developed using these data must be robust, yet capable of identifying the magnitude and direction of direct and indirect competitive interactions within the system. In constructing these models, marine mammal and fisheries scientists need to collect data that can be integrated at the appropriate scales both temporally and spatially.

9. Other Requests

During the concurrent meetings of the Fisheries Commission at this meeting, the Fisheries Commission plenum directed two requests regarding Shrimp in Div. 3M and one regarding Cod in Div. 3M, to the Scientific Council. The following are the responses from the Council as prepared during this meeting.

a) Request for Yield-per-recruit Calculations for Shrimp in Division 3M

The Council stressed that the analyses presented below are very preliminary and there is much uncertainty surrounding the inputs of natural mortality (M), weight-at-age, and the knife-edge recruitment pattern. No sensitivity analyses have been performed and the Commission should note the research recommendation in the Report of STACFIS, requesting yield-per-recruit analyses for consideration at the September 1996 Meeting.

Estimates of M for northern shrimp have varied widely - from as low as 0.25 for males to 1.5 for females after spawning. No estimates have yet been calculated for shrimp on Flemish Cap and in the preliminary yield-per-recruit analyses, two values were shown to illustrate the uncertainty.

Method

Yield-per-recruit calculations were performed using the following assumptions:

i) The age range used was 2 to 6+
ii) The spawning stock biomass (females) is represented by ages 5 and 6+
iii) Natural mortality (M) was set at two levels, 0.25 and 0.7 on all ages
iv) Fishing mortality (F) was fixed at 1.0 for both scenarios of M and for all ages.

Mean weights-at-age were approximated as:

Age	Weight (g)
2	2.6
3	5.0
4	7.6
5	9.8
6+	12.4

Simulations were performed which progressively increased the age at first capture from age 2 to age 5 inclusive to investigate the possible effects of such a management measure.

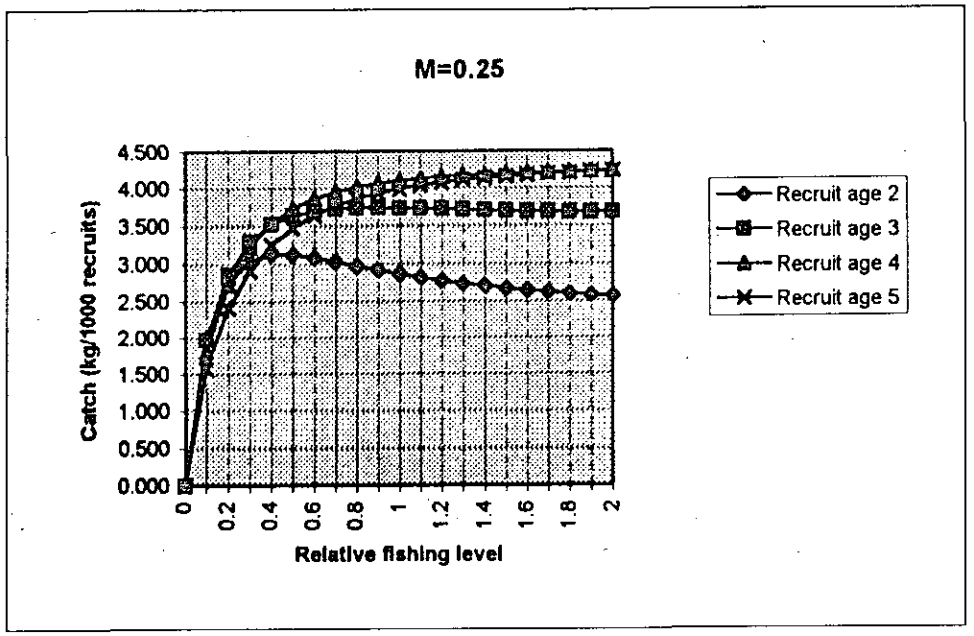
Results

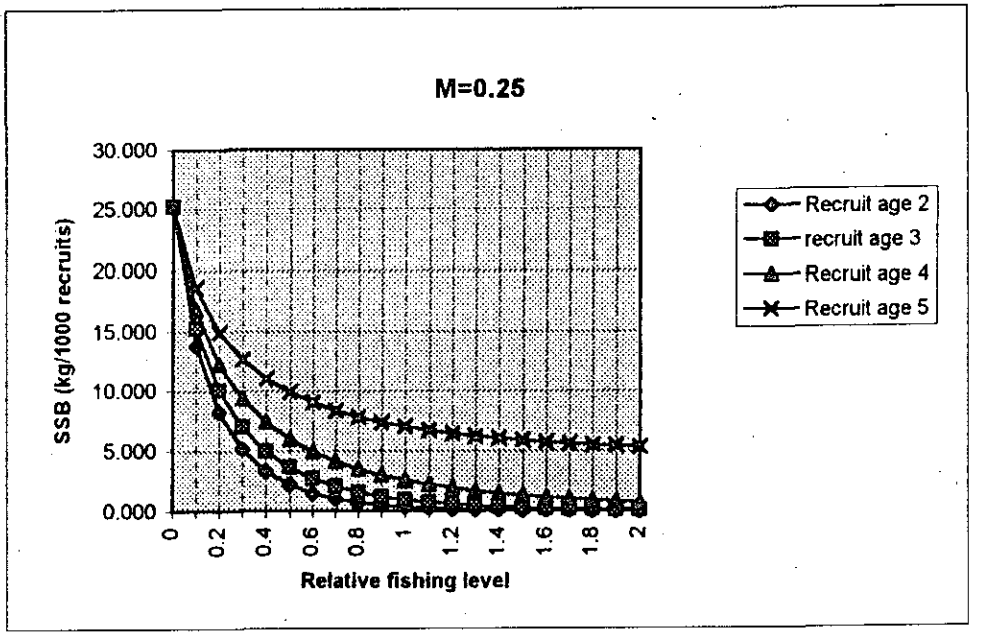
Results are presented in Figure 1 below.

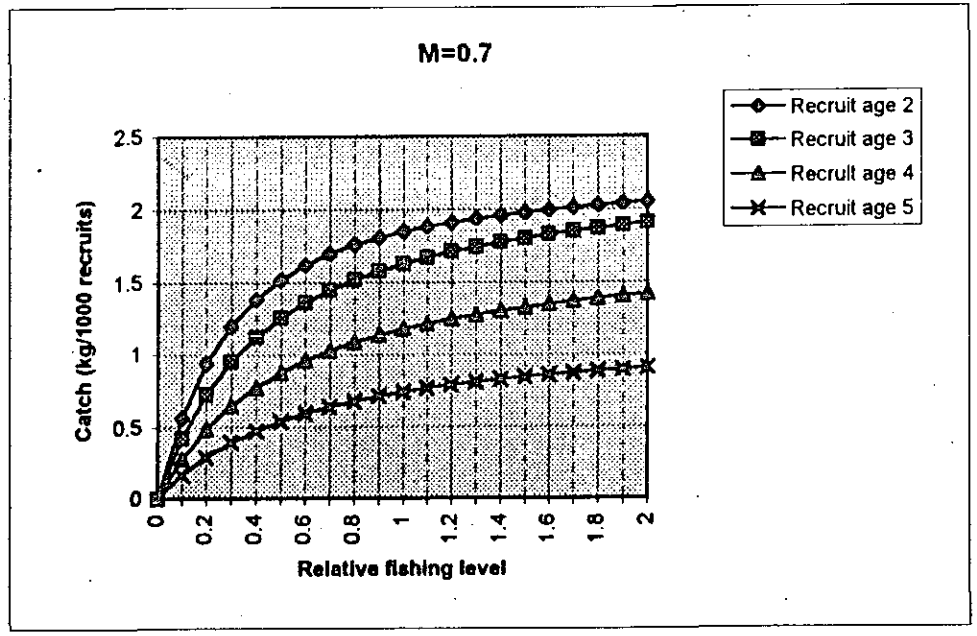
Yield - By increasing age at first capture, increases in yield are only foreseen for the lower value of M. Losses in yield were projected for the higher value of M.

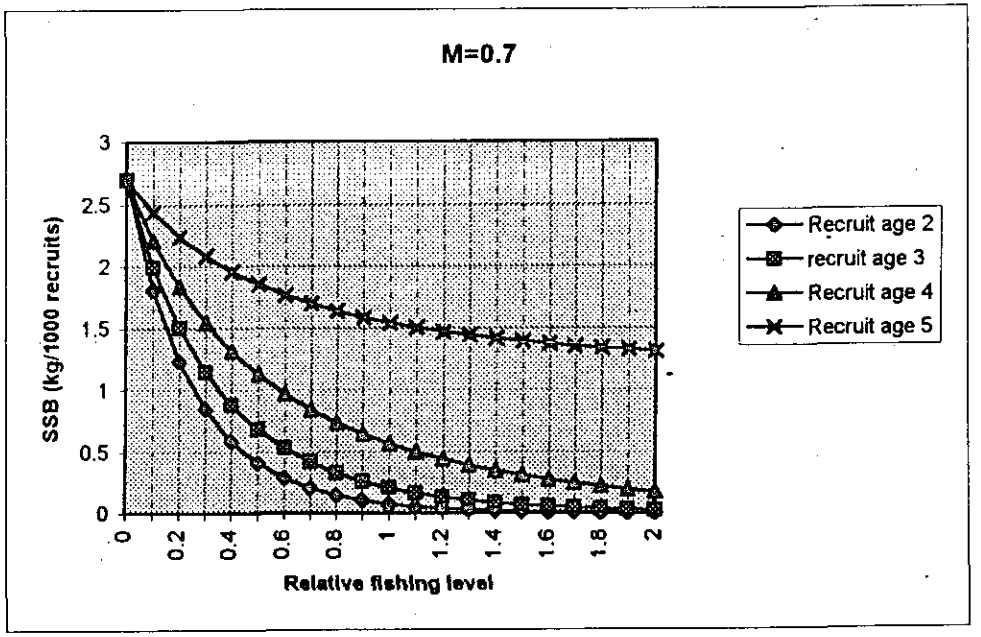
Spawning stock biomass - As expected, significant gains in SSB are predicted by increasing age at first capture under each assumption of M.

Yield and Spawning Stock Biomass per recruit for 3M shrimp, assuming two different levels of natural mortality (M).
Results are shown for differing age at recruitment to the fishery.
The Fishing mortality corresponding to a relative fishing level equal to 1, is 1.0 per year on exploited age groups.









b) **Request for Information on the Amount of Data Used in the Assessment of the Shrimp in Division 3M**

The data available to the Council are summarized in the table below. The Council noted that several countries had substantial fisheries on the Flemish Cap for shrimp without submitting any biological data. The lack of such data weakened the assessment.

Data available from the 1995 (up to 31 August) shrimp fishery in Div. 3M by nation.

Nation	Min. No. of vessels	Catch	Effort	CPUE	Fishing positions	No. Shrimp measured+	Shrimp discard	Preliminary By-catch	Total catch
CAN	7	X	X	X	X	26 381	X	X	939
EST	6	X	X	X					1 616
FRO	6	X	X	X					3 990
GRL	6	X	X	X	X	16 677	X	X	2 321
ISL	16	X	X	X					4 269
LVA	4								*350
LTV	4								*675
NOR	20					42 899			*6 100
E/POR	1								*150
RUS	15								*2 500
E/ESP	1								*158
Total	86					85 957			23 068

* Catch estimates from Canadian surveillance only.
\+ Approximately 500 shrimp per sample.

c) **Request on the Equilibrium Yield and Corresponding Spawning Stock Biomass for Division 3M Cod**

The yield-per-recruit for Div. 3M cod was calculated for a 130 mm mesh size. The mean length and weight-at-age were taken from data from the EU survey series. The natural mortality was assumed to be 0.2. The result was Y/R = 0.888 kg per recruit for $F_{0.1}$. The $F_{0.1}$ was calculated at 0.12.

At the June 1995 Meeting an Extended Survival Analysis was presented, however, the Council considered that these results were illustrative of abundance and biomass trends but not reliable for use in projections.

At the present low level of spawning stock biomass, recruitment varies widely between years. The recruitment and in particular its variability that would be produced at a much higher level of spawning stock biomass, remain unknown.

Assuming that recruitment followed the pattern seen in the period 1988-94, the yield would be around twice the current TAC but varying considerably between years. The spawning stock biomass could be 3 to 25 times greater than the level recently observed.

VII. REVIEW OF FUTURE MEETING ARRANGEMENTS

1. **Scientific Council Meeting on Northern Shrimp, November 1995**

The Council agreed to revise the dates for this meeting to 17-20 November 1995. This meeting will deal with shrimp in SA 0+1, and in Denmark Strait and off East Greenland. The meeting will be held at NAFO Headquarters, Dartmouth, Nova Scotia. The Agenda will be circulated on 15 September 1995.

2. **June 1996 Meeting of Scientific Council**

The dates previously proposed were confirmed to be 5-19 June 1996 and the meeting will be held in Dartmouth Keddy's Inn, Nova Scotia, Canada. The Council particularly noted the requirements of computer printers and such hardware given in the STACFIS Report and requested the Secretariat to attend to these requirements.

3. **Special Session and Annual Meeting September 1996**

The Council noted the dates for the 18th Annual Meeting of 7-13 September 1996 and confirmed the Special Session dates to be 4-6 September for the Workshop on 'Assessment of Groundfish Stocks Based on Bottom Trawl Survey Results'. The meeting place will be in the Dartmouth/Halifax area.

4. **June 1997 Meeting of the Scientific Council**

The provisional dates are 4-18 June 1997 and the meeting place will be in the Dartmouth/Halifax area.

VIII. FUTURE SPECIAL SESSIONS

1. **Progress Report on Workshop of September 1996**

The Chairman (and convener, H. Lassen, EU-Denmark) confirmed that plans for the Workshop on 'Assessment of Groundfish Stocks Based on Bottom Trawl Survey Results' to be held during 4-6 September 1996 have been finalized. Session chairmen have been selected, S. Smith (Canada), M. Stein (EU-Germany), H.-J. Ratz (EU-Germany), S. Walsh (Canada), and they have all accepted the tasks. A flyer has been circulated to participants of this Annual Meeting. The session chairmen will proceed to prepare text for this Workshop and these texts will be considered for publication possibly in NAFO Scientific Council Studies in conformity with the Workshop of 1992. It was noted the Workshop will be limited to 25-30 participants with preference given to Scientific Council members.

2. **Progress Report on Symposium of September 1997**

The Symposium titled 'What future for Capture Fisheries' is planned to be convened in St. John's Newfoundland during 10-12 September 1997 in conjunction with the 19th Annual Meeting. The Chairman (and convener, H. Lassen, EU-Denmark) reported on the progress, and presented a draft for the flyer to be circulated immediately after this meeting. There had been communication with the organizers of the John Cabot 500th Anniversary celebration agency in St. John's and the symposium outline and schedule had been communicated to the organizing board. The announcement had been favourably received by this organizing board and it will be necessary to continue close communication with the organizers. The next step for the Scientific Council in the organization of the Symposium is to identify keynote speakers and to raise funds for this symposium. The convenor will in collaboration with the Secretariat continue to raise funds and to find suitable keynote speakers. Considering the high ambitions for the Symposium it is estimated that approximately USD 50 000 would be needed. The flyer as accepted by the Council (see Annex 2, this report), will now be issued.

IX. OTHER BUSINESS

The Council agreed that participants lists accompanying the Scientific Council Reports should be as complete as possible, particularly including telephone and telefax numbers, and E-mail addresses. It was again observed that the Secretariat should obtain E-mail facilities as soon as possible.

X. ADOPTION OF REPORTS

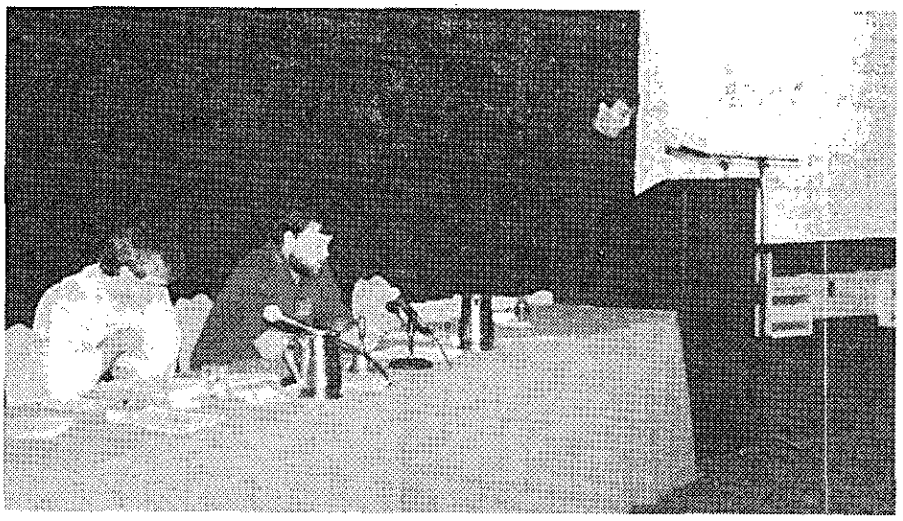
The Council met briefly at 0900 on 15 September 1995 and **adopted** the reports of its Committees (STACFIS, STACREC and STACPUB). These reports are given in Appendix I, II, and III, respectively. It then **adopted** its own Report of Scientific Council, 9-15 September 1995.

XI. ADJOURNMENT

The Chairman thanked everybody for the time he had the honour to serve as Chairman of Scientific Council. He thanked the Secretariat and the Assistant Executive Secretary for the support given to the Council and its Committees in fulfilling their work. He wished his successor W. R. Bowering (Canada) and the incoming Vice-Chairman H. P. Cornus (EU-Germany) all the best in their new capacities. In closing the meeting he wished everybody a safe journey home.

The incoming Chairman, on behalf of the Council members thanked the Chairman, H. Lassen, for his dedicated and efficient work in guiding the Council through these recent years, noting he had acted as Chairman of many key meetings before taking the Chairmanship in September 1993. The Council extended its gratitude to the Chairman for his continued support by accepting to be convener of the 1996 Special Session Workshop and the 1997 major Symposium, and hoped his contributions to the Council will continue into the future.

SYMPOSIUM ON 'THE ROLE OF MARINE MAMMALS IN THE ECOSYSTEM', 7-9 SEPTEMBER 1995



SPEAKER AT THE CLOSING SESSION

SYMPOSIUM CO-CONVENERS: J. SIGURJONSSON AND G. B. STENSON

ANNEX 1. REPORT OF THE NAFO/ICES SYMPOSIUM ON THE ROLE OF MARINE MAMMALS IN THE ECOSYSTEM

Further to the NAFO Scientific Council initial discussion in June 1989 (NAFO Sci. Coun. Rep., 1989, p. 116) and its decision in September 1992 (NAFO Sci. Coun. Rep., 1992, p. 177), the Joint NAFO/ICES Symposium on 'The Role of Marine Mammals in the Ecosystem' was held during 6-8 September 1995. The Symposium was hosted by the Scientific Council in conjunction with the NAFO 17th Annual Meeting.

The meeting was opened by W. B. Brodie (Canada), (STACFIS Chairman) who on behalf of the Scientific Council, gave a brief introduction to NAFO and its structure and activities, and commented on the importance of the scientific information from this Symposium to NAFO. J. Harwood (EU-United Kingdom), on behalf of ICES then welcomed the participants.

The following report was prepared by the co-convenors with the assistance of the session Chairs.

Introduction

The Symposium on the 'Role of Marine Mammals in the Ecosystem' was co-sponsored by the NAFO Scientific Council and the International Council for the Exploration of the Sea (ICES) with G. B. Stenson (Canada) and J. Sigurjónsson (Iceland) as co-convenors. It was held 6-8 September 1995 at the Holiday Inn, Dartmouth, Nova Scotia, Canada.

The aim of the Symposium was to attract scientists from relevant disciplines with expertise in different geographical areas to address the question of the role of mammals in the marine ecosystem. The three day Symposium was divided into four theme sessions: (1) Environmental, spatial and temporal influences on life histories (Chair: T. Haug, Norway), (2) Foraging strategies and energetic considerations in the diet (Chair: I. McLaren, Canada), (3) Marine mammal - fisheries interactions (Chair: W. D. Bowen, Canada), and (4) Theoretical considerations on the role of apex predators and multispecies models (Chair: G. A. Vikingsson, Iceland). Each session consisted of a keynote address, followed by contributed oral presentations and an extended general discussion. Poster presentations were displayed throughout the Symposium in addition to specific poster sessions.

The Symposium was attended by 113 participants from 16 countries (Argentina, Brazil, Canada, Denmark (Greenland), France, Germany, Iceland, Japan, Norway, Portugal, Russia, South Africa, Spain, The Netherlands, United Kingdom and United States of America). In total, 30 oral and 21 poster contributions were presented. A list of contributions and participants is included at the end of this report.

Papers presented at the Symposium will be considered for publication in the Journal of Northwest Atlantic Fisheries Science.

Thematic Considerations

Following is a brief summary of the presentations and of discussions that took place at the end of the respective theme sessions.

Environmental, Spatial and Temporal Influences on Life History

Seven oral and four poster presentations were presented on the relationships between environmental, spatial, temporal factors and life history parameters. The session began with a keynote address (Symposium Paper 1.1) entitled "The Spatial Dynamics of Large Marine Organisms" presented by D. Schneider (Canada) who illustrated that the distribution and spatial dynamics of large marine organisms in relation to physical environment may be more productively investigated by testing hypotheses in relation to well defined models than by direct correlation with physical measurements such as temperatures, salinity, or depth. Correlations may, however, be useful in identifying potential hypothesis for testing. Biological and physical processes need to be examined over a large variety of scales which may not be similar for all disciplines or objectives.

Several contributions addressed the physical and biological characteristics of the habitats of marine mammals. Correlations between cetacean distribution data and physical and biological parameters were demonstrated (1.7, 1.8, 1.15) and the potential of using detailed habitat analyses to predict potential areas of occurrence of the same species was shown (1.9). Dimensionless ratios of various scales were used to determine changes in distribution (1.10).

Apparent changes in the distribution of various species of marine mammals have been observed (1.3, 1.12, 1.13, 1.14) which may be related to changes in environmental conditions, sighting effort, or other factors.

Changes in the reproduction potential and body condition of harp seals in the Northwest Atlantic have been observed, which may be related to changes in seal population size, prey availability or an interaction between them (1.3). The occurrence of significant seasonal variation in body condition of Barents Sea harp seals was considered to be of importance in evaluation of the ecological role of the species (1.4).

The general discussion focused on two main issues. The first was related to the correlation between marine mammals and the scale of observations. The scale at which a marine mammal and fisheries scientists operate may not be comparable and information about prey abundance are often collected for assessment purposes which may not always fulfil the requirements needed for evaluation of marine mammal ecology. Therefore, correlation must often be made to physical or oceanographic factors which do not vary within a short time frame.

The second major topic of the discussion was the question of density dependent changes in populations of marine mammals. Although changes in morphology and reproduction parameters have been demonstrated for a number of species, such as the Northwest Atlantic harp seals, it was not clear that they have been proven to be due to classical density dependent processes. The cause of these changes becomes important if we wish to predict future changes in the population.

Foraging Strategies and Energetic Consideration

Six oral and seven poster contributions were presented on the theme of this session. The keynote address (2.1) entitled "Approaches to the quantification of the energetic requirements of marine mammal populations and their impact on marine ecosystems" was presented by G. A. J. Worthy (USA). Although the relative frequencies of food items in the diet can often be established, estimates of consumption required for determining the role and impacts of marine mammals require a variety of approaches for estimating metabolic demand to quantify and apportion prey items. Recent information on the energetic requirements of a variety of species indicate that assuming energy requirements based upon generalized mammalian relationships with body mass (the "Kleiber line") may not be appropriate for all marine mammals. New techniques of estimating diet, such as fatty acid signature analysis and stable isotope ratios, were presented and their applicability to answer different types of questions were discussed (2.2, 2.3).

A number of presentations extended traditional dietary analysis beyond the usual mere enumeration of stomach contents. Using data from the stomachs contents of fin whales off Iceland (2.4), a diel rhythm in feeding was identified and the average daily intake estimated. Recent studies provide new insights into various aspects of the foraging behaviour of Northeast Atlantic minke whales; comparison of prey consumed to estimated prey abundance obtained from resource surveys using qualitative and quantitative statistics suggests that minke whales exhibit prey selection (2.5, 2.9) while examination of the stomach contents lead to the hypothesis that the meal size varies according to the spatial distribution of the prey (2.6). Also, large and small minke whales appear to exploit the same resources in given areas, although whale size and prey type influence meal size (2.6).

An example of the use of spatial and temporal patterns in the distribution of prey and predator to identify potential interactions was presented (2.13) as well as a method of investigating prey selection in captive seals (2.7). Information on the diet of a number of species in areas which were previously unknown were presented (2.9, 2.10, 2.12) along with comparisons of the diet of co-existing predators (2.8, 2.11), or the same predator in different geographical areas (2.11).

The general discussion focused upon the usefulness of fatty acid signature analysis and stable isotope ratios for determining diets. It was noted that these methods are not intended to replace traditional techniques, but rather provide additional tools to answer specific questions. However, in order for these techniques to be useful, adequate baseline data from the potential prey species in the ecosystem must be obtained.

Marine Mammal-Fisheries Interactions

A total of 12 oral and 10 poster contributions addressing issues of marine mammal - fisheries interactions were presented. The keynote paper (3.1) entitled "On modelling approaches for evaluating seal-fishery interactions: initiatives in South Africa and for the Antarctic" was presented by D. Butterworth (South Africa). It reviewed recent modelling studies of the Benguela Current and Southern Ocean ecosystems. Perhaps the most important results of these studies is the recognition that realistic models of the interactions between marine mammal populations and fisheries must account for the major interactions affecting the system, while at the same time simplifying the system

to the point where analyses are tractable. Associated with this process is the need for the development of a risk assessment framework within which the probabilities and consequences of different outcomes may be evaluated.

Several presentations provided information that showed strong geographic and seasonal variation in the composition of the diets of pinnipeds and cetaceans. These data coupled with information on mammal abundance, individual energy requirements, and prey energy content were used to estimate the biomass of prey consumed by harp seals in the Northwest Atlantic (3.5), hooded seals in the Gulf of St. Lawrence (3.18), Cape fur seals in the Benguela ecosystem (3.2), cetaceans along the northeastern continental shelf of the United States (3.8), in waters around and adjacent to Iceland (3.22), and off the coast of Patagonia, Argentina (3.10). In all areas, marine mammals consumed large amounts of biomass, often equal to or greater than that taken by commercial fisheries, but the species consumed were a mixture of commercial and non-commercial prey. Estimates of consumption by harp seals in Atlantic Canada (3.5) illustrate the importance of understanding how diet data are incorporated into the model since changes can result in substantially different estimates. A study of estimated consumption of Atlantic cod by grey seals on the Eastern Scotian Shelf, Canada (3.4), emphasized the need for a better understanding of the functional form of seal predation, the level of natural mortality on young cod, and the sources and relationships among other components of natural mortality before the impact of seals on prey populations could be assessed.

A significant change in the age distribution of cod in the diet of seals off Iceland and concurrent declines in the size of seal stocks was observed (3.3). To determine if there was evidence of increasing juvenile mortality consistent with predictions based upon predation by seals, mortality was estimated from research vessel surveys for several Northwest Atlantic cod stocks (3.6). Although no trends were detected, the ability of the tests to detect such changes given the variability of the survey data was debated.

The potential competition between marine mammals and fisheries for prey and primary productivity in the Pacific Ocean was examined using a steady state model (3.9). Although data for many species of the marine mammals included can only be approximated as order of magnitude, the study indicated that marine mammals likely consume three times as much food (commercial and non-commercial species) as that taken by fisheries. Another study (3.7) suggested that comparison of different ecosystems, such as the Bering Sea and Barents Sea, might yield insights as to the nature of the ecological interactions between pinnipeds and fisheries.

Operational interactions between marine mammals and fisheries were discussed in six presentations. Mortalities or injuries to cetaceans due to interactions with fishing gear were documented for the US Atlantic coast and Gulf of Mexico (3.14), and the waters of the continental slope southwest of Ireland (3.15). A review of documented interactions between cetaceans and trawlers was presented (3.16) along with a study of gear damage and depredation due to apex predators in eastern Florida, USA (3.13). Preliminary results of the use of acoustic devices to reduce the incidental catch of harbour porpoise in groundfish gillnets (3.12) are encouraging. A study of surfacing patterns in captive and wild harbour porpoise (3.21) may provide behaviourial data related to the incidental capture of porpoise in fishing gear.

Still another form of interaction was illustrated by two presentations describing the parasitic fauna of beluga in the Gulf of St. Lawrence, Canada (3.19) and grey seals in Iceland (3.20). Parasites may be an important cause of mortality in beluga and a useful tool for identifying stock identity while parasitic loads in grey seals may have an impact on the parasitic burdens of commercially important fish species.

A framework developed by the Scientific Advisory Committee of the Marine Mammal Action Plan coordinated by UNEP for the scientific evaluation of programs to cull marine mammals to benefit fisheries (3.11) was presented for discussion.

The general discussion focused on the fact that the results of models designed to determine impact of marine mammals on fisheries are imprecise in most situations. Therefore, we should consider developing robust models which provide us with information on the direction and the order of magnitude of the impact. The ability of the model to distinguish among alternative scenarios must be considered. It was also noted that several studies indicate that consumption of fish resources by other predators such as predatory fish or seabirds may be important in some ecosystems.

Theoretical Considerations on the Role of Apex Predators and Multispecies Models

Five oral contributions considered theoretical considerations on the role apex predators and the use of multispecies models. The keynote address (4.1) entitled "Assessing the relationship between apex predators and fisheries: where do we go from here?" was delivered by J. Harwood (UK). Examples of marine mammal - fisheries interactions and methods for studying these were presented. Recent studies of grey seals off the coast of England

(UK) show great 'patchiness' in foraging behaviour. Therefore, it is necessary to study all of the interacting components, including the marine mammals, the prey species and the fisheries, at a finer scale than has been done previously. In order to develop dynamic models of interactions, information on the functional relationship between marine mammals and their prey, other predators, and fishermen are required.

An example of a method for quantifying sources of uncertainty for each of the components involved in estimating prey consumption of harp seals was presented (4.2) indicating considerable uncertainty in the estimates of consumption due to variability in the diet samples. Such calculations are important in identifying research needs and for evaluating alternative management options.

Alternative hypothesis proposed to explain declines in Stellar sea lions and seabirds, and increases in groundfish in the Bering Sea were described and evaluated (4.4). These changes could have been caused by changes in the environment, competition with commercial fisheries, or direct competition between sea lions and gadids for food.

Multispecies interactions in the Barents Sea were explored by using a simulation model (4.3). Sensitivity of the model to food preferences and stock sizes of harp seals and minke whales, and the relative importance of these two species to the main fish predator, cod, was described. Off Iceland, the potential interactions among three piscivorous baleen whales and their principal prey were explored using a multispecies simulation model (4.5). The results indicated that baleen whales may have significant direct and/or indirect long-term impacts on the prey species.

The general discussion dealt with specific aspects of the analysis presented and restated many of the common themes of previous discussions. The concern that multispecies models should take into account uncertainties in the inputs was emphasized.

Summary

Throughout the Symposium, reoccurring themes became evident. The basic premise of the symposium that a variety of biological and physical components in the ecosystem must be considered in order to determine the role of marine mammals and the need to include scientists from various disciplines, was emphasized. It was also evident that marine mammals must be considered on a variety of spatial and temporal scales and that their role may vary among them. The scales at which marine mammals are studied are often not compatible with the information available from other disciplines and this can only be resolved through cooperative studies with other disciplines. With respect to marine mammal - fisheries interactions, studies should take into account potential secondary interactions such as other predators or prey, which may result in conclusions which are counter-intuitive. However, in many cases it may not be possible to quantify the interactions precisely and therefore, models incorporating uncertainties in the inputs must be robust and yet capable of identifying the magnitude and direction of competitive interactions within the system.

Contributions to the Symposium

Theme Session 1: Environmental, Spatial and Temporal Influences of Life History

Oral Presentations

1.1* D. C. Schneider. The Spatial Dynamics of Large Marine Organisms.

1.3* B. Sjare, D. Chabot and G. Stenson. Declines in the Reproductive Potential and Body Condition of Harp Seals: Response to a Changing Marine Environment?

1.4* K. T. Nilssen, P. E. Grotnes, T. Haug and V. Potelov. Seasonal Variation in Condition of Adult Barents Sea Harp Seals, *Phoca groenlandica*.

1.7* R. B. Griffin. An Investigation of Relationships Between Delphinid Distributions and Copepod Abundances.

1.8* C. T. Tynan. Characterization of Oceanographic Habitat of Resident and Migratory Species of Cetaceans in the Southern Ocean Between 82-115°E.

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* Symposium Paper Number.

1.9* E. Moses and J. T. Finn. Using Geographic Information Systems to Describe Associations Between Right Whale (*Eubalaena glacialis*) Distribution and Sea-surface Temperature and Bathymetry on the Scotian Shelf.

1.10* F. Marques, J. K. Horne and J. Lien. Evaluating the Influence of Biological and Physical Processes on North Atlantic Humpback Whale Distribution.

Poster Presentations

1.12* D. Borggaard, J. Lien, S. Todd, P. Stevick and P. Hennebury. Long-term Effects of Underwater Noise Associated with Industrial Activity on Cetaceans in Trinity Bay, Newfoundland.

1.13* E. Hauksson and V. Bogason. Occurrences of Harp Seal (*Phoca groenlandica*), Hooded Seal (*Cystophora cristata*), Bearded Seal (*Erignathus barbatus*) and Ringed Seal (*Phoca hispida*) in Coastal Waters of Iceland, in the Period 1989-1994.

1.14* F. Marques, J. Lien, D. E. Sergeant and R. Seton. Changes in Sightings, Strandings and Fishing Gear Entrapments of Arctic Species of Cetaceans in Newfoundland Waters: A response to Changes in Ice Conditions?

1.15* S. E. Moore and D. P. DeMaster. Cetacean Habitats in the Alaskan Arctic.

Theme Session 2: Foraging Strategies and Energetic Considerations

Oral Presentations

2.1* G. A. J. Worthy. Approaches to the Quantification of the Energetic Requirements of Marine Mammal Populations and Their Impact on Marine Ecosystems.

2.2* S. J. Iverson. Principles of Fatty Acid Signature Analysis and its Use in Studying Foraging Ecology and Diets of Marine Mammals.

2.3* S. Todd, P. Ostram, J. Lien and J. Abrajano. Use of the Stable Isotope Ratio $\delta^{13}C$ to Determine Diet in Humpback Whales (*Megaptera novaeangliae*).

2.4* G. Vikingsson. Feeding of Fin Whales Off Iceland: Diurnal Variation and Feeding Rates.

2.5* H. J. Skaug, H. Gjøsæter, T. Haug, U. Lindstrøm and K. T. Nilssen. Do Minke Whales, *Balaenoptera acutorostrata*, Exhibit Particular Prey Preferences?

2.6* T. Haug, U. Lindstrøm, K. T. Nilssen and H. J. Skaug. On the Variation in Size and Individual Composition of Minke Whale *Balaenoptera acutorostrata* Meals.

Poster Presentations

2.7* G. Boyle. An Operant Method of Investigating Prey Selection in Seals.

2.8* S. Hassani, L. Antoine and V. Ridoux. A Comparative Approach to the Diets of Dolphins, Tunas, Sharks and Other Large Oceanic Predators Sampled in the French Tuna Driftnet Fishery of the North-East Atlantic.

2.9* T. Haug, U. Lindstrøm, K. T. Nilssen, I. Røttingen and H. J. Skaug. Diet and Food Availability for Northeast Atlantic Minke Whale, *Balaenoptera acutorostrata.*

2.10* E. Hauksson and V. Bogason. Comparative Studies on Food and Feeding Habits of Grey Seals (*Halichoerus grypus*), Common Seals (*Phoca vitulina*), Harp Seals (*Phoca groenlandica*), and Hooded Seals (*Cystophora cristata*) in Coastal Waters of Iceland.

2.11* J. W. Lawson and G. B. Stenson. Diet of Newfoundland Harp Seals: Nearshore and Offshore Contrasts.

2.12* J. Sigurjónsson, G. A. Vikingsson and S. D. Halldórsson. Food and Feeding Habits of Harbour Porpoise (*Phocoena phocoena*) off the Southwestern Coast of Iceland.

2.13* G. T. Waring and J. T. Finn. Cetacean Trophic Interactions off the Northeast USA Inferred From Spatial and Temporal Co-distribution Patterns.

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Theme Session 3: Marine Mammal - Fisheries Interactions

Oral Presentations

3.1* D. S. Butterworth. On Modelling Approaches for Evaluating Seal-Fishery Interactions: Initiatives in South Africa and for the Antarctic.

3.2* J. H. M. David, J.-P. Roux and W. K. Oosthuizen. Consumption and Diet of the Cape Fur Seal and Possible Competition With Fisheries in the Benguela Ecosystem.

3.3* E. Hauksson. Age Selection of Cod (*Gadus morhua*) by Grey (*Halichoerus grypus*) and Common (*Phoca vitulina*) seals, in Icelandic Waters, and Possible Effects of the Predation on the Cod Recruitment.

3.4* R. Mohn and W. D. Bowen. Grey Seal Predation on Eastern Scotian Shelf Cod: Consumption, Predation Mortality, and Potential Impacts.

3.5* G. B. Stenson, M. O. Hammill and J. W. Lawson. Predation of Atlantic Cod, Capelin and Arctic cod by Harp Seals in Atlantic Canada.

3.6* A. Sinclair, R. A. Myers and J. Hutchings. Seal Predation: Is There Evidence of Increased Mortality on Cod.

3.7* M. Shima, A. B. Hollowed and G. R. Van Blaricom. Comparing Pinniped-Fishery Interactions in Two Ecosystems.

3.8* R. D. Kenney, G. P. Scott, T. J. Thompson and H. E. Winn. Estimates of Prey Consumption and Trophic Impacts of Cetaceans in the Northeast U.S. Continental Shelf Ecosystem.

3.9* A. W. Trites, D. Pauly and V. Christensen. Competition Between Fisheries and Marine Mammals for Prey and Primary Production in the Pacific Ocean.

3.10* E. A. Crespo, S. N. Pedraza, S. L. Dans, M. K. Alonso, L. M. Reyes, N. A. Garcia, M. Coscarella, Y. Adri and C. M. Schiavini. Direct and Indirect Effects of the High Seas Fisheries on the Marine Mammal Populations in the Northern and Central Patagonian Coast.

3.11* M. Earle (J. Harwood). Scientific Analysis of Proposals to Cull Marine Mammals for Purposes of Fisheries Management.

3.12* J. Lien, C. Hood, D. Pitman, D. Borggaard and C. Richter. Field Tests of Acoustic Devices on Groundfish Gillnets: Assessment of Effectiveness in Reducing Harbour Porpoise By-Catch.

Poster Presentations

3.13* N. B. Barros and D. H. Adams. Fishery Interactions with Apex Predators in the Indian River Lagoon System, Florida.

3.14* R. A. Blaylock and L. J. Hansen. The Effects of Commercial Fishing Activity on Coastal Bottlenose Dolphin Distribution Behavior, and Mortality Patterns.

3.15* A. S. Couperus. Interactions Between Dutch Midwater Trawlers and Atlantic White-sided Dolphins (*Lagenorhynchus acutus*) Southwest of Ireland.

3.16* D. Fertl and S. Leatherwood. A Review of Cetacean Interactions With Trawls.

3.18* M. O. Hammill, C. Lydersen, K. Kovacs and B. Sjare. Fish Consumption by Hooded Seals in the Gulf of St. Lawrence.

3.19* L. N. Measures. Helminths of Beluga, *Delphinapterus leucas*.

3.20* D. Ólafsdóttir and E. Hauksson. Anisakid (Nematoda) Infections in Icelandic Grey Seals (*Halichoerus grypus*).

3.21* C. Richter and H. Van Doninck. A Comparison of Spatial and Temporal Surfacing Patterns in Harbour Porpoise Observed in the Wild and In Captivity.

3.22* J. Sigurjónsson and G. Vikingsson. Estimation of Food Consumption by Cetaceans in Icelandic and Adjacent Waters.

3.23* S. S. Wallace and J. Conway. Developing a System of Integrated Management for the Protection and Conservation of Endangered Marine Mammals.

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Theme Session 4. Theoretical Considerations on the Role of Apex Predators and Multispecies Models.

Oral Presentations

4.1* J. Harwood and P. Rohani. *Assessing* the Relationship Between Apex Predators and Fisheries: Where Do We Go From Here?

4.2* P. A. Shelton, W. G. Warren and G. B. Stenson. Quantifying Some of the Major Sources of Uncertainty Associated with Estimates of Harp Seal Prey Consumption.

4.3* B. Bogstad, K. H. Hauge and Ø. Ulltang. MULTISPEC - A Multispecies Model for Fish and Marine Mammals in the Barents Sea.

4.4* R. L. Merrick. Current and Historical Roles of Apex Predators in the Bering Sea Ecosystem .

4.5* G. Stefánsson, J. Sigurjónsson and G. A. Vikingsson. On Dynamic Interactions Between Some Fish Resources and Cetaceans off Iceland Based on a Simulation Model.

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* Symposium Paper Number.

List of Participants

Co-conveners:

J. Sigurjónsson
Marine Research Institute
Skulagata 4
P. O. Box 1390
121-Reykjavik
ICELAND

Phone: +354-55-20240
Fax: +354-56-23790
E-mail: johann@hafro.is

G. B. Stenson
Science Branch
Department of Fisheries and Oceans
P. O. Box 5667
St. John's, Newfoundland
CANADA A1C 5X1

Phone: +709-772-5598
Fax: +709-772-3207
E-mail: stenson@nflorc.nwafc.nf.ca

ARGENTINA

Crespo, E. A. — Casilla de Correo # 67, 9120 Puerto Madryn, Chubut
Phone: +965 51024 - Fax: +965 51543 - E-mail: crespo@cenpat.criba.edu.ar

BRAZIL

Secchi, E. R. — Laboratorio de Mamiferos Marinhos, Museu Oceanografico, "Prof. Eliezer de Carvalho Rios"
Caixa Postal 379, 96.200-970 Rio Grande RS
Phone: +0532 323496 - Fax: +0532 329633 - E-mail: musmamif@brfurg.bitnet

Rocha-Campos, C.C. — Laboratorio de Mamiferos Marinhos, Museu Oceanografico, "Prof. Eliezer de Carvalho Rios"
Caixa Postal 379, 96.200-970 Rio Grande RS
Phone: +0532 32 3496 - Fax: +0532 32 9633 - E-mail: musmamif@brfurg.bitnet

CANADA

Atkinson, D. B. — Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland, A1C 5X1
Phone: +709-772-2052 - Fax: +709-772-4188 - E-mail: atkinson@nflorc.nwafc.nf.ca

Beamish, P. C. — Dir., Ceta-Res. Inc., (Whales, Dolphins, Porpoises), Box 10, Trinity, Trinity Bay, Nfld. A0C 2S0
Phone: +709-464-3269 - Fax: +709-464-3700 - E-mail: beamish@random.ucs.mun.ca

Borggaard, D. L. — Whale Research Group, Memorial University of Newfoundland, St. John's, Nfld, A1C 5S7
Phone: +709-753-5495 - Fax: +709-737-2450 - E-mail: dborggaard@kean.ucs.mun.ca

Bowen, W. D. — Bedford Institute of Oceanography, P. O. Box 1006, Dartmouth, Nova Scotia, B2Y 4A2
Phone: +902-426-8909 - Fax: +902-426-1506 - E-mail: d_bowen@bionet.bio.ns.ca

Boyle, G. J. — Dept. of Zoology, University of Guelph, Guelph, Ontario, N1G 2W1
Phone: +519-824-4120 - Fax: +519-767-1656 - E-mail: gboyle@uoguelph.ca

Brodie, W. B. — Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland, A1C 5X1
Phone: +709-772-2054 - Fax: +709-772-4188 - E-mail: brodie@nflorc.nwafc.nf.ca

Bruce, K. A.	Marine Mammals, Dept. of Fisheries & Oceans, 200 Kent St., Ottawa, Ontario, K1A 0E6 Phone: +613-990-0289 - Fax: +613-954-0807
Christal, J.	Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-3723 - Fax: +902-494-3736
Clay, D.	Fundy National Park, Dept. of Canadian Heritage, P. O. Box 40, Alma, New Brunswick, E0A 1B0 Phone: +506-887-6100 - Fax: +506-887-6011 - E-mail: clay@nbnet.nb.ca
Conway, J.	Resource Manag. Br., Dept. of Fisheries & Oceans, P. O. Box 550, Halifax, NS, B3J 2S7 Phone: +902-426-9609 - Fax: +902-426-9683
Doubleday, W. G.	Sci. Directorate, Dept. of Fish. & Oceans, 200 Kent St., Ottawa, Ont., K1A 0E6 Phone: +613-990-0271 - Fax: +613-954-0807
Ellis, S. L.	Dalhousie University, P. O. Box 695, R.R.#1, Tantallon, Nova Scotia, B0J 3J0 Phone: +902-823-2227 - E-mail: blimp@ac.dal.ca
Gosselin, J.-F.	Fisheries and Oceans, Maurice-Lamontagne Institute, C.P. 1000, Mont-Joli, Quebec G5H 3Z4 Phone: +418-775-0581 - Fax: +418-775-0542
Gowans, S.	Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-3723 - Fax: +902-494-3736
Haché, J.	Fisheries Management, 200 Kent Street, 15th Floor, Ottawa, Ontario, K1A 0E6 Phone: +613-993-0609 - Fax: +613-990-1514
Hall, C.	National Reporter, CBC Radio, P. O. Box 3000, Halifax, Nova Scotia B3J 3E9 Phone: +902-420-4342 - Fax: +902-420-4357
Hammill, M. O.	Dept. of Fisheries and Oceans, P. O. Box 1000, Mont-Joli, Quebec G5H 3Z4 Phone: +418-775-0580 - Fax: +418-775-0542
Harrison, G.	29 Parkhill Road, Halifax, Nova Scotia B3P 1R2 Phone: +902-477-1788
Hood, C.	Dept. of Psychology, Whale Research Group, Memorial Univer., St. John's, Nfld, A1C 5S7 Phone: +709-737-8414 - Fax: +709-735-2450
Hooker, S.	Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-3723 - Fax: +902-494-3736
Hutchings, J. A.	Assist. Prof., Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-3515 - Fax: +902-494-3736 - E-mail: jhutch@cs.dal.ca
Iverson, S. J.	Assist. Prof., Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-2566 - Fax: +902-494-3736 - E-mail: siverson@is.dal.ca
Jacquet, N.	PhD Student, Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-3723 - Fax: +902-494-3736 - E-mail: njaquet@ac.dal.ca
Kirsch, P.	PhD Student, Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-2566 - Fax: +902-494-3736 - E-mail: pkirsch@is.dal.ca
Lacoste, K. N.	Biopsychology, Memorial University, 99 Newtown Rd, St. John's, Nfld, A1B 3A8 Phone: +709-722-4942 - Fax: +709-737-2430 - E-mail: klacoste@play.psych.mun.ca
Laurel, B.	Whale Research Group, Memorial University of Newfoundland, St. John's, Nfld, A1C 5S7 Phone: +709-753-5495 - Fax: +709-737-2450
Lawson, J. W.	Ocean Sciences Centre, Memorial University, St. John's, Newfoundland A1C 5S7 Phone: +709-737-3248 - Fax: +709-737-3220 - E-mail: johnwl@kean.ucs.mun.ca
Lien, J.	Whale Research Group, Memorial University of Newfoundland, St. John's, Nfld, A1C 5S7 Phone: +709-753-5495 - Fax: +709-737-2450 - E-mail: jlien@kean.ucs.mun.ca
MacKinnon, C. F.	Nova Scotia Department of Fisheries, P. O. Box 2223, Halifax, Nova Scotia, B3J 3C4 Phone: +902-424-0349 - Fax: +902-424-4671
McLaren, I. A.	Prof., Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-2565 - Fax: +902-494-3736 - E-mail: iamclar@ac.dal.ca
Marques, F. C.	Whale Research Group, Memorial University of Newfoundland, St. John's, Nfld, A1C 5S7 Phone: +709-737-7638 - Fax: +709-737-2450 - E-mail: fmarques@kean.ucs.mun.ca
McMillan, J. I.	Marine Fish Div., Dept. of Fisheries and Oceans, P O. Box 1006, Dartmouth, NS, B2Y 4A2 Phone: +902-426-3518 - Fax: +902-426-1506 - E-mail: j_mcmillan@bionet.bio.dfo.ca
Measures, L.	Maurice Lamontagne, Dept. of Fisheries and Oceans, P. O. Box 1000, Mont-Joli, Que. G5H 3Z4 Phone: +418-775-0571 - Fax: +418-775-0542 - E-mail: l_measures@qc.dfo.ca
Mellish, J. E.	Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-2566 - Fax: +902-494-3736 - E-mail: jmellish@is.dal.ca
Mercer Clarke, C.	ICED, 49 Bayview Road, Halifax, Nova Scotia, B3M 1N8 Cel. Phone: +902-499-9190 - Fax: +902-457-0793 - E-mail: merclark@ra.isisnet.com
Miller, T.	Biology Dept., Memorial University, St. John's, Newfoundland, A1B 3X9 Phone: +709-737-3248 - Fax: +709-737-3018 - E-mail: tmiller@morgan.ucs.mun.ca
Mio, R. R.	20 Boutilier Grove, Dartmouth, Nova Scotia B2X 2W1 Phone: +902-434-6526 - Fax: +902-434-0715
Misra, R.	Department of Fisheries and Oceans, P. O. Box 550, Halifax, Nova Scotia, B3J 2S7 Phone: +902-426-6208
Mohn, R.	Bedford Institute of Oceanography, P. O. Box 1006, Dartmouth, Nova Scotia, B2Y 4A2 Phone: +902-426-4592 - Fax: +902-426-1506 - E-mail: r_mohn@bionet.bio.ns.ca
Muelbert, M.	Marine Fish Div., Dept. of Fisheries and Oceans, P O. Box 1006, Dartmouth, NS, B2Y 4A2 Phone: +902-426-3521 - Fax: +902-426-1506 - E-mail: muelbert@ac.dal.ca

Myers, R. A.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland, A1C 5X1 Phone: +709-772-5431 - Fax: +709-772-4188 - E-mail: myers@mrspock.nwafc.nf.ca
Nordeen, C. L.	Dept. of Psychology, Memorial University, St. John's, Newfoundland A1C 30B Phone: +709-737-7638
North, R.	CBC Reporter (Marine Resources), P. O. Box 3000, Halifax, Nova Scotia B3J 3E9 Phone: +902-420-4348 - Fax: +902-420-4557
Pike, D.	Nunavut Wildlife Management Bd., P. O. Box 1379, Iqaluit, Northwest Territories, X0A 0H0
Recchia, M. L.	6291 Yale St., Halifax, Nova Scotia B3L 1C9 Phone: +902-429-3690
Richter, C.	Whale Research Group, Memorial University of Newfoundland, St. John's, Nfld, A1C 5S7 Phone: +709-753-2155 - Fax: +709-737-2450 - E-mail: crichter@kean.ucs.mun.ca
Russell, J.	Memorial University, General Delivery, Tors Cove, Newfoundland, A0A 4A0 Phone: +709-772-7668 - Fax: +709-737-2430 - E-mail: jrussell@kean.ucs.mun.ca
Schneider, D. C.	Ocean Science Centre, Memorial University of Newfoundland, St. John's, Nfld, A1B 3X7 Phone: +709-737-8841 - Fax: +709-737-3121 - E-mail: dschneider@kean.ucs.mun.ca
Sergeant, D. E.	Natural Resources Sci., McGill Univer., 325 Main Road, Hudson, Québec, J0P 1H0 Phone: +514-458-7108
Shelton, P. A.	Science Branch, Dept. of Fisheries & Oceans, P. O. Box 5667, St. John's, Nfld, A1C 5X1 Phone: +709-772-2341 - Fax: +709-772-4188 - E-mail: shelton@mrspock.nwafc.nf.ca
Sinclair, A. F.	Dept. of Fisheries and Oceans, P. O. Box 5030, Moncton, New Brunswick E1C 9B6 Phone: +506-851-2721 - Fax: +506-851-2387 - E-mail: sinclair@gfc.dfo.ca
Sjare, B.	Department of Fisheries & Oceans, P. O. Box 5667, St. John's, Newfoundland, A1C 5X1 Phone: +709-772-4049 - Fax: +709-772-3207 - E-mail: sjare@nflorc.nwafc.nf.ca
Todd, S.	Whale Research Group, Memorial University of Newfoundland, St. John's, Nfld, A1C 5S7 Phone: +709-737-8414 - Fax: +709-737-2450 - E-mail: stodd@kean.ucs.mun.ca
Trites, A.	Fisheries Centre, 2204 Main Mall, University of British Columbia, Vancouver, BC V6T 1Z4 Phone: +604-822-8182 - Fax: +604-822-8180 - E-mail: trites@bcu.ubc.ca
Warren, W. G.	Dept. of Fisheries and Oceans, Science Branch, P. O. Box 5667, St. John's, Nfld A1C 5X1 Phone: +709-772-4835 - Fax: +709-772-3207 - E-mail: warren@mrspock.nwafc.nf.ca
Whitehead, H.	Ass. Prof., Department of Biology, Dalhousie University, Halifax, Nova Scotia, B3H 4J1 Phone: +902-494-3723 - Fax: +902-494-3736 - E-mail: hwhitehe@ac.dal.ca
Woodman, F.	FRCC Representative, Box 40, New Harbour, Newfoundland A0B 2P0 Phone: +709-582-2830 - Fax: +709-582-2937
Woodworth, J.	Canadian Sealers Association, P. O. Box 5484, St. John's, Newfoundland, A1C 5W4 Phone: +709-772-1721 / 709-489-1419 - Fax: +709-738-1661 / 709-489-1511

DENMARK (GREENLAND)

Kapel, F. O.	Greenland Institute for Natural Resources, Tagensvej 135, 1, DK-2200 Copenhagen Phone: +45 31 854444 - Fax: +45 35 821850
Siegstad, H.	Greenland Institute for Natural Resources, P. O. Box 570, DK-3900 Nuuk, Greenland Phone: +299 21095 - Fax: +299 25957

FRANCE

Briand, D.	IFREMER, Station de S. Pierre et Miquelon, P. O. Box 4240, 97500 Saint Pierre et Miquelon Phone: +508 41 30 83 - Fax: +508 41 49 36
Hassani, S.	OCEANOPOLIS, Port de Plaisance du Moulin Blanc, B. P. 411 - 29275 Brest Cedex Phone: +33 98 34 4040 - Fax: +33 98 34 40 69 - E-mail: oceanopo@dialup.francenet.fr
Ridoux, V.	OCEANOPOLIS, Port de Plaisance du Moulin Blanc, B. P. 411 - 29275 Brest Cedex Phone: +33 98 34 4040 - Fax: +33 98 34 40 69 - E-mail: oceanopo@dialup.francenet.fr

GERMANY

Cornus, H. P.	Institut für Seefischerei, Palmaille 9, D-22767, Hamburg Phone: +49 40 38905194 - Fax: +49 40 38905263 - E-mail: internet: 100565.1223@compuserve.com
Stein, M.	Institut für Seefischerei, Palmaille 9, D-22767, Hamburg Phone: +49 40 38905174 - Fax: +49 40 38905263 - E-mail: internet: 100565.1223@compuserve.com

ICELAND

Hauksson, E.	Icelandic Fisheries Laboratories, Skulagata 4, 105 Reykjavik Fax: +354 5620240
Stefánsson, G.	Marine Research Institute, Skulagata 4, P. O. Box 1390, 121 Reykjavik Phone: +354 5520240 - Fax: +354 5623790 - gunnar@hafro.is

Vikingsson, G. A. — Programme for Whale Research, Marine Research Institute, P. O. Box 1390, 121 Reykjavik
Phone: +354 5520240 - Fax: +354 5623790 - gisli@hafro.is

JAPAN

Kato, H. — National Research Institute of Far Seas Fisheries, 5-7-1 Orido, Shimizu, Shizuoka 424
Phone: +81 543 34 0715 - Fax: +81 543 35 9642

Yamada, H. — Seikai National Fisheries Research Institute, 49 Kokubu-Machi, Nagasaki, 850
Phone: +81 958-22 8158 - Fax: +81 958-21 4494 - E-mail: yamada@snf.affrc.go.jp

Yokawa, K. — National Research Institute of Far Seas Fisheries, 5-7-1 Orido, Shimizu, Shizuoka 424
Phone: +81 543 34 0715 - Fax: +81 543 35 9642

NORWAY

Blichfeldt, G. — High North Alliance, P. O. Box 123, N-8390 Reine i Lofoten
Phone: +47 76 092414 - Fax: +47 76 092450

Haug, T. — Norwegian Institute of Fisheries & Aquaculture, P. O. Box 2511, N-9002 Tromsø
Phone: +47 776 24220 - Fax: +47 776 29100

Nilssen, K. T. — Norwegian Institute of Fisheries & Aquaculture, P. O. Box 2511, N-9002 Tromsø
Phone: +47 776 24221 - Fax: +47 776 29100

Øritsland, T. — Marine Mammals Div., Institute of Marine Research, P. O. Box 1870 Nordnes, N-5024 Bergen
Phone: +47 55 23 86 11 - Fax: +47 55 23 86 17

Sanderson, K. — North Atlantic Marine Mammal Commission, University of Tromsø, 9037 Tromsø
Phone: +47 776 45903 - Fax: +47 776 45905 - E-mail: kates@nammco.no

Skaug, H. J. — Norwegian Computing Center, P. O. Box 114, Blindern, N-0314 Oslo

Ulltang, Ø. — Institute of Marine Research, P. O. Box 1870 Nordnes, N-5024 Bergen
Phone: +47 55 23 86 10 - Fax: +47 55 23 83 87

PORTUGAL

Avila de Melo, A. — Instituto Portugues de Investigacao Maritima (IPIMAR), Alges-Praia, 1400 Lisbon
Phone: +351 1301 7361 - Fax: +351 1301 5948

Godinho, L. — Instituto Portugues de Investigacao Maritima (IPIMAR), Alges-Praia, 1400 Lisbon
Phone: +351 1301 7361 - Fax: +351 1301 5948

RUSSIA

Videneev, Yu. — Repres. of Russia on Fisheries, Welsford Place, 2202-2074 Robie St., Halifax, NS B3K 5L3
Phone: +902-425-6270 - Fax: +902-423-0943

SOUTH AFRICA

Butterworth, D. S. — Dept. of Maths and Applied Maths, University of Cape Town, South Africa
Fax: +27 21650 2334 - E-mail: dell@maths.uct.ac.za

David, J. H. M. — Sea Fisheries Research Institute, Private Bag X2, Rogge Bay 8012, Cape Town
Phone: +27 21 4023164 - Fax: +27 21 252920 - E-mail: jhmdavid@sfri.sfri.ac.za

Wickens, P. A. — Zoology Dept., University of Cape Town, Rondebosch, 7700 Cape Town
Phone: +27 21 6503608 - Fax: +27 21 6503301 - E-mail: pwickens@ucthpx.uct.ac.za

SPAIN

Vazquez, A. — Instituto de Investigaciones Marinas, Muelle de Bouzas, 36208 Vigo
Phone: +34 86 231930 - Fax: +34 86 292762 - E-mail: avazquez@iim.csic.es

THE NETHERLANDS

Couperus, A. S. — Netherlands Institute for Fisheries Research, P. O. Box 68, 1970 A B IJmuiden
Phone: +31 2 555 64690 - Fax: +31 2 555 64644 - E-mail: a.s.couperus@rivo.agro.nl

UNITED KINGDOM

Casey, J. — Ministry of Agriculture, Fisheries & Food, Fisheries Lab., Lowestoft (Suffolk) NR33 OHT
Phone: +44 1 502 524251 - Fax: +44 1 502 524511 - E-mail: j.casey@dfr.maff.gov.uk

Harwood, J. — c/o British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET
Phone: +44 01223 311354 - Fax: +44 01223 328927

UNITED STATES OF AMERICA (USA)

Barros, N.	Hubbs Sea World Research Inst., P. O. Box 691602, Orlando, Florida 32869-1602 Phone: +407-363-2662 - Fax: +407-345-5397 - E-mail: barros@pegasus.cc.ucf.edu
Blaylock, R. A.	National Marine Fisheries Service, 75 Virginia Beach Drive, Miami, Florida 33149 Phone: +305-361-4299 - Fax: +305-361-4515 - E-mail: ben_blaylock@ssp.nmfs.gov
Early, G. A.	New England Aquarium, Central Wharf, Boston, Massachusetts, 02110 Phone: +617-973-5246 - Fax: +617-723-4596 - E-mail: gearly@tiac.net
Fertl, D. C.	Minerals Manag. Service, 1201 Elmwood Park Blvd., Mail Stop 5410, New Orleans, LA 70123 Phone: +504-736-2766 - Fax: +504-736-2407 - E-mail: dagmar_fertl@smtp.mms.gov
Finn, J. T.	Univ. of Mass., Forestry & Wildlife, Holdsworth Nat. Resources Center, Amherst, MA 01003-4210 Phone: +413-545-1819 - Fax: +413-545-4358 - E-mail: finn@forwild.umass.edu
Griffin, R. B.	Univer. of RI, Graduate School of Oceanography, Box 200-Bay Campus, Narragansett, RI 02882 Phone: +401-792-6192 - E-mail: bgriffin@whsun1.wh.whoi.edu
Griffin, N.	2 Neptune St., Jamestown, Rhode Island 02835 Phone: +401-423-3562
Hall, M.	Inter-American Tropical Tuna Comm., c/o Scripps Institute of Oceanography, 8604 La Jolla Shores Dr., La Jolla, CA 92037-1508 Phone: +619-546-7044/0828 - Fax: +619-546-7133 - E-mail: m-h@ucsd.edu
Hirons, A. C.	Inst. of Marine Science, Sch. of Fisheries & Ocean Sci., Univer. of Alaska, Fairbanks, AK 99775 Phone: +907-474-5442 - Fax: +907-474-5863 - E-mail: ftach@aurora.alaska.edu
Kenney, R. D.	Univer. of RI, Graduate School of Oceanog., Box 41-Bay Campus, Narragansett, RI 02882-1197 Phone: +401-792-6664 - Fax: +401-792-6497 - E-mail: rkenney@gsosun1.gso.uri.edu
Marshall, C. D.	Dept. of Physiological Sci., Box 100144 JHMHC, Univer. of Florida, Gainesville, FL 32610-0144 Phone: +904-392-4700, ext. 3854 - Fax: +904-392-5145 -E-mail: cdm@vetmed1.vetmed.ufl.edu
Merrick, R. L.	National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115 Phone: +206-526-6173 - Fax: 1 206-526-6615
Murphy, K. J.	Mitre Corporation, 7525 Colshire Drive, McLean, Virgina 22102-3481 Phone: +703-883-7238 - Fax: +703-883-6817 - E-mail: kmurphy@mitre.org
Schell, D. M.	Inst. of Marine Science, Sch. of Fisheries & Ocean Sci., Univer. of Alaska, Fairbanks, AK 99775 Phone: +907-474-7978- Fax: +907-474-5863 - E-mail: ffdhs1@aurora.alaska.edu
Shima, M.	School of Fisheries, WH-10, University of Washington, Seattle, WA 98195 Phone: +206-526-4330 - Fax: +206-526-6723 - E-mail: mshima@u.washington,edu
Smolen, M. J.	World Wildlife Fund, 1250 Twenty-Fourth St., NW, Washington, DC 20037-1175 Phone: +202-861-8354 - Fax: +202-293-9211 - E-mail: smolen+r%wwfus@mcimail.com
Tynan, C.	National Marine Mammal Laboratory, 7600 Sand Point Way, NE, Seattle, Washington 98115 Phone: +206-526-4033 - Fax: +206-526-6015 - E-mail: tynan@afsc.noaa.gov
Worthy, G. A. J.	Marine Mammal Res. Prog., Texas A&M Univer. 4700 Av. U, Bldg 303, Galveston, TX 77551 Phone: +409-740-4721 - Fax: +409-740-4717 - E-mail: worthy_g@tamug2.tamu.edu
York, A. E.	National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115-0070 Phone: +206-526-4045 - Fax: +206-526-6615 - E-mail: york@orca.akctr.noaa.gov

ANNEX 2. ANNOUNCEMENT OF THE 1997 SYMPOSIUM

What Future for Capture Fisheries

A Shift in Paradigm: Visioning Sustainable Harvests From the Northwest Atlantic in the Twenty First Century

Hosted by the Scientific Council of the
Northwest Atlantic Fisheries Organization (NAFO)
10-12 September 1997
St. John's, Newfoundland, Canada

Objectives:

1. Present the international profile of NAFO - a model of international collaborative research, management and cooperation.
2. Undertake a visioning exercise of sustainable international fisheries cooperation and management for the twenty first century.
3. Examine shifts in the traditional capture fisheries and new livelihoods for the coastal community.
4. Produce a book, based on the outcome of the symposium - commemorating 500 years of Northwest Atlantic livelihoods based on harvesting the sea.

The Symposium itself is built around an Opening Session with three keynote speakers and five sessions.

Opening Session:	**Keynote**	The NAFO model of international collaborative research, management and cooperation.
	Keynote	The framework within which capture fisheries will operate in the future - Development of UNCLOS 1982.
	Keynote	Sustainability - Ecological impact from fisheries - the political environmental issues and how this will affect how capture fisheries will operate in the future.

Session 1 - Management Approaches - Caring for the Future Resources

1. Trends in international cooperation in fisheries - monitoring, surveillance and control.
2. Controlling marine fisheries 50 years from now - satellite surveillance or a changed regime - can economy and biology cooperate.
3. Geographical case studies - the future for fishery dependent communities (e.g. Iceland, Faroe Island, Greenland, Newfoundland).

Session 2 - History of Fishing the Northwest Atlantic

1. History of fisheries in the Northwest Atlantic - the 500-year perspective.
2. The history of fisheries management and the scientific advice - the ICNAF/NAFO history from the end of WW2 to the present.

Session 3 - Fisheries Research: Perspectives for the Twenty First Century

1. Where is fisheries science heading - special emphasis on fish stock assessment work.
2. What can technology offer the future fisheries scientist - possibilities for obtaining better estimates of fish stock abundance (e.g. observations from the sea) and their stock structure (e.g. DNA technology). What can information technology and science offer - will we be able to process the mass of data future technology will enable us to collect.
3. Integrating fisheries observations with environmental data - towards a better understanding of the conditions for fish in the sea.

Session 4 - Sustainable Livelihood for the Coastal Community

1. Aquaculture *vs* marine fisheries - will capture fisheries remain competitive?
2. Impact on coastal livelihood from future changes in production and demand for fish.

Session 5 - The Future for Capture Fisheries

1. The capture technology of the future - large trawlers with sea going factories or small vessels of the Coastal State.

This Symposium is being held in conjunction with the Cabot 500th Anniversary Celebration in St. John's, Newfoundland. For further information, please contact:

Convener

Hans Lassen
Danish Institute for Fisheries Research
Charlottenlund Slot
DK-2920 Charlottenlund
Denmark

Telephone: +45 33 96 33 00
Telefax: +45 33 96 33 33
E-mail: HL@DFU.MIN.DK

NAFO Secretariat

Tissa Amaratunga, Assistant Executive Secretary
Northwest Atlantic Fisheries Organization (NAFO)
P. O. Box 638
Dartmouth, Nova Scotia
Canada B2Y 3Y9

Telephone: +902 469-9105
Telefax: +902 469-5729
Telex: 019-31475

ANNEX 3. LIST OF RECOMMENDATIONS - 9-15 SEPTEMBER 1995

The following are the recommendations received by the Scientific Council from its Standing Committees. The complete list of recommendations appear below under each Standing Committee Report.

SCIENTIFIC COUNCIL

IV. RESEARCH COORDINATION

Research Coordination for Greenland Halibut, Formulationof Research Proposal for Synoptic Survey

The Council **recommended** that *Contracting Parties adopt the proposal and make every possible effort to ensure that a coordinated synoptic survey in the Convention Area is undertaken at the earliest practical opportunity.*

STACFIS (see Appendix I)

Shrimp in Division 3M

For shrimp in Div. 3M, it is **recommended** that:

- *Sizes and maturity of shrimp from the EU surveys should be presented, in future, by depth and/or stratum to better evaluate changes in stock structure between years.*
- *Yield-per-recruit analyses should be available for consideration at the September 1996 Meeting.*
- *Detailed information on the age, growth and recruitment of redfish on Flemish Cap need to be tabled at the June 1996 Meeting in order to interpret the effectiveness of sorting grates in reducing redfish by-catch.*
- *Redfish by-catch information from all participating fleets, including length distributions, catch rates and proportions of total and shrimp catch weights, should be made available for the June 1996 Meeting.*

STACREC (see Appendix II)

Acquisition of STATLANT Data

Publication of Statistical Information

STACREC was informed that STATLANT 21B data had been received from France for 1992, but required clarification before they can be finalised. STACREC **recommended** that *the publication of the NAFO Statistical Bulletin, Vol. 42, be completed as soon as possible when the data from EU-France and Norway were clarified for STATLANT 21B data for 1992.*

Gear Codes

STACREC noted that the introduction of a new trawl gear (twin trawl) into the shrimp fisheries in Div. 3M in 1995. The introduction of this gear has implications for interpretation of fisheries data. STACREC **recommended** that *the Secretariat take steps to modify the STATLANT 21B questionnaire to include this new twin trawl gear type used in the shrimp fishery, with a new gear code.*

Biological Surveys in the Regulatory Area

..... STACREC **recommended** that *the Scientific Council encourage Contracting Parties planning research activities in the Regulatory Area, to submit a summary of their research proposals, outlining the objectives and methods, to the Scientific Council.*

Redfish Ageing Workshop

Contracting Parties are encouraged to inform national laboratories of the workshop, and encourage interested scientists to attend. STACREC **recommended** that *a summary of the report of the ICES sponsored Workshop on Ageing of Sebastes sp. be presented to the June 1996 Meeting of Scientific Council.*

STACPUB (see Appendix III)

Status of Papers on Shrimp in Division 3M for a Single Publication

STACPUB **recommended** that *a draft of the proposed publication on Flemish Cap be made available for discussion during the November 1995 Scientific Council Meeting on shrimp in Davis and Denmark Straits.*

APPENDIX I. REPORT OF STANDING COMMITTEE ON FISHERY SCIENCE (STACFIS)

Chairman: W. B. Brodie Rapporteurs: Various

The Committee met at the Holiday Inn, Dartmouth, Nova Scotia, Canada, at various times during 9-14 September 1995, to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on certain finfish and invertebrate marine stocks. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (Denmark, Germany, Portugal, Spain and United Kingdom), Iceland, Japan, Russian Federation, and observers from the United States of America and ICES. The Executive Secretary and Assistant Executive Secretary were in attendance.

I. OPENING

The Chairman opened the meeting by welcoming participants. The agenda was reviewed and a plan of work developed for the meeting.

II. STOCK ASSESSMENTS

1. **Shrimp in Division 3M** (SCR Doc. 95/100, 101, 102, 103, 105, 106)

a) **Introduction**

The shrimp fishery in Div. 3M began in late April, 1993, when two Canadian offshore vessels were granted exploratory permits to fish for *Pandalus borealis* in the area. Initial catch rates were favourable and, shortly thereafter, fishing activity increased to include about 50 vessels in early July but subsequently declined over the remainder of the year. Only 4 vessels were reported fishing shrimp at the end of December. Fishing continued into 1994 at low intensity. Activity increased over winter to 17 vessels by late February and remained near that level until early April, decreasing thereafter. From mid-April to mid-June, the number of vessels increased from 7 to 47 and then decreased steadily to 3 at the end of the year. In 1995, vessel activity was low throughout the January-March period but increased substantially from 7 vessels in early-April to 71 by late-July. Since then, about 60 vessels have continued to fish for shrimp up to the end of August.

Estimated catches were approximately 27 000 tons in 1993 and 24 000 tons in 1994 (unofficial). Catch statistics (to August 31) indicate removals of about 23 000 tons so far in 1995. Vessels from as many as 13 nations have participated, on and off, since 1993. Preliminary catches (tons) by nation and year are given below.

Nation	1993	1994	1995 (to Aug 31)
Canada	3 724	1 041	939
EU-Denmark	800	400	
Estonia	0	1 081	1 616
Faroe Islands	8 545	6 556	3 990
Greenland	3 786	2 276	2 321
Iceland	2 243	2 300	4 269
Latvia	0	300	350
Lithuania	0	1 225	675
Norway	7 308	8 299	6 100
EU-Portugal	0	0	150
EU-Spain	0	300	158
Russia	300	300	2 500
St. Vincent	0	75	
Total	26 706	24 153	23 068

b) **Input Data**

i) **Commercial fishery data**

Information from the fleets of three nations showed that the spatial distribution of effort differed between years. Canadian vessels shifted effort to the west and southwest portions of the Cap in 1994 and 1995, compared to 1993. Further, fishing occurred in much shallower depths in 1995. Vessels from Greenland and Faroe Islands also reduced effort substantially in eastern areas compared to 1993.

In 1995, several Greenlandic and Faroese vessels towed two complete shrimp trawls, simultaneously. This technological change was first noted for an Icelandic trawler in 1994. The effort was doubled for CPUE calculations for Greenlandic and Icelandic vessels only.

Data from nations which provided both catch and effort estimates showed that unstandardized catch rates were substantially lower in 1994 than in 1993. There was slight improvement in the 1995 CPUEs over the 1994 values in some instances but these remained lower than those of 1993.

Size composition data from commercial sampling by Canada, Faroe Islands and Iceland in 1993 showed that large, female shrimp dominated the catches by number and weight. Samples from the same nations in 1994 indicated that males were much more prevalent in the catches than in the previous year. Canadian and Greenlandic data for 1995 showed a further increase in the importance of the male component.

Sampling data showed the occurrence of three size groups of males in both 1993 and 1994 but only two in 1995. An additional size group of small female shrimp was evident in 1995 and it was concluded that the 1991 year-class changed sex a year earlier then expected.

Average shrimp density estimates were derived based on 4 754 commercial trawl hauls of Faroese vessels made between May 1993 and September 1994. Density in the areas fished by the Faroese fleet declined from 2.03 g/sq. m. in 1993 to 1.24 in 1994.

Despite the decrease in mean size of shrimp due to the dominance of small males in the catches in 1995, data on shrimp discarding from the 1995 Canadian and Greenlandic fisheries showed that, discard levels remained low, as in previous years. This might be related to the current high value for small, industrial grade shrimp.

By-catch in 1993 consisted primarily of small redfish (14 cm) and Canadian observer data indicated levels of 9 and 13% of the total catch weight in May and June, increasing to 44% in July. Redfish were still a problem in 1994 (up to 32% in April), despite the mandatory use of sorting grates, and occurred in large numbers at 17-18 cm. In 1995, redfish by-catch was much lower, increasing from <1% in March to 4.7% in June. Redfish was also the most dominant by-catch species taken by Greenland in both 1994 and 1995. Although redfish by-catch was much lower in 1995, it was not clear whether or not this was entirely due to the reduction of maximum bar spacings from 28 mm in 1994 to 22 mm in 1995. Concern was expressed for the possible numbers of fish caught which could not be addressed in the data based on weight alone. A research recommendation was formulated to resolve this issue at the June 1996 Meeting.

ii) **Research survey data**

Oceanographic data were obtained from the Flemish Cap during a Canadian survey conducted in July 1995 and compared to long-term (1961-90) average conditions and those of 1993. The 1995 temperature anomalies in depths greater than 300 m were about -0.3°C, while those in shallower water over the Cap ranged from -0.5 to -1.0°C. Temperatures, while remaining colder than normal, increased over 1993 values, especially in the upper water layer (<50 m). Generally, the cold temperatures which occurred over the continental shelf and on the Flemish Cap since the late-1980s continued into 1995. The general circulation in the area is characterized by an anticyclonic gyre which could play an important role in the retention of shrimp larvae. This circulation was more pronounced

in 1993 than in 1995. It is possible that changes in the intensity of the general circulation might also affect the distribution of shrimp over the Cap.

EU groundfish surveys were conducted on Flemish Cap from 1988 to 1995. Shrimp biomass indices were calculated from the catches obtained using a groundfish bottom trawl and therefore did not represent the absolute shrimp biomass. However, they showed that relative shrimp biomass from 1991 to 1993 was substantially higher than during the 1988-90 period. Biomass apparently declined since 1992 but the estimates remained higher than the level observed during the 1988-90 period. The 1994 estimate was likely biased downward due to a large, meshed liner in the codend of the trawl in that year.

Year	Biomass Index (tons)	Average Catch per Mile (kg)	Standard Error
1988	2 164	1.54	± 0.28
1989	1 923	1.37	± 0.24
1990	2 139	1.53	± 0.21
1991	8 211	5.83	± 0.71
1992	16 531	11.75	± 1.86
1993	9 256	6.57	± 1.04
1994	3 337	2.37	± 0.35
1995	5 413	3.85	± 0.44

The surveys also showed that abundance was highest in the western, northern and northeastern parts of the Flemish Cap and in depths ranging from about 300 to 500 m, the areas fished commercially since 1993. In 1994 and 1995, proportionately more biomass was found in western and southwestern areas while densities in some eastern strata declined substantially, consistent with the westward shift in fishing effort.

c) **Assessment Results**

The research and commercial fishery data of recent years showed that several changes have occurred on Flemish Cap related to the distribution, abundance and demographic structure of the shrimp resource. Although catches have been maintained at a high level (about 23 000 tons to the end of August 1995), catch rates from countries that fished each year were lower in 1994 than in 1993. The 1995 rates improved slightly in some cases but remained below 1993 levels. The area fished has changed between years, thereby limiting the usefulness of the CPUE data for inferring changes in abundance of the stock. Data from some nations showed a clear shift to the west and southwest in 1994 and 1995 and the Canadian fishery extended into much shallower depths in 1995. Catch, effort and catch-per-unit-effort were all much lower in eastern areas in 1994 and 1995 than in 1993. The 1994 and 1995 EU survey results are consistent with the commercial fishery data, in that respect.

The composition of the shrimp catches has also changed between years. Males were more prevalent in 1994 than in 1993 and more prevalent in 1995 than in 1994. The large females in 1994 were the remains of the 1988 year-class which did not contribute significantly to the 1995 fishery. The 1995 fishery, in fact, depended up the abundance of young male shrimp, notably the 1993 year-class (age 2) and, to a lesser degree, the 1992 year-class.

Unlike the fishery data, the research survey results did not show a dominance of the 1993 year-class. Doubt was expressed on how efficiently the lined groundfish trawl retains these very small shrimp. Survey results, on the other hand, supported the observation from the fishery that the 1991 year-class changed sex a year earlier than expected.

All data sources indicate that the spawning biomass (females) in 1995 was substantially lower than the level of the early-1990s despite the fact that the 1991 year-class has already changed sex. It is also clear that the 1988 year-class had passed through the population. All year-classes from 1989 onward have been much weaker than the 1988 year-class. The 1993 year-class has already been subjected to intensive fishing in 1995. It is the younger male shrimp that will form the spawning biomass in two or three years time. The stock/recruitment relationship is unknown for shrimp on Flemish Cap but a continued intensive fishery on young male shrimp will reduce the future spawning biomass as well as yield-per-recruit.

Also, the importance of shrimp as prey for several commercial groundfish species was noted but there are no data upon which the importance can be quantified.

Redfish by-catch was much lower in 1995 than in the previous two years, but it is uncertain whether or not this was a direct result of reducing the bar spacings in the sorting grates from 28 to 22 mm. If the by-catch levels of 1993 and 1994 were mainly due to the abundant 1989 year-class, these fish might have been big enough in 1995 to be excluded by grates with either spacing. More information on the size/age distribution of redfish in the Flemish Cap area is required to adequately address this question.

d) **Research Recommendations**

For shrimp in Div. 3M, it was **recommended** that:

- *Sizes and maturity of shrimp from the EU surveys should be presented, in future, by depth and/or stratum to better evaluate changes in stock structure between years.*
- *Yield-per-recruit analyses should be available for consideration at the September 1996 Meeting.*
- *Detailed information on the age, growth and recruitment of redfish on Flemish Cap need to be tabled at the June 1996 Meeting in order to interpret the effectiveness of sorting grates in reducing redfish by-catch.*
- *Redfish by-catch information from all participating fleets, including length distributions, catch rates and proportions of total and shrimp catch weights, should be made available for the June 1996 Meeting.*

2. Greenland Halibut

The Scientific Council at its meeting of 7-21 June 1995 considered special questions on Greenland halibut in SA 2+3 (see Annex 2A of the Agenda for June 1995 Meeting). Matters not completely addressed by the Council were referred to STACFIS for consideration at this meeting. The following are the responses:

a) **L_{25} (round total length) for 130 mm trawl**

At its June 1995 Meeting, STACFIS reviewed the results of several selectivity studies on Greenland halibut for mesh sizes ranges from 127 to 133 mm. It was concluded that the L_{25} for Greenland halibut ranged from 30-35 cm for a mesh size of 130 mm. Further information at this meeting supported those estimates.

STACFIS reported in June 1995:

> 'Provide information in terms of yield per recruit and spawning biomass-per-recruit on:
>
> - the present harvest pattern particularly the current NAFO regulated mesh size
> - harvesting practices that delayed significant recruitment until 60 cm fish length
> - harvesting practices that permitted significant recruitment at 30 cm.
>
> Calculation of yield-per-recruit and spawning biomass-per-recruit suggested that banning of fishing before Greenland halibut reaches 60 cm while maintaining the present effort level would increase the potential long term yield three times, and spawning stock biomass in the order of 6-7 times, respectively. However, it would be difficult to generate such an exploitation pattern for trawlers, given the manner in which trawls select and retain fish. Current trawl fisheries exploit Greenland halibut mainly in the range 30-60 cm.
>
> Substantial improvement of the exploitation pattern would be achieved by adoption of alternative fishing methods such as, long lining with appropriate hook sizes, and gill netting with mesh size around 200 mm. Such fisheries would exploit Greenland halibut larger than 60 cm. Because of the sexual difference in growth, with males only reaching a maximum length of 65-70 cm while females reach lengths in excess of 90 cm, the recruitment to such a fishery would be less than suggested by the calculations and the increase in yield indicated above is an overestimate. The gain to the spawning stock biomass would be approximately correct.

Restricting the Greenland halibut fishery to deeper than 1 200 m should decrease the proportion of small Greenland halibut in the catch, since the larger individuals are found in deeper water.

Studies presented at this meeting suggested that L_{25} for a 130 mm mesh in the codend is in the range of 30-35 cm. The current harvesting practice apparently permits significant catches of Greenland halibut in this range."

b) **Area and Seasonal Distribution of Immature and Mature Biomass Between SA 2+3K and Divisions 3LMNO**

With respect to this question by Canada on Greenland halibut, STACFIS continues to be unable to respond adequately due to the significant shortfall in survey coverage over the area and depths required. No survey data are available for Div. 2GH for the last 7 years and are very limited for depths beyond 1 000 m in Subarea 2 or beyond 732 m in Div. 3NO. No adequate information regarding this request will be forthcoming until complete survey coverage has been accomplished. A survey proposal to provide the necessary data can be found in the STACREC Report of this meeting.

3. **Area and Seasonal Distribution of Juvenile Fish of Protected Species (Cod, Redfish, Witch Flounder, American Plaice, Yellowtail Flounder, and Greenland Halibut)**

A response to the Fisheries Commission request on this topic was dealt with directly by Scientific Council. It was noted that there has been some recent work in this area, and that the general subject of how to analyze survey data in general was being addressed in the Special Session (Workshop) in September 1996.

4. **Optimal Minimum Fish Size for Protected Species in Subareas 2+3**

STACFIS noted that a response on this Fisheries Commission topic was dealt with directly by the Scientific Council.

III. ARRANGEMENTS FOR CONDUCTING STOCK ASSESSMENTS IN 1996

1. **Work Plan for the June 1996 Meeting**

Noting the urgent demands for computer printouts for consideration during meetings, STACFIS emphasized the need for additional laser printers at the June 1996 Meeting. Based on the heavy demand for such printers experienced at the June 1995 Meeting, it is suggested that a minimum of 3 such printers would be required, in addition to the present computer hardware made available by the Secretariat. At least one of these printers should support *Post-Script*.

2. **Update List of Designated Experts**

Recognizing the workload of the Designated Experts during the June Meetings, STACFIS felt it would be desirable to nominate a separate scientist for each stock. However, it was noted that this was not practical at the present time. Accordingly, the list of Designated Experts for 1995 was reviewed and the following were tentatively identified for the 1996 assessments:

- From the Science Branch, Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, P. O. Box 5667, St. John's, Newfoundland, Canada, A1C 5X1
[Telefax: +709 772-4188 - E-mail: SURNAME@NFLORC.NWAFC.NF.CA]

for	Cod in Div. 3NO	M. B. Davis
	Redfish in Div. 3LN	D. Power
	American plaice in Div. 3LNO	M. J. Morgan
	Witch flounder in Div. 3NO	W. R. Bowering
	Yellowtail flounder in Div. 3LNO	S. J. Walsh
	Greenland halibut in SA 2 + Div. 3KL	W. R. Bowering
	Roundnose grenadier in SA 2+3	D. B. Atkinson
	Capelin in Div. 3L	J. E. Carscadden
	Capelin in Div. 3NO	J. E. Carscadden
	Squid in SA 3+4	G. H. Winters
	Shrimp in Div. 3M	D. G. Parsons

- From the Instituto de Investigaciones Marinas, Muelle de Bouzas, 36208 Vigo, Spain [Telefax: +34 86 292762 - Tel No.: +34 86 231930 - E-mail: AVAZQUEZ@IIM.CSIC.ES]

  for Cod in Div. 3M — A. Vazquez

- From the Instituto Espanol de Oceanografia, Centro Oceanografico de Cantabria, Aptdo 240, 39080 Santander, Spain [Telefax: +34 42 275072 - Tel. No.: +34 42 275033]

  American plaice in Div. 3M — E. de Cárdenas

- From the Institut fur Seefischerei, Palmaille 9, D-22767, Hamburg, Republic of Germany [Telefax: +49 40 38905263 - Tel No.: +49 40 38905194 - E-mail: internet: 100565.1223@compuserve.com]

  for Redfish in Div. 3M — H. P.Cornus

- From the Greenland Institute of Natural Resources, P. O. Box 570, DK-3900 Nuuk, Greenland [Telefax: +299 25957 - Tel No.: +299 21095]

  for Northern shrimp in SA 0+1 — H. Siegstad
  Greenland halibut in Div. 1A — G. Bech

- From the Greenland Institute of Natural Resources, Tagensvej 135, 1, DK-2200 Copenhagen N, Denmark [Telefax: +45 35 821850 - Tel No.: +45 31 854444]

  for Roundnose grenadier in SA 0+1 — O. Jørgensen
  Wolffish in SA 1 — O. Jørgensen
  Greenland halibut in SA 0+1 — O. Jørgensen

- From the Institut für Seefischerei, Fischkai 35, D-27572 Bremerhaven, Germany [Telefax: +49 471 73127 - Tel No.: +49 471 73473]

  for Redfish in SA 1 — H. J. Rätz

- From the Marine Fish Division, Department of Fisheries and Oceans, Bedford Institute of Oceanography, P. O. Box 1006, Dartmouth, Nova Scotia, Canada, B2Y 4A2 [Telefax: +902 426-7827 - Tel No.: +902 426-2937 - E-mail: M_SHOWELL@BIONET.BIO.DFO.CA]

  for Silver hake in Div. 4VWX — M. A. Showell

- From the Marine Research Institute, Skulagata 4, P. O. Box 1390, 121 - Reykjavik, Iceland [Telefax: +354 562 3790 - Tel No.: +354 552 0240- E-mail: UNNUR@HAFRO.IS]

  for Northern shrimp in Denmark Strait — U. Skúladóttir

The Secretariat was requested to confirm the availability of the Designated Experts from their respective laboratories. Confirmation of Designated Experts is requested by 1 January 1996 and no response by that time will be taken to mean no objection to the nomination.

IV. SILVER HAKE AGEING METHODOLOGY REPORT

No information on this item was available, so the topic was deferred to the June 1996 Meeting.

V. OTHER MATTERS

1. STACFIS Agenda for November 1995 Meeting

STACFIS noted the agenda for the November 1995 Meeting of STACFIS with respect to Shrimp in Subareas 0 and 1, and Denmark Strait will be made available immediately following this meeting.

2. Adjournment

There being no other business, the Chairman, prior to adjournment, thanked the participants and the Secretariat for their work during the meeting.

APPENDIX II. REPORT OF STANDING COMMITTEE ON RESEARCH COORDINATION (STACREC)

Chairman: D. Power Rapporteur: J. Casey

The Committee met at the Holiday Inn, Dartmouth, Nova Scotia, Canada on 9-14 September 1995, to discuss various matters pertaining to statistics and fisheries research in the Regulatory Area, as referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (Denmark, Germany, Portugal, Spain and United Kingdom), Japan, Russian Federation, and observers from United States of America and ICES. Noting that STACREC Chairman C. A. Bishop (Canada) had retired in July 1995, the incoming Chairman (as of end of this 17th Annual Meeting), D. Power (Canada), agreed to chair this Committee Meeting.

1. Acquisition of STATLANT 21 Data

a) Publication of Statistical Information

The Secretariat reminded the Committee that STATLANT 21A data for 1994 had still not been received from several countries. STACREC agreed that the Secretariat should not compile the SCS Document on provisional nominal catches for 1994 at this time.

With regard to STATLANT 21B data, the Secretariat informed the Committee that, compilation of data had proceeded reasonably well, but that submissions from some countries were still outstanding.

Outstanding submissions for both STATLANT 21A and 21B data are given in Table below.

List of STATLANT 21A and 21B reports which have not been submitted.

STATLANT 21A	STATLANT 21B	
1994	1992	1993
Cuba	EU-France	Faroes
Korea	Norway	France (SP)
Lithuania		Norway
USA		EU-Portugal
		USA

STACREC was informed that STATLANT 21B data had been received from France for 1992, but required clarification before they can be finalised. STACREC **recommended** that *the publication of the NAFO Statistical Bulletin, Vol. 42, be completed as soon as possible when the data from EU-France and Norway were clarified for STATLANT 21B data for 1992.*

The Committee noted that the Fisheries Commission, at its last meeting, had commented on the lack of STATLANT 21B data for 1994. Heads of Delegations were informed and the Secretariat informed STACREC that the response to the letter had been quite good. The Secretariat anticipated that publication of STATLANT 21B data for 1993 and 1994, could be envisaged relatively soon.

b) Gear Codes

STACREC noted that the introduction of a new trawl gear (twin trawl) into the shrimp fisheries in Div. 3M in 1995. The introduction of this gear has implications for interpretation of fisheries data. STACREC **recommended** that *the Secretariat take steps to modify the STATLANT 21B questionnaire to include this new twin trawl gear type used in the shrimp fishery, with a new gear code.*

c) Recording of Catch Statistics for *Pandalus borealis*

STACREC noted that catch statistics for *Pandalus borealis* are recorded under two different species codes and listed as pink shrimp and northern shrimp separately. The Committee requested that the Secretariat contact the relevant Statistical agencies to ask for clarification.

d) **Catch Statistics for Seals**

At its June 1995 Meeting, STACREC reported that there was some inconsistency in the reporting of the Greenland seal catches. In some years the numbers caught were estimated from pelt sales, and this method may provide an underestimate of total removals. The Committee requested that the Secretariat contact the appropriate authorities to obtain clarification on this matter.

2. **Research Coordination for Greenland Halibut, Formulation of Research Proposal for Synoptic Survey**

a) **Synoptic Survey**

In June 1993, Scientific Council of NAFO recommended that consideration be given to the implementation of a collaborative RV trawl survey for Greenland halibut from Davis Strait to the Grand Bank and Flemish Cap. Until such a survey was conducted, it was thought that an adequate assessment of stock size and relative distribution was unlikely (Sci. Coun. Rep. 1994, p. 157). In June 1995, STACREC recommended that parties interested in such a synoptic survey meet and develop a plan.

At this STACREC meeting, the need for such a survey was considered in detail, and a proposal for collaborative survey of this kind was formulated. The proposal as adopted by the Scientific Council is reported in Section VI of the Council Report.

3. **Review of Research Documents**

Three research documents were reviewed by STACREC.

a) **Age Structure of Roughhead Grenadier (*Macrourus berglax*) 3LM, 1993-94** (SCR Doc. 95/27)

Age compositions for roughhead grenadier catches from Div. 3LM for 1993-94 were presented. Growth of the species in these Divisions was described using the von Bertalanffy growth model. The results indicate that the species is slow-growing and long-lived.

b) **Age and Growth of Redfish in Flemish Cap (Division 3M)** (SCR Doc. 95/31)

Comparisons between age readings of redfish in Div. 3M using scales and otoliths were made. Validation of otolith readings was performed using length modal analysis of data collected on EU surveys conducted in Div. 3M from 1988 to 1994. The author concluded that ageing using otoliths was the most reliable technique. Furthermore, the results also indicated that the modal length group of redfish at 6-8 cm observed in July each year, corresponded to 1 year old fish.

c) **Feeding Relationships of Demersal Fish on Flemish Cap in Summer 1993-1994** (SCR Doc. 95/104)

The feeding patterns of 15 fish species taken by demersal trawls from Flemish Cap in summer 1993 and 1994 were presented. An examination of diet composition and changes in feeding habits with size, distinguished three groups: 1) specialists (4 species), having no differences in feeding habits with size and only a small number of main prey taxa; 2) high diversity feeders (7 species), with a highly diversified diet and feeding differences between different size groups; 3) low diversity feeders (4 species), with few and variable dietary categories. To measure overlap, cluster analysis of percentage volumetric data using Chekanowski's index, produced distinct groups which reflected the greater or lesser proximity to the lower fish trophic levels and the ontogenetic changes in diet.

4. **Other Matters**

a) **Publication of List of Fishing Vessels**

The Secretariat informed the Committee that there were still serious shortfalls in submission of the lists of vessels fishing in the NAFO area. The 1992 triennial report has not been published due to many outstanding submissions, and the 1995 compilation should now be underway. STACREC recognizes that from a fisheries science standpoint, these data are rarely used, but recognized that they are potentially useful to other Committees. STACREC requested the Secretariat to investigate the background to the requirement for such a list and its usage in NAFO. STACREC would review this matter in June 1996.

b) **National Research Reports for 1994**

The Chairman acknowledged receipt of the 1994 Research Report from USA and thanked the authors for their contribution. The Committee noted that in 1994, revised sampling and reporting protocols were implemented in the north-east region of the USA. As a result, new auditing and allocation procedures are being developed to prorate total reported landings by species among areas, and until these procedures are fully developed, reported landings from USA will not be available by NAFO Division. STACREC emphasized the importance of receiving catch statistics from the United States on a species/Divisional basis as in the past.

c) **Biological Surveys in the Regulatory Area**

STACREC noted that while Contracting Parties are informed of proposed research activity in the Regulatory Area, the information is not always transmitted to the Chairs of Scientific Council and its Committees on a timely basis. STACREC considers such information of significant value to the Scientific Council and agreed that steps be taken to ensure that Scientific Council is made aware of all such research plans. STACREC **recommended** that *the Scientific Council encourage Contracting Parties planning research activities in the Regulatory Area, to submit a summary of their research proposals, outlining the objectives and methods, to the Scientific Council.*

d) **Redfish Ageing Workshop**

STACREC was informed of an ICES sponsored Workshop on Ageing of *Sebastes* sp. to be held in Bremerhaven, Germany (co-chaired by D. B. Atkinson (Canada) and K. Kosswig (Germany)) during 4-8 December, 1995. Topics to be discussed include comparisons of the use of scales and otoliths as well as comparisons of techniques and age validation. STACREC proposed that Contracting Parties be encouraged to inform national laboratories of the workshop, and encourage interested scientists to attend. STACREC **recommended** that *a summary of the report of the ICES sponsored Workshop on Ageing of Sebastes sp. be presented to the June 1996 meeting of Scientific Council.*

e) **Data Necessary for Stock Assessments**

The available data from commercial fisheries relative to the assessment of shrimp in Div. 3M for 1995 up to 31 August are as follows:

Stock	Country	Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
Shrimp Div. 3M	CAN	939	X	X	X	X		X
	EST	1 616	X					
	FRO	3 990	X					
	GRL	2 321	X	X	X			X
	ISL	4 269	X					
	LVA	350						
	LTV	675						
	NOR	6 100		X	X			X
	E/PRT	150						
	E/ESP	158						
	RUS	2 500						

5. **Acknowledgements**

The Chairman expressed his thanks to the Secretariat, the rapporteur, and all participants for their assistance in compiling all the information necessary for the meeting.

APPENDIX III. REPORT OF THE STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chairman: W. R. Bowering Rapporteur: D. B. Atkinson

The Committee met at Holiday Inn, Dartmouth, Nova Scotia Canada on September 11 and 13, 1995. In attendance were W. R. Bowering (Canada, Chairman), D. B. Atkinson (Canada) representing M. J. Morgan (Canada), M. Stein (EU-Germany), H.-P. Cornus (EU-Germany) invited as incoming Chairman, A. Vazquez (EU-Spain) and the Assistant Executive Secretary (T. Amaratunga).

1. Review of Scientific Publications

a) Status of Journal of Northwest Atlantic Fishery Science

At the Scientific Council Meeting during September 1993, the Council agreed that a special issue of the Journal should be published containing the papers presented at the NAFO 1993 Symposium on 'Gear Selectivity/ Technical Interactions in Mixed Species Fisheries'. At its meeting in June 1995 STACPUB noted the editors had placed a deadline date of 17 July 1995 with the authors. S. Murawski (USA) had reported some progress. However, there were still some delays being experienced with authors. STACPUB hoped that this issue is still expected to be completed in late-1995, as indicated by S. Murawski.

b) NAFO Scientific Council Studies

Studies Number 23, containing 5 miscellaneous papers is in the final stage of preparation. *Publication of this issue is* expected by late-1995.

With reference to the 1994 Symposium on 'Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and Behaviour of Marine Life', STACPUB decided, at the June 1995 Meeting, that the Studies series was the suitable publication vehicle. STACPUB was informed that all 12 papers received as SCR Documents during the Symposium have now been prepared at the Secretariat for final consideration by co-conveners and/or authors.

The Assistant Executive Secretary also informed the Committee that the 1992 Statistical Bulletin was ready to be delivered to the printer when revised data were received from Norway. This has resulted in a delay of publication, but the Bulletin should now be available by the end of October 1995.

2. Promotion and Distribution of Scientific Publications

The Committee noted with pleasure the considerable international interest in the Symposium on 'The Role of Marine Mammals in the Ecosystem'. The papers presented will be published in a special edition of the Journal of Northwest Atlantic Fisheries (see item 4(a) below), and the Committee agreed that production and availability of this publication should be widely advertised. It was agreed that until more information is available on the timing of the publication, promotion should not occur, but when it is closer to the completion date, STACPUB should discuss how best to promote the volume.

The Committee also noted that there have been discussions concerning the possible collation of papers reviewed during the June 1995 Meeting of the *ad hoc* Working Group on Harp and Hooded Seals (see Other Matters below). It was agreed the production of this volume should also be advertised and that the Chairman should confer with the Secretariat and Committee members on the best approach as soon as it becomes clear what the publication strategy will be.

3. Editorial Matters

a) Editorial Board

It was noted in June, 1995 that Sv. Aa. Horsted (Denmark-Greenland) had requested to withdraw from the Editorial Review Board. Since then, a request has also been received from Dr. R. Misra (Canada) to withdraw, also as a result of retirement. The Committee expressed its sincere appreciation to Dr. Misra for his dedicated, comprehensive work, and extended its best wishes to him.

As a result of these requests, it is necessary to find 2 replacements to the Board. Names of a number of possible candidates were put forward although in some instances they had yet to be approached concerning their possible interest. It was agreed that individuals should be approached, and results of the consultations be forwarded to the Chairman through the Secretariat by 15 October 1995. The list of possible candidates will then be circulated by the Chairman to Committee members for consideration, and agreed replacements will be determined through telecommunication.

The Committee agreed that after replacements are found, further discussions on the possibility of increasing the number of Editors would be held.

b) **Other Matters**

Concern was once again expressed about the decreased submissions, and slow editing of Journal submissions. Considerable discussion on this topic took place and it was agreed that the causes remain very unclear and therefore difficult to address. The one specific problem identified pertained to publication of papers presented at the 1993 Symposium. The Committee agreed to defer this matter but urged members to think further about it so that discussion can continue and the matter hopefully resolved during June, 1996.

4. **Review of Papers for Possible Publication**

a) **Consideration of Publication of Papers from September 1995 Symposium**

Papers presented at the Symposium on 'The Role of Marine Mammals in the Ecosystem' will be considered for publication in the Journal of Northwest Atlantic Fishery Science. The deadline for submission will be 1 October, 1995. The co-convenors of the Symposium, G.B. Stenson (Canada) and J. Sigurjonnson (Iceland) will undertake responsibility of obtaining peer review for submitted manuscripts.

The Committee noted that the Symposium was co-hosted by ICES, and that appropriate consideration and acknowledgment of this must occur in conjunction with the publication. The Assistant Executive Secretary was requested to pursue the most appropriate way to deal with this.

b) **Other Papers Presented at the September 1995 Meeting**

STACPUB members considered SCR Doc. 95/104 for its suitability for publication in either Studies or the Journal. It was agreed the Secretariat request the author to submit it for consideration.

c) **Status of Papers on Shrimp in Division 3M for a Single Publication**

Some progress had been made regarding the comprehensive publication on the biology of, and fishery for shrimp on Flemish Cap. An annotated outline had been distributed to relevant scientists and some input had been received. However, a draft document is not yet available.

STACPUB **recommended** that *a draft of the proposed publication on Shrimp on Flemish Cap be made available for discussion during the November 1995 Scientific Council Meeting on shrimp in Davis and Denmark Straits.*

d) **Status of Papers on West Greenland Cod**

It was reported that 4 papers are currently under review, two papers have been promised for the end of October, and the status of another two papers is uncertain. It is hoped that this project will be concluded by the end of the year at which time it will be determined if there are sufficient papers to make up a complete Journal volume. If not, then accepted papers will be published in upcoming volumes.

The Committee noted that because of delays in production of this special volume, one paper has already been published in an earlier volume of the Journal.

5. Other Matters

a) Joint ICES/NAFO Working Group on Harp and Hooded Seals

The Joint ICES/NAFO Working Group on Harp and Hooded Seals met in June 1995 during which 10 Scientific Council Research (SCR) Documents were presented. Most of these documents were quite extensive and together present an excellent summary of current knowledge of the status of harp and hooded seals. During recent discussions with some members of the Working Group, it was suggested that it would be extremely useful to compile these documents into a single issue of the *NAFO Scientific Council Studies* to ensure that they are available to anyone interested in the conclusions. Therefore, it is proposed that all of the SCR Documents presented at the June 1995 Working Group Meeting be considered for a special issue of the Council Studies. This will be conditional upon approval of the remaining members of the Working Group.

b) Acknowledgments

There being no further business, the Chairman thanked members for their contributions. He also expressed gratitude to the Assistant Executive Secretary for his support and organization of materials required during the meeting and that he convey the Committee's appreciation to the Secretariat staff for their able assistance. A special thanks was given to D. B. Atkinson for his assistance as rapporteur.

The Chairman noted that this was the last meeting under his leadership, and wished the incoming Chair H.-P. Cornus (EU-Germany) success in his work.

APPENDIX IV. AGENDA SCIENTIFIC COUNCIL - 9-15 SEPTEMBER 1995

I. Opening (Chairman: H. Lassen)

1. Appointment of rapporteur
2. Adoption of agenda
3. Plan of work

II. Fishery Science (STACFIS Chairman: W. B. Brodie)

1. Opening

2. Matters related to Stock assessments [see Annex 1]

   a) Assessment of Shrimp in Division 3M [item outstanding from June 1995 Meeting]

   b) Greenland halibut

   - L_{25} (round total length) for 130 mm trawl
   - Area and seasonal distribution of immature and mature biomass between SA 2+3K and Div. 3LMNO.

   c) Area and seasonal distribution of juvenile fish of protected species (cod, redfish, witch flounder, American plaice, yellowtail flounder and Greenland halibut)

   d) Optimal minimum fish size for protected species in Subareas 2+3

3. Arrangements for conducting stock assessments in 1996

   a) Work plan for the June 1996 Meeting
   b) Update list of Designated Experts

4. Silver hake ageing methodology report

5. Other matters

III. *Ad hoc* Working Group on the Interrelation Between Harp and Hooded Seals and Commercial Fish Stocks (Chairman: G. Stenson) [items outstanding from June 1995 Meeting]

1. Presentation of Report from the Symposium on "The Role of Marine Mammals in the Ecosystem"
2. Review information of seal food consumption by species, area and season with special reference to recent changes in the food supply. Estimate the total food consumption by seals for commercial fish species.
3. Review the existing knowledge on interactions between seals and commercial fish stocks.
4. Identify research needed to better quantify interactions between seals and commercial fish stocks.
5. Assessment of effects on the seal stock of recent environmental changes or changes in food supply.
6. Review the existing knowledge on impact on the ecosystem from the recent increase in seal populations.

IV. Research Coordination (STACREC Chairman: C. A. Bishop)

1. Acquisition and publication of STATLANT data.
2. Research coordination for Greenland halibut, formulation of research proposal for synoptic survey
3. Review of research documents
4. Other matters

V. Publications (STACPUB Chairman: W. R. Bowering)

1. Review of scientific publications

2. Promotion and distribution of scientific publications

3. Editorial matters

   a) Editorial board
   b) Other matters

4. Review of papers for possible publication

   a) Consideration of publication of papers from September 1995 Symposium.
   b) Others papers presented at the September 1995 Meeting
   c) Status of papers on Shrimp in Div. 3M for a single publication
   d) Status of papers on West Greenland Cod

5. Other matters

VI. Management Advice and Responses to Special Requests [see Annex 1]

1. Minimum fish size for Greenland halibut
2. Minimum landing size
3. TACs for Greenland halibut in SA 2 + Div. 3K and Div. 3LMNO
4. Research coordination of Greenland halibut
5. Measures to protect juvenile fish of regulated species
6. Optimum minimum fish sizes for regulated species
7. Usefulness of a minimum mesh size in the capelin fishery
8. a) Report on the nature and extent of analyses tabled at the Symposium with respect to the interaction between seals and commercial fish stocks
   b) Recommendations on research needed to further quantify the interaction between seals and commercial fish stocks [item outstanding from June 1995 Meeting]
9. Other requests

VII. Review of Future Meeting Arrangements

1. Scientific Council Meeting on northern shrimp 16-20 November 1995*
2. June 1996 Meeting of Scientific Council
3. Special Session and Annual Meeting, September 1996
4. June 1997 Meeting of Scientific Council

VIII. Future Special Sessions

1. Progress report on Workshop for September 1996
2. Progress report on Symposium for September 1997

IX. Other Business

X. Adoption of Reports

1. Committee Reports of present meeting (STACFIS, STACREC, STACPUB)
2. Report of Scientific Council, September 1995

XI. Adjournment

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* These dates were revised to 17-20 November during this meeting.

ANNEX 1

FISHERIES COMMISSION REQUEST FOR SCIENTIFIC ADVICE

Special Meeting of the Fisheries Commission - 7-9 June 1995

The Fisheries Commission, with the concurrence of the Coastal State, requests that the Scientific Council, as regards points 1 and 2 at a meeting in advance of the 1995 Annual Meeting, provide scientific advice in response to the following issues:

1. A minimum fish size for Greenland halibut

   Provide advice on the minimum fish size for Greenland halibut in SA 2+3, in terms of round (total) length, corresponding to 25% retention by the existing legal minimum mesh size for trawls.

2. TACs for Greenland halibut in SA 2+ Div. 3K and Div. 3LMNO

   The Fisheries Commission has subdivided the 1995 TAC for Greenland halibut in SA 2+3 into two TACs for SA 2 + Div. 3K and Div. 3LMNO. In responding to the Commission's request for advice for the management of Greenland halibut in SA 2+3 for 1996, the Scientific Council should recommend an overall TAC for SA 2+3 and provide advice on dividing the overall TAC into two TACs for SA 2 + Div. 3K and for Div. 3LMNO.

3. Further measures to protect juvenile fish of regulated species, e.g. area/seasonal closures

   Taking into account available information on the geographical and seasonal distribution of regulated species of various sizes, identify, where practical and sufficient information is available, seasonal and area fishery closures which would reduce the proportion of juveniles of regulated species in commercial catches.

4. Optimal minimum fish sizes

   Taking into account the implications on conservation of the stocks and long-term harvest of alternative sizes at first entry into the fishery, recommend optimal (in terms of maximum yield per recruit) minimum fish sizes for regulated species in the NRA, and advise on the corresponding minimum mesh sizes for trawls and other gear.

5. Minimum mesh size in the Capelin fishery

   Provide advice on the usefulness of a minimum mesh size in the trawl fishery for Capelin.

PREVIOUS FISHERIES COMMISSION REQUESTS

In September 1993 the Fisheries Commission forwarded i.a. the following request to the Scientific Council:

5. Noting that the Scientific Council has scheduled a Symposium on Seals in the Ecosystem for September 1995, the Fisheries Commission requests a report in 1994 on the nature and extent of analyses that are expected to be tabled at the Symposium with respect to the interrelation between seals and commercial fish stocks.

In September 1994, the Fisheries Commission forwarded the following requests:

5. Noting that the Scientific council held a Symposium on Seals in the Ecosystem, the Fisheries Commission requests a detailed report on the nature and extent of analyses that were tabled at the Symposium with respect to the interrelation between seals and commercial fish stocks, together with recommendations on research needed to quantify further interactions.

6. Noting the Scientific Council's recommendations for coordinated research on Greenland halibut, the Fisheries Commission and the two Coastal States emphasize the urgency of acquiring information on the distribution and stock status. The Scientific Council is requested to pursue its coordinated efforts and member countries are urged to commit the necessary resources to the research.

The following request for advice was received on 17 June 1994. This is presented to the Scientific Council with a view to developing terms of reference for a proposed meeting of the ICES/NAFO Working Group.

"Denmark (on behalf of Faroe Islands and Greenland) request advice from the NAFO Scientific Council (eventually via the Joint ICES/NAFO Working Group on Harp and Hooded Seals) on the following issues

Harp and hood seals

- assessment of stock sizes, distribution and pup production of harp and hooded seals in the Northwest Atlantic;

- assessment of sustainable yields at present stock sizes and in the long term under varying options of age composition in the catch;

- advise on catch options in the NAFO area;

- assessment of effects of recent environmental changes or changes in the food supply and possible interaction with other living marine resources in the area."

APPENDIX V. LIST OF RESEARCH AND SUMMARY DOCUMENTS - SEPTEMBER 1995
RESEARCH DOCUMENTS (SCR)

Doc. No.	Ser. No.	
95/80[1]	N2597	MOORE, S. E., and D. P. DEMASTER. Cetaceans habitats in the Alaskan Arctic.
95/81[1]	N2598	GRIFFIN, R. B. An investigation of relationships between odontocete distributions and zooplankton abundances.
95/82[1]	N2604	FERTL, D., and D. LEATHERWOOD. Cetacean interactions with trawls: a preliminary review.
95/83[1]	N2605	BOGSTAD, B., K. H. HAUGE, and Ø. ULLTANG. MULTSPEC - a multispecies model for fish and marine mammals in the Barents Sea.
95/84[1]	N2606	MERRICK, R. L. Current and historical role of apex predators in the Bering Sea ecosystem.
95/85[1]	N2607	HAUKSSON, E., and V. BOGASON. Vagrant seals visiting the coastal waters of Iceland, in the period 1989-1994; hooded seals (*Cystophora cristata* Erxleben, 1777), harp seals (*Phoca groenlandica* Erxleben, 1777), bearded seals (*Erignathus barbatus* Erxleben, 1777) and ringed seal (*Phoca hispida* Schreber, 1775).
95/86[1]	N2608	ÓLAFSDÓTTIR, and E. HAUKSSON. Anisakid (Nematoda) infections in Icelandic grey seals (*Halichoerus grypus* Fabr.).
95/87[1]	N2609	KENNEY, R. D., G. P. SCOTT, T. J. THOMPSON, and H. E. WINN. Estimates of prey consumption and tropic impacts of cetaceans in the U.S. Northeast continental shelf ecosystem.
95/88[1]	N2610	CRESPO, E. A., S. N. PEDRAZA, S. L. DANS, M. K. ALONSO, L. M. REYES, N. A. GARCIA, M. COSCARELLA, and A. C. M. SCHIAVINI. Direct and indirect effects of the High Seas fisheries on the marine mammal populations in the northern and central Patagonian coast.
95/89[1]	N2611	BOYLE, G. J. An operant methods of investigating prey selection in seals.
95/90[1]	N2612	TRITES, A. W, D. PAULY, and V. CHRISTENSEN. Competition between fisheries and marine mammals for prey and primary production in the Pacific Ocean.
95/91[1]	N2613	TODD, S., P. OSTROM, J. LIEN, and J. ABRAJANO. Use of the stable isotope ratio $\delta^{13}C$ to determine diet in humpback whales (*Megaptera novaeangliae*).
95/92[1]	N2614	NILSSEN, K. T., P. E. GROTNES, T. HAUG, and V. POTELOV. Seasonal variation in body condition of adult Barents Sea harp seals (*Phoca groenlandica*).
95/93[1]	N2615	SHELTON, P. A., W. G. WARREN, G. B. STENSON, and J. W. LAWSON. Quantifying some of the major sources of uncertainty associated with estimates of harp seal prey consumption. Part I. Uncertainty in consumption estimates associated with population size, residency, energy requirement and diet.
95/94[1]	N2616	WARREN, W. G., P. A. SHELTON, and G. B. STENSON. Quantifying some of the major sources of uncertainty associated with estimates of harp seal prey consumption. Part II. Uncertainty in estimates of harp seal population size.
95/95[1]	N2617	STENSON, G. B., M. O. HAMMILL, and J. W. LAWSON. Predation of Atlantic cod, capelin, and Arctic cod by harp seals in Atlantic Canada.

[1] Symposium Papers.

95/96[1]	N2618	HAUG, T., U. LINDSTRØM, K. T. NILSSEN,and H. J. SKAUG. On the variation in size and individual composition of minke whale (*Balaenoptera acutorostrata*).
95/97[1]	N2619	SKAUG, H. J., H. GJØSÆTER, T. HAUG, U. LINDSTRØM, and K. T. NILSSEN. Do minke whales (*Balaenoptera acutorostrata*) exhibit particular prey preferences?
95/98[1]	N2620	SIGURJÓNSSON, and G. A. VIKINGSSON. Estimation of food consumption by cetaceans in Icelandic and adjacent waters.
95/99[1]	N2621	STEFÁNSSON, A., J. SIGURJÓNSSON, and G. VIKINGSSON. On dynamic interactions between some fish resources and cetaceans off Iceland based on a simulation model.
95/100	N2622	SAINZA, C. Northern shrimp (*Pandalus borealis*) on Flemish Cap in July 1995.
95/101	N2624	SIEGSTAD, H., and C. HVINGEL. The Greenland fishery for northern shrimp (*Pandalus borealis*) on Flemish Cap, NAFO Division 3M, in 1994 and 1995.
95/102	N2625	COLBOURNE, E. Oceanographic conditons on the Flemish Cap during the summery 1995, with comparisons to the 1961-1990 average.
95/103	N2626	PARSONS, D. G., and P. J. VEITCH. The Canadian fishery for northern shrimp (*Pandalus borealis*) on Flemish Cap (NAFO Division 3M), 1993 to 1995.
95/104	N2627	RODRÍGUEZ-MARÍN, E. Feeding relationships of demersal fish in Flemish Cap in summer, 1993-1994).
95/105	N2628	NICOLAJSEN, Å. Biomass estimate of the northern shrimp stock on Flemish Cap (Division 3M) for 1993 and 1994.
95/106	N2629	PARSONS, D. G. Preliminary assessment of shrimp (*Pandalus borealis*) in Division 3M (Flemish Cap) - 1995.

SUMMARY DOCUMENTS (SCS)

Doc. No.	**Ser. No.**	
95/20	N2630	WIGLEY, S. E., R. K. MAYO, H. MUSTAFA, and F. M. SERCHUK. United States research report for 1994.
95/21	N2632	NAFO. Report of Scientific Council, 9-15 September 1995 Meeting.

[1] Symposium Papers.

APPENDIX VI. LIST OF PARTICIPANTS - SEPTEMBER 1995

CANADA

Representatives:

Beckett, J. S. — Fisheries Research Branch, Dept. of Fisheries & Oceans, 200 Kent St., Ottawa, Ont. K1A 0E6
Phone: +613-990-0279 - Fax: +613-954-0807

Bowering, W. R. — Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Newfoundland A1C 5X1
Phone: +709-772-2054 - Fax: +709-772-4188 - E-mail: bowering@nflorc.nwafc.nf.ca

Atkinson, D. B. — Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Newfoundland A1C 5X1
Phone: +709-772-2052 - Fax: +709-772-4188 - E-mail: atkinson@nflorc.nwafc.nf.ca

Advisers/Experts

Brodie, W. B. — Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1
Phone: +709-772-2054 - Fax: +709-772-4188 - E-mail: brodie@nflorc.nwafc.nf.ca

Parsons, D. — Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1
Phone: +709-772-2093 - Fax: +709-772-4105 - E-mail:

Power, D. — Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1
Phone: +709-772-4935 - Fax: +709-772-4188 - E-mail:

Sjare, B. — Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1
Phone: +709-772-4049 - Fax: +709-772-3207 - E-mail: sjare@nflorc.nwafc.nf.ca

Stenson, G. B. — Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1
Phone: +709-772-5598 - Fax: +709-772-3207 - E-mail: stenson@nflorc.nwafc.nf.ca

Halliday, R. G. — Marine Fish Division, Dept. of Fisheries & Oceans, BIO, P. O. Box 1006, Dartmouth, N.S.
Phone: +902-426-3240 - Fax: +902-426-1506 - E-mail: r_halliday@bionet.bio.dfo.ca

DENMARK (IN RESPECT OF FAROE AND GREENLAND)

Advisers/Experts

Kapel, F. O. — Greenland Institute of Natural Resources, Tagensvej 135, 1, DK-2200 Kobenhavn N
Phone: +45 31 854444 - Fax: +45 35 821850 - E-mail: grfifok@inet.uni.c.dk

Nicolajsen, Å. — Fiskorannsoknarstovan, Fish. Lab., Nóatún, Box 3051, FR110 Torshavn, Faroe Islands
Phone: +298 15092 - Fax: +298 18264

Siegstad, H. — Greenland Institute of Natural Resources, Box 570, 3900 Nuuk
Phone: +299 21095 - Fax: +299 25957

EUROPEAN UNION (EU)

Representatives:

Astudillo, A. — Commission of the European Union, Rue Joseph II, 99, 1040 Brussels, Belgium
Phone: +322 296 119 - Fax: +322 296 6046

Lassen, H. — Danish Institute for Fish. Research, Charlottenlund Slot, DK-2920, Charlottenlund, Denmark
Phone: +45 33 963352 - Fax: +45 33 963333 - E-mail: hl@dfu.min.dk

Advisers/Experts

Cornus, H.P. — Institut für Seefischerei, Palmaille 9, D-22767, Hamburg, Germany
Phone: +49 40 38905194 - Fax: +49 40 38905263 - E-mail: internet.100565.123@compuserve.com

Stein, M. — Institut für Seefischerei, Palmaille 9, D-22767, Hamburg, Germany
Phone: +49 40 38905194 - Fax: +49 40 38905263 - E-mail: internet.100565.123@compuserve.com

Cross, D. — EUROSTAT, Commission of the European Union, Jean Monet Building, Luxembourg
Phone: +352 4301 37249 - Fax: 352 4301 37318 - E-mail: david.cross@eurostat.cec.be

Godinho, M.L.	Instituto Portuges de Investigacao Maritima, Av. de Brasilia, Alges-Praia, Lisbon, Portugal Phone: +351 1301 7361/0814 - Fax: +351 1301 5948
Avila de Melo, A.	Instituto Portugues de Investigacao Maritima (IPIMAR), Av. de Brasilia, Lisbon, Portugal Phone: +351 1301 0814 - Fax: +351 1301 5948
De Cárdenas, E.	Instituto Español de Oceanografia, Aptdo 240, Santander, Spain Phone: +34 42275033 - Fax: +34 42275072
Motos, L.	AZTI, Instituto para la Ciencia y Tecnologia Pesquera, Av. Satrustegi 8, 20008 - San Sebastian, Spain Phone: +34 43214124 - Fax: +34 43212162
Vazquez, A.	Instituto de Investigaciones Mariñas, Muelle de Bouzas, 36208 Vigo, Spain Phone: +34 86231930 - Fax: +34 86292762 - E-mail: AVAZQUEZ@IIM.CSIC.ES
Casey, J.	Dir., of Fish. Res., Fish. Lab., Pakefield Rd., Lowestoft, Suffolk NR33 OHT, United Kingdom Phone: +44 1502524251 - Fax: +44 1502524511 - E-mail: j.casey@dfr.maff.gov.UK

ICELAND

Representative:

Sigurjonsson, J.	Marine Research Institute, Skulagata 4, P. O. Box 1390, 121-Reykjavik Phone: +354 5520240 - Fax: +354 5623790 - E-mail: johann@hafro.is

JAPAN

Advisers/Experts

Murai, T.	Deputy Dir., Development Dept., Japan Marine Fishery Resources Research Center (JAMARC), Godo Kaikan Bldg.3-27 Kioi-Cho, Chiyoda-ku, Tokyo 102 Phone: +0332658301 - Fax: +0332622359
Yamada, H.	49 Kokubu-Machi, Nagasaki 850 Phone: +95 8228158 - Fax: +95 8214494
Yokawa, K.	National Research Institute of Far Seas Fisheries, 5-7-1 Orido, Shimizu 424 Phone: +81543340715 - Fax: +81 543359642

RUSSIA

Representative:

Troyanovsky, F. M.	Dir., Polar Res. Instit. of Marine Fish. & Oceanogr. (PINRO), 6 Knipovich St., Murmansk 183763 Phone: +47 78910158 - Fax: +47 78910518 - E-mail: PINRO@IMR.NO

Advisers/Experts

Shibanov, V. N.	Polar Res. Instit. of Marine Fish. & Oceanography (PINRO) 6 Knipovich St., Murmansk 183763 Phone: +47 78910423 - Fax: +47 78910518 - E-mail: PINRO@IMR.NO

OBSERVERS

Serchuk, F.	NMFS, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543-1097, USA Phone: +508-548-5123 - Fax: +508-548-5124 - E-mail: Fserchuk@whsun1.wh.whoi.edu
ICES Rep. (H. P. Cornus)	Institut für Seefischerei, Palmaille 9, D-22767, Hamburg, Germany Phone: +494038905194 - Fax: +49404038905263 - E-mail: internet.100565.123@compuserve.com