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NORTHWEST ATLANTIC FISHERIES ORGANIZATION

Scientific Council Reports 1995

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PREFACE

This sixteenth issue of *NAFO Scientific Council Reports* containing reports of Scientific Council Meetings held in 1995 is compiled in four sections: **Part A** – Report of the Scientific Council Meeting during 7-21 June 1995 which addressed the annual requests for scientific advice on fisheries management, **Part B** – Report of the Annual Meeting during 9-15 September 1995; the report of the Special Session on "The Role of Marine Mammals in the Ecosystem" which was held during 6-8 September 1995, is included in the Report of the Annual Meeting, and **Part C** – Report of the Scientific Council Meeting during 17-20 November 1995 which conducted assessments on shrimp in Subareas 0 and 1, and Denmark Strait. **Part D** of this volume contains the Agenda, Lists of Research and Summary Documents, Lists of Participants, and List of Recommendations relevant to Part A, B, and C.

The *NAFO Scientific Council Reports* series replaced *ICNAF Redbook* series which terminated with the last issue in 1979. The first issue of this series was published in December 1980.

January 1996

Tissa Amaratunga
Assistant Executive Secretary

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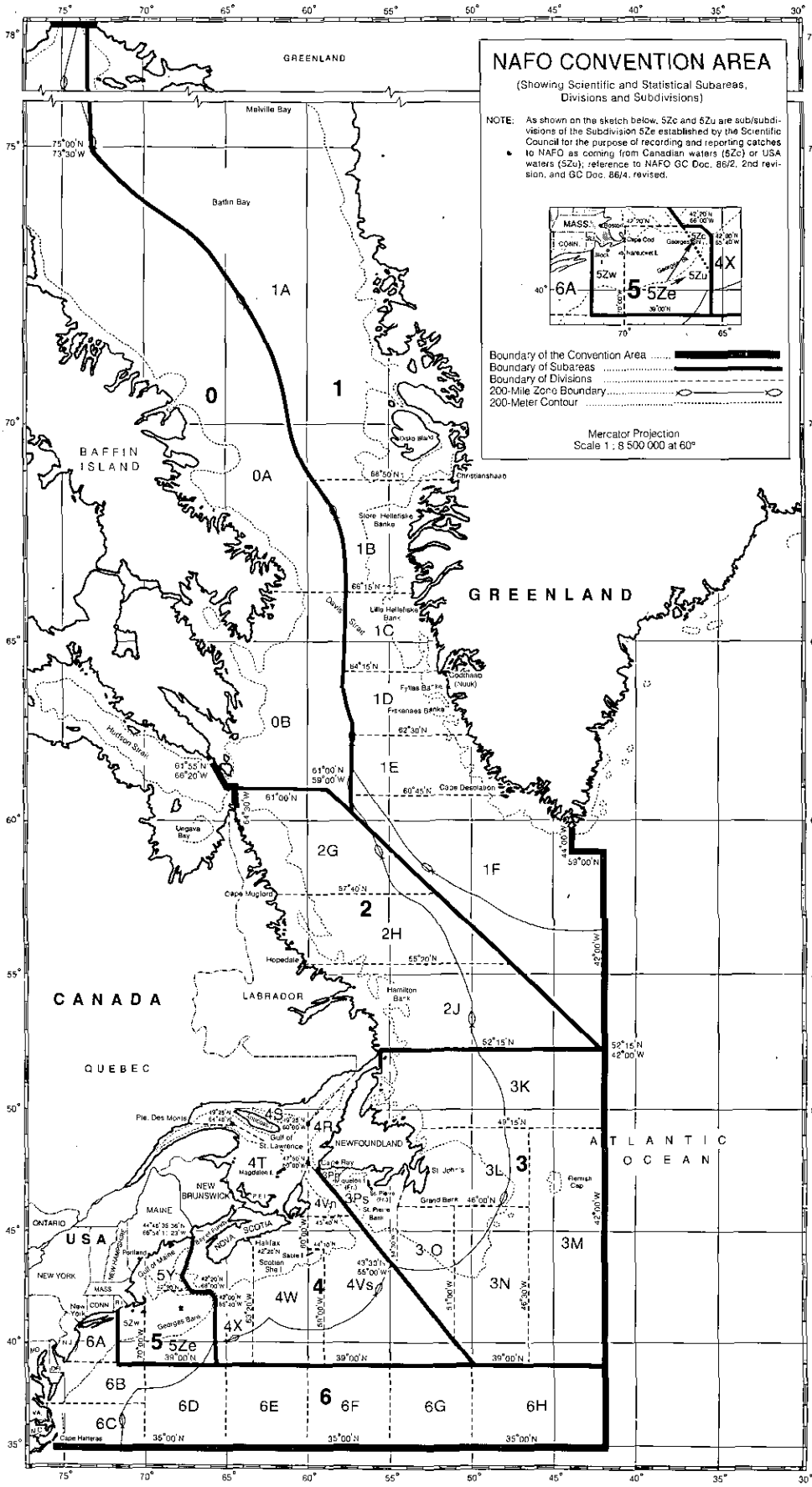
NAFO CONVENTION AREA
(Showing Scientific and Statistical Subareas, Divisions and Subdivisions)
NOTE: As shown on the sketch below, 5Zc and 5Zu are sub/subdivisions of the Subdivision 5Ze established by the Scientific Council for the purpose of recording and reporting catches to NAFO as coming from Canadian waters (5Zc) or USA waters (5Zu); reference to NAFO GC Doc. 86/2, 2nd revision, and GC Doc. 86/4, revised.
Boundary of the Convention Area
Boundary of Subareas
Boundary of Divisions
200-Mile Zone Boundary
200-Meter Contour
Mercator Projection
Scale 1 : 8 500 000 at 60°
GREENLAND
BAFFIN ISLAND
CANADA
QUEBEC
LABRADOR
NEWFOUNDLAND
ATLANTIC OCEAN
USA
MAINE
NEW YORK
ONTARIO
NEW BRUNSWICK
NOVA SCOTIA
Melville Bay
Baffin Bay
Davis Strait
Hudson Strait
Ungava Bay
Cape Mugford
Hopedale
Cape Desolation
Fyllas Banke
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Store Hellefiske Banke
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Hamilton Bank
Gulf of St. Lawrence
Pte. Des Monts
Magdalen Is.
St. John's
Grand Bank
Flemish Cap
St. Pierre Bank
Halifax
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PART A

Scientific Council Meeting, 7-21 June 1995

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Group Photograph, Scientific Council, 7-21 June 1995

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Back Row: A. Avila de Melo, O. Jørgensen, M. Stein, E. F. Murphy, V. A. Rikhter, L. Motos, H.-J. Rätz, A. Volochine, W. B. Brodie, H. P. Cornus, J. Casey, W. R. Bowering, D. B. Atkinson, S. J. Walsh, J.-C. Mahé, D. Power, H. Lassen, D. E. Stansbury, K. H. Nygaard, J. S. Beckett, K. Yakawa, M. L. Godinho, G. Bech

(From left to right)

REPORT OF SCIENTIFIC COUNCIL

7-21 June 1995

Chairman: H. Lassen Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada during 7-21 June 1995, to consider the various matters listed in its agenda (see Agenda I, Part D, this volume).

Representatives attended from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), European Union (Denmark, France, Germany, Portugal, Spain and United Kingdom), Japan and Russian Federation, and an observer from United States of America. The Assistant Executive Secretary was in attendance.

The Executive Committee met prior to the opening session of the Council, and the provisional agenda and work plan were discussed in relation to the new structure and work distribution of the Scientific Council and its Committees.

The opening session of the Council was called to order at 1015 hours on 7 June 1995.

The Chairman welcomed everyone to the second year at this venue for this meeting. The Assistant Executive Secretary was appointed rapporteur. The Council reiterated its standing invitation to the USA, welcoming S. Wigley, National Marine Fisheries Service, Woods Hole, Massachusetts, USA, as an observer to this meeting. The Council noted the Angolan scientists who had requested to be observers at the June 1994 Meeting, had subsequently visited the Secretariat.

The Council was informed by the Executive Secretary, that in accordance with Rule 2.3 of the Rules of Procedure with respect to proxy votes, he had received authorization from Estonia, Latvia, Lithuania and Norway to record their abstentions during any voting procedures.

The Council reiterated that any public releases of the Scientific Council deliberations could only occur when the adopted Scientific Council report of this meeting was available to Contracting Parties.

In introducing the provisional agenda, the Council noted that the Joint ICES/NAFO Working Group on Harp and Hooded Seals, as requested by the Scientific Council was currently in progress and the report of its deliberations would be ready for review by the Council on Friday, 9 June 1995.

Matters referred to the Working Group by the Council would be contained in the Working Group Report which will be issued as a Scientific Council Summary (SCS) document.

The provisional agenda was **adopted** as presented (see Agenda I, Part D, this volume).

The Chairman's proposal to appoint a Nominating Committee composed of M. Stein (EU-Germany) and A. Vazquez (EU-Spain) was accepted for the purpose of nominating officers to the Scientific Council and the Standing Committee on Research Coordination (STACREC).

In introducing the plan of work, the Chairman described the approach being taken by the Council at this meeting, in accordance with the decision made in 1994 on the reorganization of the Scientific Council. He outlined that STACFIS will fulfil its role as the body which will conduct the assessments, while the Council will address the tasks of developing prognoses on those assessments, and providing advice and recommendations. Accordingly, the STACFIS report will contain the assessment results and that report will be presented for consideration by the Council.

The Chairman noted that NAFO has had a difficult and busy time over the last year but the Scientific Council would have no difficulties in accomplishing its work, keeping in mind at all times the Council's task of providing objective scientific advice. The Chairman encouraged members to keep on track with discussions limited to scientific issues in order to complete the job at hand.

The Chairman informed the Council that having considered the workload anticipated at this meeting, he had informed the Chairman of the Fisheries Commission that the Council could not address any requests that may come from the Fisheries Commission Meeting of 7-9 June 1995, and any such requests would be deferred to the Scientific Council Meeting of September 1995.

The session was adjourned at 1045 hours on 7 June 1995.

The Council reconvened at 0900 hours on 14 June 1995 to review arrangements for future Special Sessions and Scientific Council meetings. It was agreed that the Chairman would convene a Working Group to draw up plans for the 1996 Special Session, and chair the Steering Committee to draw up guidelines for the 1997 Symposium.

The Council then reviewed the Summary of the Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, relevant to the request for advice from Denmark (Greenland). The proposed text was **adopted** as reported in Section X of the Council report.

The session was adjourned at 1010 hours on 14 June 1995.

The Council met again during 17-21 June 1995, to address all outstanding matters in the agenda.

The concluding session was convened at 1100 hr on 21 June 1995. The Council considered and **adopted** the Reports of the Standing Committees STACFEN, STACFIS, STACREC and STACPUB.

The Council then considered and **adopted** the Report of the Scientific Council of this meeting of 7-21 June 1995, noting minor changes as noted during this review would be made by the Chairman and the Assistant Executive Secretary.

The meeting was adjourned at 1210 hr on 21 June 1995.

The reports of the Standing Committees are appended as follows: Appendix I - Report of Standing Committee on Fisheries and Environment (STACFEN), Appendix II - Report of Standing Committee on Fishery Science (STACFIS), Appendix III - Report of Standing Committee on Research Coordination (STACREC), Appendix IV - Report of Standing Committee on Publications (STACPUB).

The Agenda, List of Research (SCR) and Summary (SCS) Documents, and the List of Participants of this meeting are given in Part D, this volume.

The Council's considerations on the Standing Committee Reports, and the other matters addressed by the Council follow in Sections II-XIV. The **recommendations** from this meeting are listed in Part D, this volume.

II. FISHERIES AND ENVIRONMENT (see STACFEN report, App. I)

1. Review of the Terms of Reference of STACFEN

The Council welcomed its first report of STACFEN, and extended its support to this Standing Committee to continue to improve in the knowledge pertaining to the effects of the environment on fish stocks and fisheries. Partly as a vehicle for integrating environmental studies with the fish stock assessments, the Scientific Council planned a workshop for September 1996, see section VII.2.

2. Invited Lecture on Remote Sensing

The Council noted that STACFEN was provided with a general overview of the marine remote sensing by A. Thomas from the Atlantic Centre for Remote Sensing of the Oceans (ACRSO), Bedford, Nova Scotia. Numerous applications of remote sensing using satellite imagery, primarily from the NAFO area were discussed. These included examples of atmospheric and oceanic variables. Remote sensing is also used to detect biological information: e.g. measurement of chlorophyll concentration and phytoplankton production.

The Council found that invited lectures are a useful tool to draw the Committee's attention to current environmental issues, and encouraged the STACFEN Chairman to continue this practice.

3. **Review of Environmental Studies in 1994**

The Council noted that ten documents dealing with environmental issues were reviewed. Extremely cold air temperatures (monthly mean anomalies of up to -6K) were observed in winter off West Greenland while above normal air temperatures persisted in the summer at Egedesminde, but were near normal at Nuuk. Similar cold conditions in winter were observed in 1993 and during most of the previous decade. The cold winter was responsible for below normal annual mean temperatures in the region and continued the cooling trend at Nuuk at West Greenland which began in the 1960s. A cooperative Canadian/German study presented the seasonal variability of the hydrographic properties off West Greenland using an analysis of historical data collected between 1920 and 1988. The time of the monthly mean near-surface salinity minimum occurred progressively later from south to north along southwestern Greenland, in August off Cape Farewell to October in the Davis Strait region. This salinity minimum reflected ice melt off East Greenland which was advected northward along West Greenland by the residual current. A northward velocity of approximately 0.16 m/sec was estimated from the timing of the salinity minima along the coast, which closely matched that of the observed speeds over the shelf.

The summertime area of the Cold Intermediate Layer (CIL) across the Newfoundland Shelf returned to near the long-term mean during 1994 at Bonavista but remained above normal on Hamilton Bank and on the Grand Bank. The volume of CIL waters (subzero temperatures) has been slowly decreasing since 1991. A significant south to north temperature gradient (warmer in the north) within the CIL was believed to be a result of the insulating effect of the winter ice cover.

Russian studies compared the near-bottom temperature, salinity, nutrients, circulation and zooplankton to silver hake catch distributions. The feeding and prespawning silver hake were on the warm side of the shelf/slope front.

4. **Overview of Environmental Conditions in 1994**

The Council noted the presentation of the annual overview paper based on several long-term oceanographic and meteorological data sets, as well as summarized results from available research documents. The overview presentation reported that extremely cold air temperatures were again observed over southern Labrador and Newfoundland in winter, due to intensification of the atmospheric circulation pattern as indicated by a strongly positive North Atlantic Oscillation (NAO) index. Air temperatures warmed to above normal values during the summer and autumn although the annual means remained slightly below normal.

Below normal temperatures were observed throughout most of the water column at Station 27 in winter and in the deep waters during the entire year. The latter continued a trend that has lasted over ten years. By the summer, however, temperature of the surface waters had increased upwards of 2°C above normal.

Cold waters continued in the 50-100 m depth range over the Scotian Shelf and in the deep waters of the northeastern Scotian Shelf. The negative anomalies in some regions were near to those recorded in the 1960s. The decline in temperature had begun in the mid- to late-1980s but the 1995 temperatures again appeared to be on the increase.

Warm conditions were observed throughout most of the Gulf of Maine during 1994. Increases in salinities at the mouth of the Bay of Fundy provided evidence that this warming was due to an increased influence of offshore slope waters.

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

1. Opening

The Council welcomed the report of STACFIS. The Council noted that, unlike in previous years STACFIS at this meeting was referred the task of the review of stocks, and requested to report on the assessment results.

2. General Review of Catches and Fishery Activities

The Council welcomed the review STACFIS undertook on the first day of the meeting to establish the accepted catches for consideration in the assessments, as it was noted that the estimates of national catches for 1994 from various sources showed discrepancies.

The Council was again concerned that STATLANT 21A data were not available from all Contracting Parties to allow a general review of fishery trends. The Council agreed that this analysis would not be done during this meeting, expressing concerns that the unavailability of these data hampers satisfactory progress in the stock assessment work.

3. Review of Recommendations from 1994 Meetings

The Council recognized that relevant recommendations were reviewed by STACFIS and addressed where possible.

4. Stock Assessments

It was noted that STACFIS evaluated the states of stocks referred to it by the Council. The assessment reports are given in the Report of STACFIS in Appendix II. The summaries and the conclusions of the assessments, on a stock-by-stock basis, are presented in Section X of this report along with other management advice as requested by the Fisheries Commission and the Coastal States.

5. Ageing Studies

STACFIS conducted discussions on ageing of silver hake and on the exchange of otoliths of American plaice and Greenland halibut.

The Council asked the Secretariat to keep members of the Scientific Council informed on the workshop on ageing of redfish to be held in Bremerhaven late in 1995, once the dates for that meeting have been announced (see Report of 9-15 September 1995 Meeting of Scientific Council).

6. Gear and Selectivity Studies

The Council noted that a significant amount of information on selectivity of trawls fishing for Greenland halibut had been presented. The Council noted that these data will be essential for formulating the responses to the requests from the Fisheries Commission from its meeting of 7-9 June 1995 (FC Doc. 95/4).

IV. RESEARCH COORDINATION (see STACREC Report, App. III)

1. Opening

The Council welcomed the report of STACREC, observing that matters referred by the Council were addressed.

2. Fisheries Statistics

a) Progress Report on Secretariat Activities in 1994/95

The Council noted that although some improvements were observed, there were still difficulties in the timely acquisition of STATLANT 21A reports, which are vital for production of several documents necessary for the annual June assessments meetings.

The Council was pleased to note that some of the outstanding data from EU-France and France (SP) had been received recently, and agreed to include them in publication of the Statistical Bulletin.

The Council noted steps were being taken to improve the format of reporting statistics in the Meeting documents.

The Council agreed with STACREC concerns that there had been a persistent divergence in recent years, between the 'official' catches reported in STATLANT forms which are published in the Bulletin and those available from other sources which are used in assessments. The Council agreed that methods should be pursued to document the process used to derive catches used in the assessments, and how these catch figures should be recorded in statistical publications.

b) **Report of the 16th Session of CWP and Preparation for the 17th Session**

The Council accepted the review done by STACREC on the Report of the 16th Session of CWP, and endorsed the view that NAFO has a long history which other international bodies of CWP can draw upon.

The Council endorsed the **recommendation** that the Assistant Executive Secretary attend the *ad hoc* consultation planned for July 1996 in Rome. The Council also endorsed the **recommendation** that NAFO should work to ensure that CWP meetings of regional interest be held as needed.

The Council noted that the proposed venue being considered for the 17th Session of CWP was Hobart, Australia. An alternative is EUROSTAT office in Luxembourg. The Council endorsed the **recommendation** that the Chairman of STACREC and the Assistant Executive Secretary should attend, and concurred that with advanced planning and the use of discount airfares, the cost of participation at either site would be similar.

Council noted the 2nd World Fisheries Congress will be held 28 July-2 August, 1996, in Brisbane, Australia, and agreed it would be valuable if a presentation was made to that meeting describing the long and relatively unique experiences of NAFO (and ICNAF). It was felt that such a presentation would enhance NAFO's image and would be valued globally, particularly in the management of high seas fisheries. The Council endorsed the **recommendation** that the World Fisheries Congress meeting be brought to the attention of the General Council and Fisheries Commission and propose that there be attendance as well as a presentation describing NAFO's experiences.

3. **Biological Sampling**

The Council noted that the Provisional List of Biological Sampling for 1993 was prepared by the Secretariat (SCS Doc. 95/11). Data from commercial fisheries pertinent to stock assessments were also tabulated, and National Representatives reported their sampling programs for the 1994/95 commercial fisheries to STACREC.

4. **Biological Surveys**

a) **Report on Activities in 1994**

The Council noted an inventory of biological surveys conducted, and a more detailed account of the survey data available for 1994 relative to their stocks, was tabled by National Representatives and Designated Experts.

b) **Surveys Planned for 1995 and Early-1996**

The Council noted an inventory of biological surveys planned for 1995, as submitted by National Representatives and Designated Experts, was compiled by the Secretariat.

c) **Review of Stratification Schemes**

The Council was pleased that the revised stratification scheme presented to STACREC by Canada in June 1994 was being used by Contracting Parties, and copies of the charts as needed would be supplied to the Secretariat.

d) **Coordination of Surveys**

The Council acknowledged the STACREC decision on the need to coordinate research surveys. The Council addressed issues regarding a synoptic survey for Greenland halibut throughout its range of abundance in response to the request by the Fisheries Commission. The Council endorsed the **recommendation** that parties interested in a synoptic survey for Greenland halibut meet and formulate such a plan.

5. **Non-traditional Fishery Resources in the NAFO Area**

The Council agreed with STACREC as to the importance of maintaining adequate statistical records and sampling, where possible, for non-traditional species such as skate and wolffish.

The Council endorsed the **recommendation** that analyses of distribution and abundance of non-traditional species be conducted for the extensive survey databases and the results be presented at the June 1996 Scientific Council Meeting.

6. **Other Matters**

a) **List of Fishing Vessels for 1992**

The Council reiterated the STACREC request that National Representatives should ensure that their reports for the triennial publication of List of Fishing Vessels for 1992 were forwarded to the Secretariat.

b) **List of Tagging Activities**

The Secretariat compiled a list of tagging activities in 1995 (SCS Doc. 95/7). Representatives were requested to check the list and report errors and omissions.

c) **Update of Information on Conversions Factors**

The Council noted that conversion factors compiled by FAO (FAO Circular Letter 847) were tabled. The factors were derived for conversion from product weight to equivalent whole fresh weight. New product development would require special studies to establish conversion factors. These conversion factors would not be appropriate to convert product weight through a weight-length relation to fish length.

d) **Pilot Observer Program**

The Council noted concerns raised by STACREC as to the implications of 100 % observer coverage on national sampling programs. The importance of maintaining national sampling programs was reiterated noting that the observers in the Pilot Observer Program were trained for enforcement purposes and may lack the expertise required to collect biological samples. The Council noted that these data would potentially be valuable for assessment of fish stocks and urged national representatives through their national offices to get access to these data.

e) **Other Business**

Some flounder catches taken by Korea and Canada (Scotia Fundy Region) have been reported as "flounder unspecified". STACREC requested the Secretariat to determine from Korea and Canada if information was available to break down these catches into species items.

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

1. Opening

The Council welcomed the report of STACPUB, noting its standard matters were addressed.

2. Review of Scientific Publications

The Council was pleased to note Journal Vol. 16, containing 7 miscellaneous papers and 3 notices was published in July 1994. Further it was noted that Journal Vol. 17 containing an Introduction, 5 papers presented at the November 1990 Canada-USSR Meeting on Capelin and 2 notices (77 pages) was published in October 1994.

The Council also noted Studies No. 21, containing 10 papers on Northern Cod and 3 notices was published in December 1994, and Studies No. 22, containing 6 miscellaneous papers, 1 notice and 1 obituary was published in May 1995.

The Council was pleased that 5 miscellaneous papers had been submitted for Studies No. 23 and are in the final stages of preparation.

The Council noted NAFO Statistical Bulletin, Vol. 41 for 1991 was published without France (St. Pierre and Miquelon) data, in February 1995. Further it was noted that NAFO Statistical Bulletin, Vol. 42 for 1992 was in the final stages of preparation and will be published soon.

3. Production Costs and Revenues for Scientific Council Publications

The Council noted no significant departures from previous year's production and revenue costs. The Council further noted ongoing reviews by the Secretariat to limit the number of print pages.

4. Promotion and Distribution of Scientific Publications

The Council was pleased that a paper compiling the historic oceanographic work on Flemish Cap as requested by STACPUB during the September 1994 meeting, had been prepared during the June 1995 meeting.

It was noted that some progress had been made on the proposal made at the November 1994 Meeting, to compile a single publication containing papers on Flemish Cap shrimp. The Council looked forward to further information at the September 1995 Meeting.

5. Editorial Matters

a) Editorial Board

The Council was informed that editor Sv. Aa. Horsted (Denmark-Greenland) had requested to withdraw from the Editorial Board because of retirement. The Council expressed its appreciation of the dedicated work done by Sv. Aa. Horsted and extended best wishes. The Chairman agreed to write a letter of appreciation to Sv. Aa. Horsted on behalf of the Council.

b) Considerations for Publishing Symposium Proceedings

The Council noted that discussions in STACPUB following a recommendation from the September 1994 Meeting had been concluded. The Council agreed that collection of papers from a Symposium in a single publication was useful, and further agreed that publications of Symposium proceedings be issued as supplementary issues of either Journal or Studies.

The Council agreed that conveners of a Symposium would have to decide whether contributions to the Symposium should aim at Journal or Studies before posters are sent out announcing the Symposium. If discussions at the Symposium have to be included in the proceedings, the conveners should aim for Studies, and it should be clearly stated that publication in the proceedings should not hamper a possible future publication of the same or an altered paper in primary literature.

The Council noted that conveners of the 1994 Symposium on 'Impact of Anomalous Oceanographic Conditions at the Beginning of the 1990s in the Northwest Atlantic on the Distribution and the Behaviour of Marine Life', will now proceed to finalize the publication of the proceedings in a supplementary issue of Studies.

6. **Papers for Possible Publication**

a) **Review of Contributions to the 1995 Meetings**

The Council accepted the STACPUB nomination of 16 papers from this meeting for consideration for publication in the Journal or Studies.

VI. COLLABORATION WITH OTHER ORGANIZATIONS

The Council addressed matters regarding the 16th and 17th Session of the CWP and the CWP *Ad hoc* Consultation, in its consideration of the Report of STACREC.

VII. ARRANGEMENTS FOR SPECIAL SESSIONS

1. **Special Session of September 1995**

The co-conveners, J. Sigurjonsson (Iceland) and G. B. Stenson (Canada) informed the Council that there has been considerable expressed interest in the joint NAFO/ICES Symposium on "The Role of Marine Mammals in the Ecosystem". There were 20-25 abstracts submitted to date, and a number of others requesting further information. The co-conveners will prepare the meeting schedule in early-July.

Considering the general interests on the Symposium, the Council anticipated that more than 200 participants could attend the Symposium.

2. **Special Session of September 1996**

The Council decided that the 1996 Special Session would be a Workshop on "Assessment of Groundfish based on Bottom Trawl Survey Results". This proposal replaces the 1994 proposal of a Symposium (NAFO Sci. Coun. Rep. 1994, p. 51). This workshop would include integration of catch and environmental data.

The Council established a Working Group (Chaired by H. Lassen) to design the workshop, in the general plan of the 1992 Workshop, with the view to providing NAFO participants a hands-on experience followed by a published manual. The complete proposal which the Secretariat should use to announce the workshop, is presented in SCS Doc. 95/18, Serial No. N1588. H. Lassen accepted the request by the Council to be Convener of this Workshop.

3. **Special Session of September 1997**

The Council was informed that Canada had invited NAFO to have its Annual Meeting of September 1997 in St. John's, Newfoundland, in conjunction with the 500th year celebrations of the arrival of John Cabot.

The Council agreed that the Symposium on "What Future for Capture Fisheries" to aim at a general worldwide audience, as proposed during the June 1994 Meeting (NAFO Sci. Coun. Rep., 1994, p. 51), would be an appropriate symposium for the event.

The Council agreed that the Steering Committee (Chaired by H. Lassen) struck in 1994 would draw up formal guidelines for the Symposium. Considering the significant international interest it is intended to generate, and the considerable work involved in organizing such a symposium, the Council agreed the Secretariat should look for assistance from groups outside NAFO to develop a comprehensive symposium program based on the Scientific Council guidelines. Objectives and outline of the symposium would further be developed between the Chairman and the Secretariat.

VIII. FUTURE SCIENTIFIC COUNCIL MEETINGS

1. **Annual Meeting and Special Session in September 1995**

The *Scientific Council* would next meet at the Annual Meeting of NAFO, in September 1995, at the Holiday Inn, Dartmouth, Nova Scotia, Canada.

The Council noted a considerable amount of additional work is slated for the Scientific Council Meeting, particularly to deal with requests from the Fisheries Commission and Coastal States on Seals, Greenland halibut, Shrimp in Div. 3M and mesh size questions. It was agreed that additional meeting days would be needed.

The Council therefore agreed to meet during 9-15 September 1995, which includes the Saturday, 9 September, and Sunday, 10 September 1995, in addition to the scheduled dates for the Annual Meeting.

This would be preceded by the Joint NAFO/ICES Symposium on "The Role of Marine Mammals in the Ecosystem" during 6-8 September 1995.

2. **Special Meeting on Shrimp Assessment in November 1995**

The Council agreed to conduct its Special Meeting for the Assessment of Shrimp in Subareas 0 and 1 and Shrimp in Denmark Strait, at NAFO headquarters, Dartmouth, Nova Scotia, during 16-20 November 1995 (dates were revised to 17-20 November 1995 during the September Meeting of the Scientific Council).

3. **Scientific Council Meeting in *June 1996***

The Council agreed to schedule this meeting for 5-19 June 1996.

4. **Annual Meeting and Special Session in September 1996**

The Council noted it would meet during the Annual Meeting scheduled for 9-13 September 1996. This would be preceded by the Workshop on "Assessment of Groundfish based on Bottom Trawl Survey Results", during 4-6 September 1996.

5. **INTERNET Communication Among Scientists**

The Council noted that the use of E-mail is commonplace for most of the scientists involved with work on the Scientific Council. The Council **recommended** that *the Secretariat obtain access to this INTERNET communication facility*. The cost of this form of communication competes well with other forms and the method is much faster.

IX. NOMINATION AND ELECTION OF OFFICERS

The Chairman's proposal (7 June 1995) to appoint a *Nominating Committee composed* of M. Stein (EU-Germany) and A. Vazquez (EU-Spain) was accepted by the Council.

On 21 June 1995 the Chairman requested the Nominating Committee to present its proposal for the nomination of Chairman to the Scientific Council, Vice-Chairman of the Scientific Council who would become the *ex officio* Chairman of STACPUB, and Chairman of STACREC. M. Stein reported that the Committee, after consulting with representatives, was ready to make nominations.

Noting that the appointments were for two-year terms beginning at the end of the September 1995 Annual Meeting of the Scientific Council, the Chairman called for nominations and election.

For the office of Chairman of Scientific Council, the current Vice-Chairman W. R. Bowering (Canada) was nominated by the Committee and the Council elected him by unanimous consent.

For the office of Vice-Chairman of Scientific Council and *ex officio* Chairman of STACPUB, the Committee nominated H.-P. Cornus (EU-Germany) and the Council elected him by unanimous consent.

For the office of Chairman of STACREC, the Chairman nominated D. Power (Canada), and the Council elected him by unanimous consent.

X. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS

1. Introduction

The Council received the STACFIS report and reviewed the assessments, and formulated summaries and its management advice for consideration by the Fisheries Commission and the Coastal States.

The Council discussed the format of the stock review section of its report. The format was changed and the previously used Summary Sheets were replaced by 1-2 page reports for each stock including 1-5 graphs with entries as described below:

Format For Scientific Council Stock Section

Stock name

Background:

species mix, uncertainties about stock delineation

Fishery and catches:

Graph with catches and TAC (agreed)
Table with catch and recommended and agreed TAC

Example

	('000 tons) Catch	TAC Recommended	TAC Agreed
1992	1.9	150	150
1993	2.8	150	150
1994	6.0	150	150
1995	-	150	150

Record the existence of non-reported, mis-reported, under-reported or over-reported catches.

Data:

Available data
Special problems with data.

Assessment:

Comments on type of assessment
CPUE development and changes in length distribution of catches
Fishing Mortality (when applicable)
Graph

Recruitment (when applicable)
Graph

Spawning stock biomass (if SSB is not available, replace by a proxy e.g. trawlable biomass, and change heading accordingly)
Graph

Forecast (management option table) (when applicable)

State of the Stock:

Summary of STACFIS conclusions

Recommendation:

TAC and other management recommendations

Special Comments:

Any additional comments

Source of information:

SCR Doc. 95/...., SCS Doc. 95/.....

It was further noted, the presentation sequence of the stocks in this report was changed to reflect the origin of each request.

2. **Request for Advice by the Fisheries Commission (1994)**

a) **Responses to the Fisheries Commission**

For stocks within or partly within the Regulatory Area as requested by the Fisheries Commission, the following are the responses in the requested sequence.

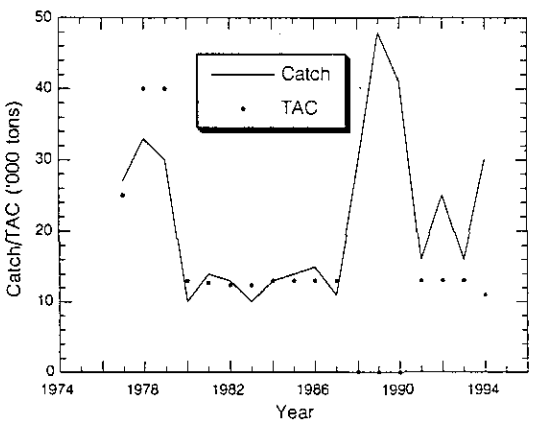
Cod in Div. 3M

Background: The cod stock on Flemish Cap is considered to be a discrete population.

Fishery and Catches: Since 1988 catches have exceeded the TACs.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	25	0	13
1993	16	0	13
1994	30	0	11
1995	-	0	11

[1] Provisional.



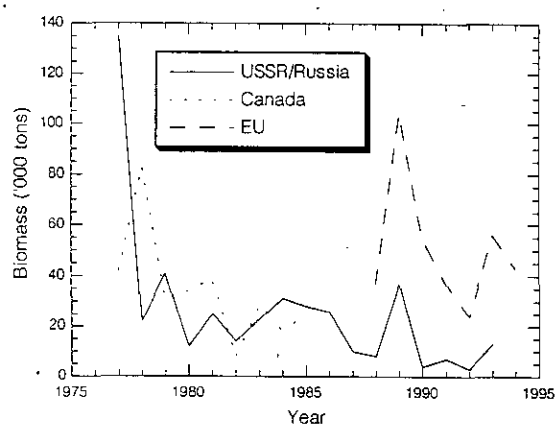
Data: Catch-effort and sampling data were available for Portuguese trawlers and gillnetters together with similar data for Spanish pair-trawlers. Data were available from two annual surveys which cover the distribution area of the stock: a Russian trawl-acoustic survey (1977-93) and an EU survey (1988-94).

Assessment: An analytical assessment was presented which was used only to infer trends in biomass and fishing mortality. This assessment could not be used for catch projections.

Fishing Mortality: Has been very high in recent years.

Recruitment: The 1985 and 1991 were the more abundant year-classes in recent years. The 1993 and 1994 year-classes seem to be weak.

Biomass:



State of the Stock: The fishable biomass is mainly young fish exposed to high fishing mortalities. Age 5+ biomass, assumed equal to the spawning stock biomass, is at a low level which in 1994 however is uncertain due to a reduction in age-at-first-maturity to 4 years. This reduction in age-at-first-maturity is interpreted as a reaction to the decline of the adult stock.

Recommendations: A rational exploited cod fishery on Flemish Cap requires both a reduction of catches on young fish, and a reduction of the fishing effort level from its current high level. For 1996 the catch should be limited to the vicinity of the current TAC.

Special Comments: The cod fishery will remain an opportunistic fishery, where the catches will follow recruitment fluctuations if the above two management objectives cannot be achieved. As a consequence, the overall yield of the fishery will under the current exploitation pattern remain well below its potential level.

Sources of information: SCR Doc. 95/26, 30, 73 (revised), 75, 77; SCS Doc. 95/13, 15.

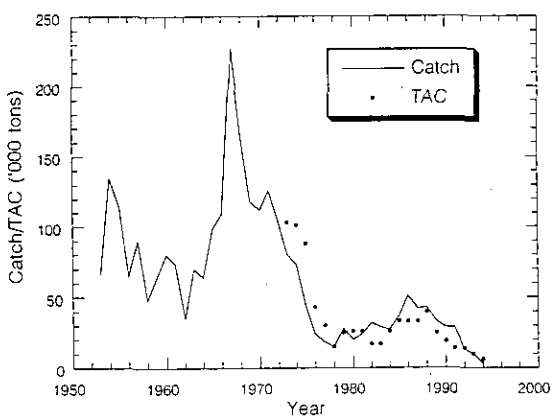
Cod in Div. 3N and 3O

Background: This stock occupies the southern part of the Grand Bank of Newfoundland. Cod are found over the shallower parts of the Bank in summer, particularly in the Southeast Shoal area (Div. 3N) and on the slopes of the Bank in winter as cooling occurs.

Fishery and Catches: There has been no directed fishery since mid-1994.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	12.6	13.6	13.6
1993	9.7	10.2	10.2
1994	2.7	6.0	6.0
1995	-	0.0	0.0

[1] Provisional.



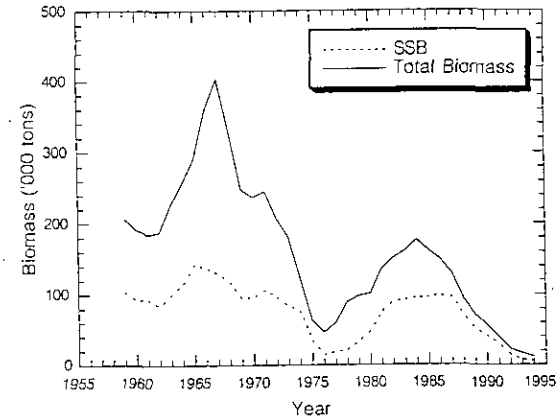
Data: Catch-at-age data were available from the Portuguese gillnet and otter trawl fishery for the first part of 1994. Russian research survey data were available up to 1993. Stock abundance, biomass and age structure were available from three Canadian groundfish surveys.

Assessment: An analytical assessment was adopted for this stock.

Fishing Mortality: Has been reduced on the fully recruited ages (7-10), however, there has been an increase on younger immature fish (ages 3-4).

Recruitment: Year-classes since 1990 appear to be weak. The current estimates of the 1989 and 1990 year-classes are much lower than previously estimated.

Biomass: The 1994 total (age 3^+) and spawning stock biomass estimates are the lowest in the time series.



State of the Stock: The stock was at an all time low in 1994 and was represented mainly by 2 year-classes (1989 and 1990).

Recommendation: There should be no direct fishing for cod in Div. 3N and 3O in 1996. By-catches in fisheries targeting other species should be kept at the lowest possible level.

Sources of information: SCR Doc. 95/55, 70; SCS Doc. 95/13

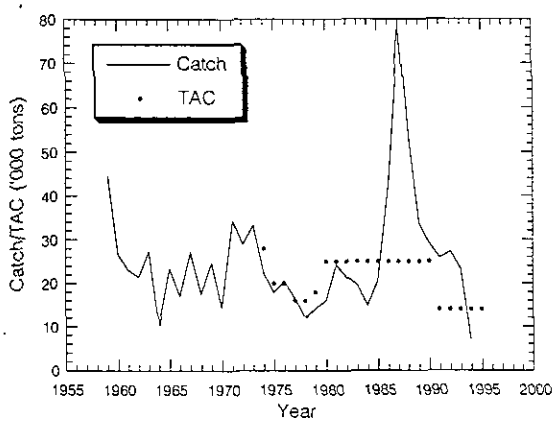
Redfish in Div. 3L and 3N

Background: There are two species of redfish, *Sebastes mentella* and *Sebastes fasciatus* which occur in Div. 3LN and are managed together. These are very similar in appearance and are reported collectively as redfish in statistics. The relationship to adjacent NAFO Divisions is unclear and further investigations are necessary to clarify the integrity of the Div. 3LN management unit.

Fishery Development and Catches: The 1994 catch was about 7 000 tons. This was the first year since 1985 that the TAC was not exceeded. The reduction is primarily due to reduced effort because of a relatively poor fishery on the Beothuk Knoll. Substantial catches, as much as 24 000 tons have been taken by non-Contracting Parties since 1987. There were 1 000 tons taken by these countries in 1994.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	27	14	14
1993	23	14	14
1994	7	14	14
1995		14	14

[1] Provisional.



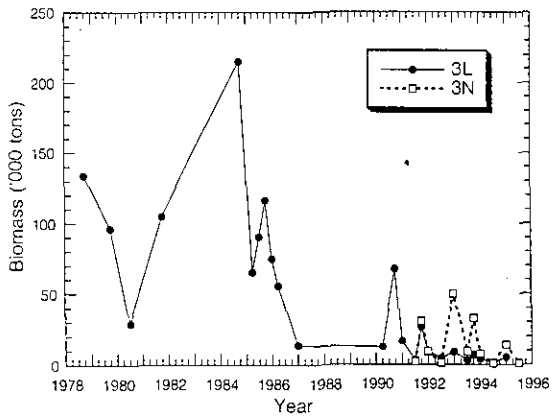
Data: Catch-rate indices derived for Div. 3L and 3N based on NAFO database. Catch-rate index for Div. 3LN based on Portuguese observed data. Separate bottom trawl surveys conducted by both Canada and Russia in Div. 3L and 3N.

Assessment: Not possible to provide an estimate of the absolute size of stock.

Fishing Mortality: Assumed to have declined in 1994 due to reduced effort. In late-1980s large catches likely generated high fishing mortalities.

Recruitment: Poor recruitment in Div. 3L since early-1980s. In Div. 3N no sign of any good year-classes, since those of 1986/87 which may already be recruiting to the fishery.

State of the Stock: Appears to be very low in Div. 3L with no sign of good recruitment. Has declined in Div. 3N from 1984 to 1991 but the status since then is uncertain.



Recommendation: The Council was pleased to note that 1994 was the first time since 1985 that the catch was below the agreed TAC. The Council can only evaluate the appropriateness of a TAC of 14 000 tons if catches are maintained at or below this level for a number of years. Total catches of redfish in Div. 3LN should not exceed 14 000 tons in 1996.

Special Comment: Catches by non-Contracting Parties in recent years have ranged from 1 000 tons in 1994 to 10 000 tons in 1992.

Sources of Information: SCR Doc. 95/13, 48, 51, 55, 69; SCS Doc. 95/4, 13.

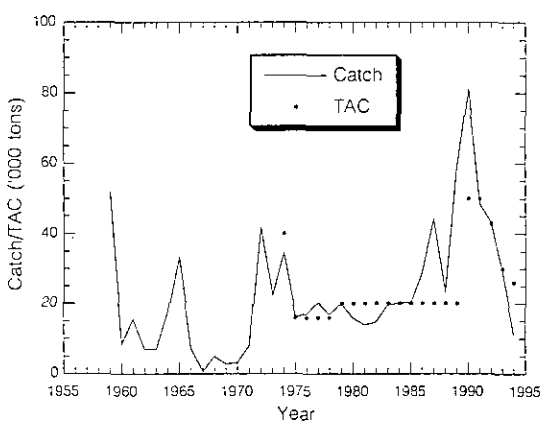
Redfish in Div. 3M

Background: There are three species of redfish which are commercially fished on Flemish Cap: deepsea redfish (*Sebastes mentella*), golden redfish (*Sebastes marinus*) and Acadian redfish (*Sebastes fasciatus*). The term beaked redfish is used for *S. mentella* and *S. fasciatus* combined. They are all reported combined in the commercial fishery.

Fishery and Catches: Directed fishing on redfish in Div. 3M in 1994 was mainly conducted by non-Contracting Parties and Russia. The Spanish and Portuguese redfish catches were mainly by-catch in the cod fishery. This was a change in comparison to 1993 when other Contracting Parties were also engaged in this fishery and the Portuguese fleet fished directly on redfish. Total catches dropped from 29 000 tons in 1993 to 11 000 tons in 1994. The reduction in catches was mainly caused by less effort by nearly all participating fleets. Non-Contracting Parties accounted for 60% of the catches.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	43	35	43
1993	29	20	30
1994	11	20	26
1995		20	26

[1] Provisional.



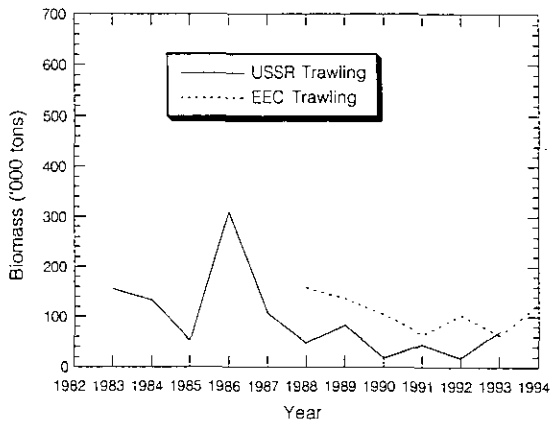
Data: Catch-at-age data and CPUE data were available for only a small part of the catches. There is still the problem of unreported catches by non-Contracting Parties. Results from bottom trawl surveys were also available.

Assessment: Due to insufficient data no analytical assessment could be done.

Fishing Mortality: Assumed to have declined due to reduced effort.

Recruitment: Survey results indicate increase in juvenile redfish biomass

Biomass:



The size of spawning stock biomass is unknown.

State of the Stock: The overall trawlable biomass seems to be back to levels seen in 1989 and 1990. This increase was mainly related to golden redfish and juveniles.

Recommendation: Catches higher than 20 000 tons in the period 1986 to 1992 were observed simultaneously with a decline in trawlable biomass. It would not be prudent to allow total catches to rise above a level of 20 000 tons, unless strong recruitment to the exploitable stock is confirmed. This is the level of catches in the period 1975 to 1985 when stable conditions were observed. Total catches of redfish in Div. 3M should therefore not be allowed to exceed 20 000 tons in 1996.

Special Comment: Although there is an indication of increased numbers of juvenile redfish, the implications for future directed redfish fisheries are uncertain pending evaluation of the effectiveness of the sorting grates now being used in the shrimp fishery in reducing the by-catch of small redfish. This will require the submission of the relevant redfish by-catch data from the shrimp fishery.

Sources of Information: SCR Doc. 95/26, 48, 51, 71; SCS Doc. 95/4, 12, 13, 15.

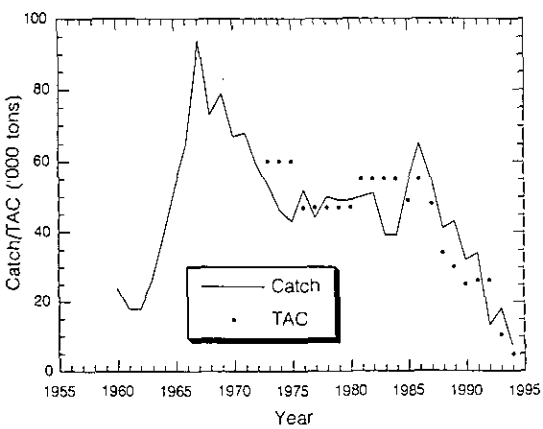
American Plaice in Div. 3L, 3N and 3O

Background: Historically, American plaice in Div. 3LNO has comprised the largest flatfish fishery in the Northwest Atlantic.

Fishery and Catches: In most years the majority of the catch has been taken by offshore otter trawlers. There was no directed fishing in 1994 and there was a moratorium in 1995.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	13	25.8	25.8
1993	17	10.5	10.5
1994	7	4.8	4.8
1995	0	0	

[1] Provisional.



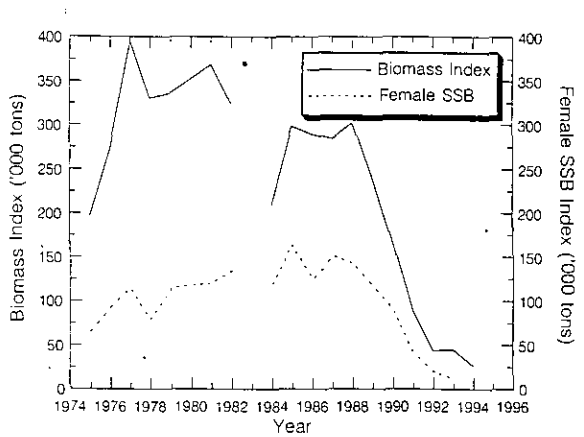
Data: Biomass and abundance data were available from several surveys. Limited catch/effort data were available from Portuguese vessels, as well as sampling data from Portuguese and Spanish vessels.

Assessment: No analytical assessment was possible due mainly to uncertainties with catch and catch-at-age data.

CPUE: Portuguese CPUE has been stable from 1990 to 1994.

Recruitment: The 1988 and 1989 year-classes show some promise but there has been no evidence of large year-classes since then.

Biomass and Spawning Stock Biomass:



Forecast: Recovery of this stock in the short term is very unlikely.

State of the Stock: The stock is at a record low level.

Recommendation: No fishing on American plaice in Div. 3LNO in 1996. By-catches should be reduced to the lowest possible level.

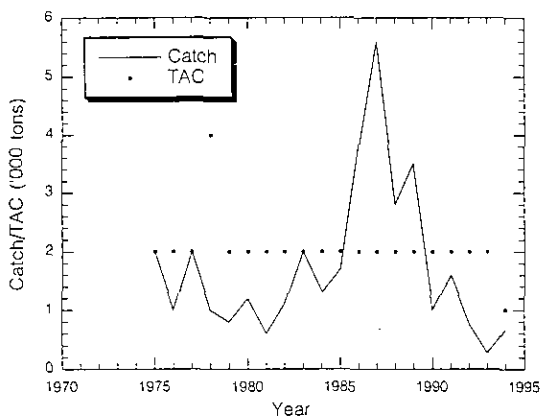
Sources of Information: SCR Doc. 95/48, 51, 55, 58, 59, 62; SCS Doc. 95/13, 15.

American Plaice in Div. 3M

Background: The stock mainly occurs on Flemish Cap at depths shallower than 600 m. It is mainly taken as by-catch in the cod and Greenland halibut trawl fisheries.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	0.8	2	2
1993	0.3	2	2
1994	0.7	1	1
1995		0	0

[1] Provisional.



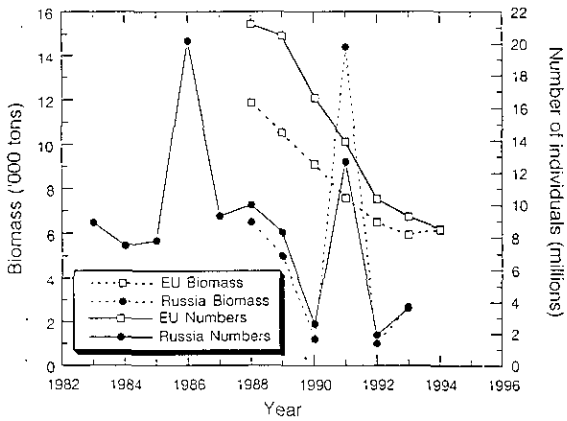
Fishery and Catches: After 1987 the catches declined drastically, partly due to a shift in the target species for the Spanish small freezers.

Data: Abundance and biomass indices are available from Russian surveys (1983-93) and EU surveys (1988-94).

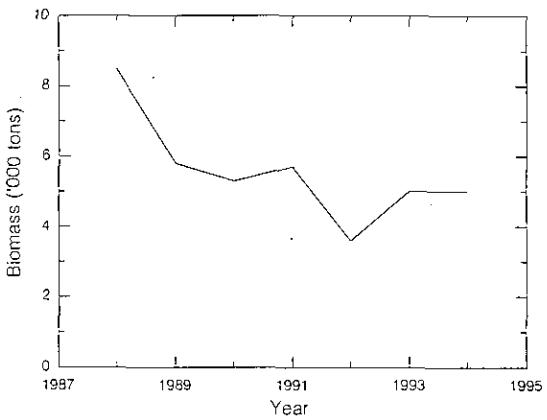
Assessment: *Fishing Mortality*: In 1993-94 the fishing mortality was the lowest estimated for the period 1988-94. It is believed that F is now at the level of M (approximately 0.2).

Recruitment: 1991 and 1992 year-classes appear to be weak.

Biomass and Abundance:



The SSB index remained more or less stable since 1990.



State of the Stock: The stock appears to have remained at low level, no good recruitments are expected since the 1990 year-class.

Recommendation: There should be no directed fishery on this stock in 1996. By-catches should be reduced to the lowest possible level.

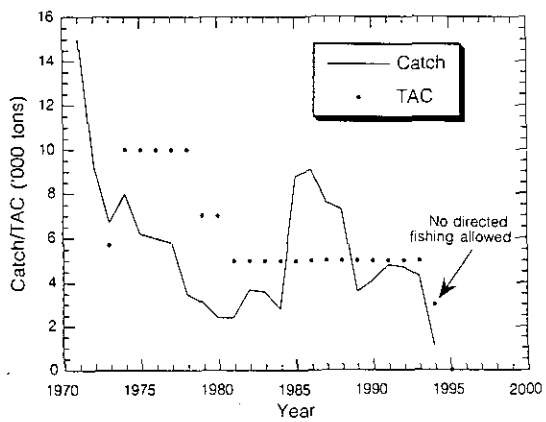
Sources of information: SCR Doc. 95/26, 48, 51, 72; SCS Doc. 95/13, 15.

Witch Flounder in Div. 3N and 3O

Background: The stock mainly occurs in Div. 3O along the deeper slopes of the Grand Bank. It has been fished mainly in winter- and spring-time on spawning concentrations.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	4.8	5	5
1993	4.4	5	5
1994	1.1	3	3[2]
1995	-	0	0[2]

[1] Provisional.
[2] No directed fishing allowed.

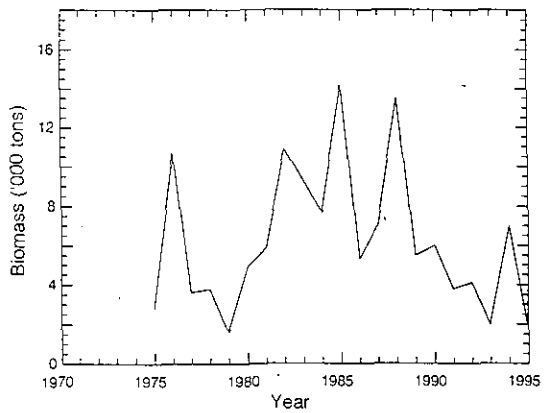


Fishery and Catches: Catches exceeded the TAC by large margins during the mid-1980s, but have been more stable since then near the level of the TAC up to 1993. The catch in 1994 was 1 100 tons despite the moratorium on directed fishing.

Data: Abundance and biomass data were available from spring surveys during 1971-95 and autumn surveys during 1990-94. No recent ageing data were available.

Assessment: No analytical assessment was possible.

Biomass:



State of the Stock: Stock appears to be at a very low level.

Recommendation: No fishing on witch flounder in 1996 in Div. 3N and 3O to allow for stock rebuilding to former levels. By-catches be reduced to the lowest possible level.

Sources of Information: SCR Doc. 95/8, 51, 55, 58, 63; SCS Doc. 95/15.

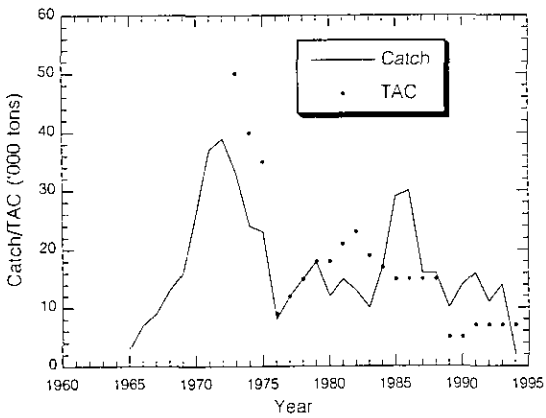
Yellowtail Flounder in Div. 3L, 3N, and 3O

Background: The stock is mainly concentrated on the southern Grand Bank and is recruited from the Southeast Shoal area *nursery ground, where the* juvenile and adult components overlap in their distribution.

Fishery and Catches: There was a moratorium on directed fishing in 1994 and catches were taken as by-catch in other fisheries.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	11	7	7
1993	14	14	7
1994	2	7[2]	7[2]
1995		0[2]	0[2]

[1] Provisional.
[2] No directed fishery.



Data: Catch-at-age and CPUE were available from 1965 to 1993 but not for 1994. Abundance and biomass indices were available from annual Canadian spring (1975-95) and autumn (1990-94) bottom trawl surveys and juvenile bottom trawl surveys (1986-94).

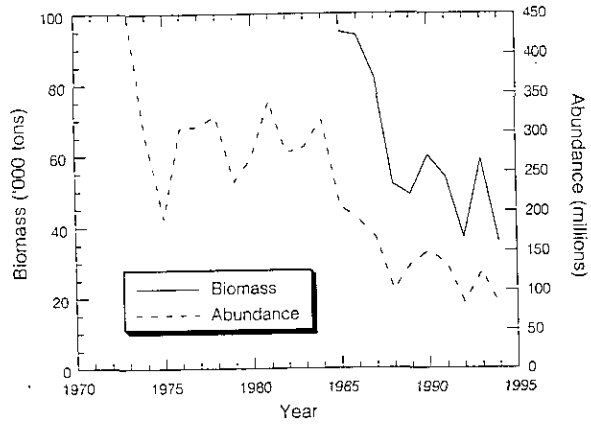
Additional estimates were available from a 1995 Spanish survey in the NAFO Regulatory Area.

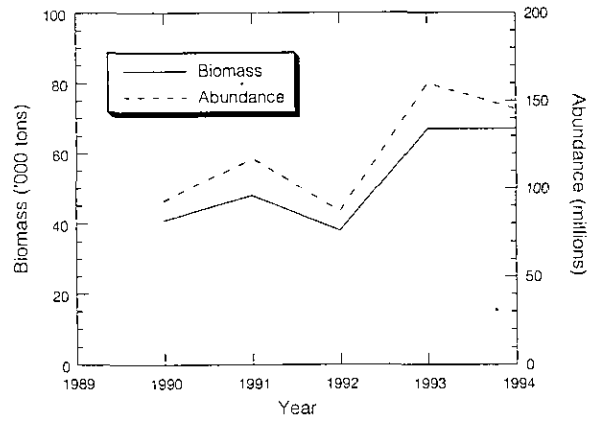
Assessment: No analytical assessment possible due mainly to uncertainties with catch and catch-at-age data.

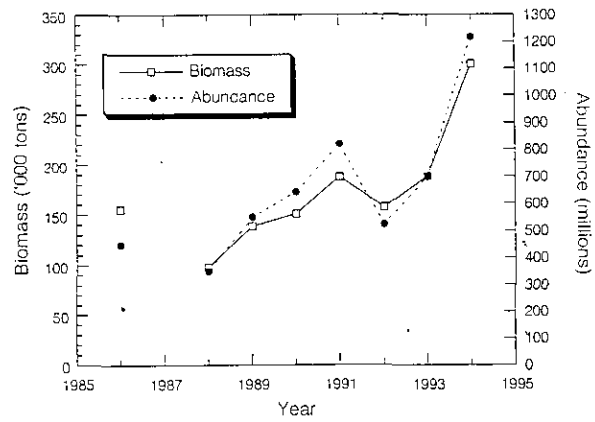
Fishing Mortality: Total mortality is high on older ages.

Recruitment: The 1990-93 year-classes, in the spring and autumn surveys, appeared to be below average and weaker than their immediate predecessors. The 1994 estimate of these year-classes from the juvenile survey was the highest. This, however, is assumed to reflect changes in catchability, and must be treated with caution.

Biomass:







State of Stock: The stock is at a low level. Potential growth of the stock from the relatively large 1984-86 year-classes has not occurred, likely because of large catches of these cohorts as juveniles by fisheries in the Regulatory Area, and because the TAC has been exceeded each year from 1984 to 1993. The stock area has contracted in recent years and this change could strongly influence catch rates in the research surveys and may have contributed to the high

variance seen in recent surveys. As well, this contraction of the stock to a small geographical area makes it very vulnerable to over exploitation.

Recommendation: There should be no directed fishing of yellowtail flounder in 1996. By-catches should be reduced to the lowest possible level.

Sources of Information: SCR Doc. 95/55, 58, 74, 79.

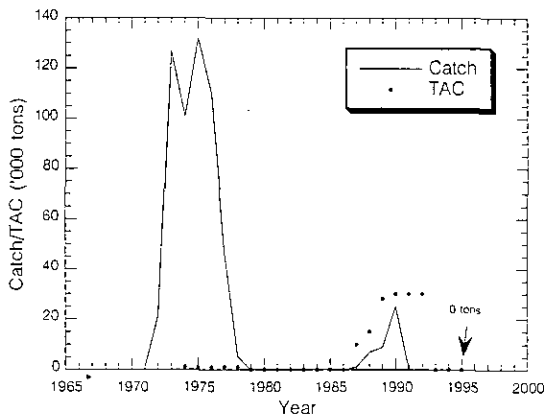
Capelin in Div. 3N and 3O

Background: Spawns on the south part offshore of the area of the southeast shoal.

Fishery and Catches: The fishery was closed during 1979-86 and again since 1993.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	+	30	30
1993	+	0	0
1994	+	0	0
1995	-	0	0

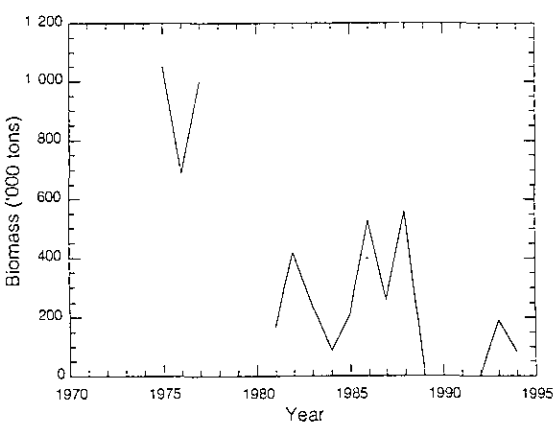
[1] Provisional.



Data: Acoustic surveys by Canada and Russia. In 1994 only a Russian survey was available.

Assessment: *Recruitment*: The age 2 recruitment was 36% of the total biomass estimate from the 1994 survey but this could not be compared with results of previous surveys.

Biomass: SSB (age 2+) was estimated by Canadian and USSR/Russian hydroacoustic surveys. In 1994 a Russian survey found virtually all of the fish in Div. 3O.



State of the Stock: The stock is at very low levels relative to those from the 1980s.

Recommendation: No directed fishery to be allowed in Div. 3N and 3O in 1996.

Source of information: SCR Doc. 95/10

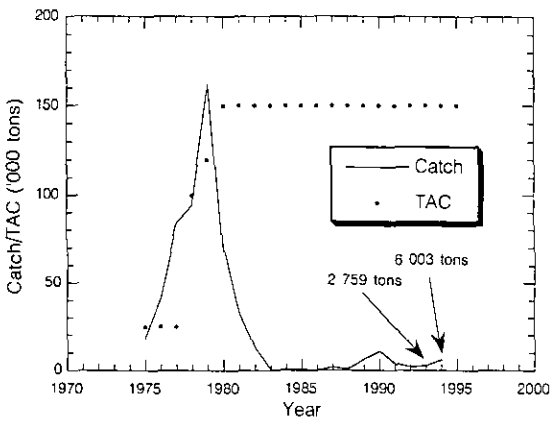
Squid in Subareas 3 and 4

Background: The major portion of the stock resides in Subarea 6 and further south.

Fishery and Catches: Most of the 1994 catch was taken by Cuba as by-catch in the silver hake fishery.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	1.9	150	150
1993	2.8	150	150
1994	6.0	150	150
1995	-	150	150

[1] Provisional.



Data: No recent data available.

Assessment: No assessment was possible without up-to-date information particularly on recruitment.

Recommendation: No advice possible.

Sources of information: SCS Doc. 95/8, 12.

Greenland Halibut in Subarea 2 and Div. 3KLMNO

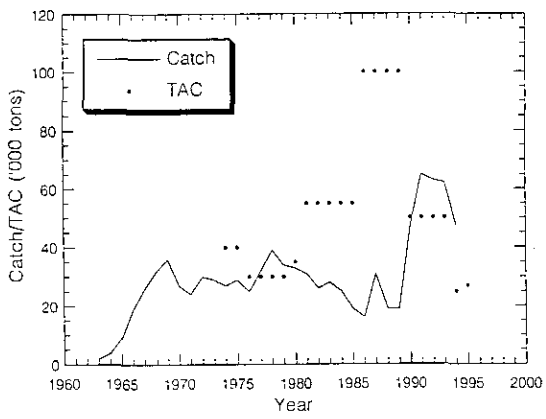
Background: The Greenland halibut stock in Subarea 2 and Div. 3KLMNO is considered to be part of a biological stock complex which includes Subareas 0 and 1.

Fishery and Catches: Catches increased sharply in 1990 due to a developing fishery in the Regulatory Area of Div. 3LMN and continued at high levels during 1991-94. Canadian catches were relatively stable during 1988-91 but declined considerably in 1992-94 to their lowest levels observed since the fishery began in the 1960s.

Catches show best estimates, and range of possible estimates in brackets.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1991	(55-75)	50	47
1992	63	50	50
1993	(42) 62	50	50
1994	48 (53)	-	25
1995	-	<40	27

[1] Provisional
[2] Established autonomously by Canada in 1992-94 and NAFO Fisheries Commission in 1995.



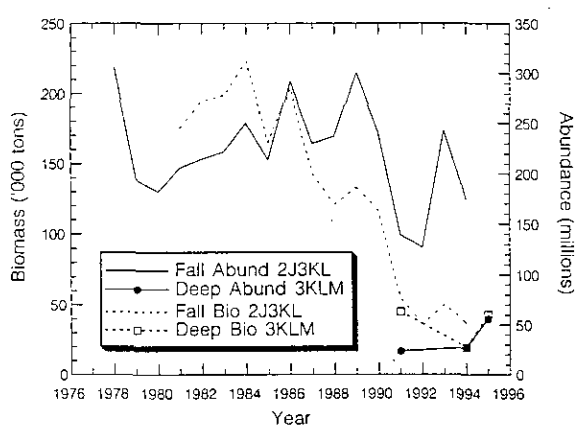
Data: Although catch-rate data are available from various sources, abundance and biomass indices from research vessel surveys continue to provide the major database for review of this stock.

Assessment: Analytical assessments considered unacceptable until migratory patterns and stock structure are more fully understood.

Fishing Mortality: Not precisely known but believed to be above sustainable levels with the current exploitation pattern.

Recruitment: The 1991 year-class estimated to be better than average in both the 1994 assessment and the current assessment. The 1990 year-class was also believed to be above average in the 1994 assessment, however, the size of this year-class is less clear in the current assessment but is at least average and may be better than average.

Biomass:



State of the Stock: In its 1994 assessment, the Council concluded that the fishery has been, in recent years, exploiting this stock well above levels which may be considered sustainable. In the 1994 assessment, all available stock indicators (survey results and catch rates in commercial fisheries) suggested a significant decline in stock size since the late-1980s up to 1994, particularly among the older age groups (10+). Most data from the current assessment confirm this view although there is some indication of improved recruitment.

Recommendation: The Council is unable to advise on a specific level of TAC for 1996. However, this TAC should continue to be set at levels well below the catches achieved in the period 1990-94 until it is clear that the fishable stock is increasing.

The Council is also very concerned that the catches taken from this stock consist mainly of young, immature fish of ages several years less than that at which sexual maturity is achieved, thereby increasing the risk of overexploitation. It is noted also that such exploitation results in foregoing much potential yield. The Council therefore recommends that measures be considered to reduce, as much as possible, the exploitation of juvenile Greenland halibut.

Sources of Information: SCR Doc. 95/26, 28, 29, 48, 54, 55, 56, 57, 58, 64, 65, 78; SCS Doc. 95/13, 15.

b) **Responses to Special Requests for Management Advice by the Fisheries Commission**

The following are the responses to special requests by the Fisheries Commission:

i) **Cod in Divisions 2J, 3K and 3L** (SCR Doc. 95/46)

The Scientific Council was again requested to: *provide information, if available, on the stock separation in Div. 2J+3KL and the proportion of the biomass of the cod stock in Div. 3L in the Regulatory Area and a projection if possible of the proportion likely to be available in the Regulatory Area in future years. Information was also requested on the age composition of that portion of the stock occurring in the Regulatory Area.*

The stock separation issue has been reviewed previously (NAFO Sci. Coun. Rep., 1986) and it was then concluded that it was appropriate to assess cod in Div. 2J, 3K and 3L as a single stock complex. There is currently no additional information to change this conclusion. The general issue of stock definition is being addressed by research using a suite of genetic techniques (nuclear DNA gene probes). It is hoped these studies will lead to a better understanding of the Div. 2J+3KL stock complex.

Estimates of the proportion of the cod biomass in Div. 3L in the Regulatory area were updated to include the 1994 research vessel survey data. The results from autumn surveys showed biomass in the Regulatory Area (9.7%) to be the highest in the time series. The spring survey series continued to show the increasing trend in the percentage of biomass in the Regulatory Area, with the 1994 point of 63% being the highest in the time series, although it was noted that these percentages represent a very low trawlable biomass. The results from the survey series used are as follows:

Season RV survey conducted	Years RV survey conducted	Range of proportions of Div. 3L biomass occurring in the Regulatory Area (1994 value in brackets)	Average proportion (%)
Winter	1985-86	23.8-26.8	25.3
Spring	1977-94	0.4-63.1 (63.1)	10.3
Autumn	1981-94	0.5-9.7 (9.7)	3.5

The proportions observed are estimates for the months in which the surveys were conducted and may not represent distributions in non-surveyed months. Although only two winter surveys have been conducted, the proportion of biomass in the Regulatory Area at that time appeared to be substantially higher than at other times.

Results of the autumn surveys conducted in all three Divisions (2J, 3K and 3L) by Canada from 1981 to 1994, showed that the proportion of the cod in the Regulatory Area at that time of year was less than 1%, on average, of the total Div. 2J+3KL biomass. In the past, year-specific percentages ranged from 0.10% to a high of 1.52% but has increased in recent years to 5.17% in 1993 and was 4.4% in 1994. In 1994, the stock was still at an extremely low level. The average breakdown of biomass by Division was as follows:

Division	Mean relative proportion of Div. 2J and 3KL biomass (%) 1981-1994	1994 Autumn %
2J	30	20
3K	34	40
3L	36	40

Survey data indicated that the proportion of total stock biomass occurring in the Regulatory Area was less than 10% in winter, less than 5% on average in spring and autumn.

Age compositions derived from spring and autumn surveys in Div. 3L indicated that for most years there was a higher proportion of younger cod in the Regulatory Area. Estimates for winter surveys showed that age compositions were similar in both areas. Cod age compositions from autumn research vessel surveys combined for Div. 2J+3KL were similar to those which occurred in Div. 3L inside the 200-mile fishing zone.

ii) **Implications of mesh size in mid-water trawls for redfish in Div. 3LN**

The Fisheries Commission requested from the Scientific Council *a review of the implications of using 90 mm minimum mesh size in mid-water trawls when fishing for redfish in Div. 3LN.*

The Scientific Council reviewed selectivity data on redfish from Russian experiments carried out in Div. 3N and Canadian experiments with bottom trawl in Subdiv. 3Ps. In Div. 3N in 1994 the use of 130 mm mesh size codends allowed the escapement of 90%, by weight, of the catch of redfish. Scientific Council noted that this would be specific to the stock situation. However, that under these conditions the use of codend mesh size greater than 90 mm in the redfish fishery in Div. 3N may not result in the significant long term gains in yield if assumptions of high mortality during haul back are correct. Fishing on individuals of a stock many years before they have reached sexual maturity puts the stock at risk of biological collapse, even at relatively low levels of fishing mortality. Any redfish fishery in this area using 90 mm mesh codends needs to be controlled carefully. Scientific Council was encouraged by the success of using lastridge rope rigged codends of bottom trawls (90 mm) which allow the meshes to remain open during towing and improving the escapement of more small fish, while retaining more commercial size redfish.

iii) **Interrelation between seals and commercial fish stocks**

The Fisheries Commission requested that *information on the interrelation between seals and commercial fish stocks be tabled.*

This subject was addressed during the meeting of the Joint ICES/NAFO Working Group on Harp and Hooded Seals, 5-9 June 1995. The Scientific Council will hold a Symposium 6-8 September 1995, which is expected to add to the available database relevant to the request by the Fisheries Commission. The Scientific Council therefore decided to wait until its September 1995 Meeting to complete its report on this item for presentation to the Fisheries Commission.

iv) **Coordinated research on Greenland halibut**

The Fisheries Commission requested that *the Scientific Council pursue its coordinated efforts in the research on the Greenland halibut resources.*

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

The issue of coordinated research relative to Greenland halibut was considered by STACREC with respect to the need for a synoptic survey for Greenland halibut. It was suggested that such a survey would require one or two years planning time and it was **recommended** that *parties interested in a synoptic survey meet and formulate a plan.* A group should be formed from these parties to set dates and specify vessel and scientific staff requirements. The plan would describe the Scientific Council's requirements with respect to the question.

The Scientific Council has extended its usual meeting in September 1995 (11-15 September) by two days (9 and 10 September) to discuss Greenland halibut problems particularly with respect to the requests received from the Fisheries Commission in June 1995. The group mentioned above will meet during the September 1995 Meeting and draw up a research proposal for adoption by the Scientific Council. Members of this group are urged to seek commitment from their authorities on allocation of the necessary research resources.

3. **Requests for Management Advice by Coastal States**

a) **Responses to Coastal States**

For stocks within the 200-mile fishery zone in Subareas 1-4, the Coastal States Canada and Denmark (in respect of Faroe Islands and Greenland), requested advice from the Scientific Council. The following are the responses in the sequence they were requested:

With respect to Cod in Div. 2J+3KL the Council noted that the Fisheries Commission had also requested advice for this stock and that the specific response for this stock is given under the responses to the Fisheries Commission.

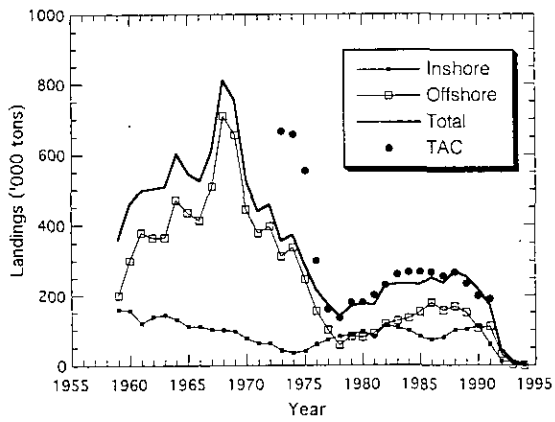
COD in Div. 2J, 3K and 3L

Background: Cod in these Divisions are considered a stock complex which may include stock components. Research is ongoing, particularly with regard to genetic differences, to clarify the issue. Migrations have been to inshore in summer and offshore in winter.

Fishery and Catches: The rapid decline in the resource in the 1990s led to reduced TACs and eventually to a moratorium on commercial fishing in 1992. Some non-commercial fishing was permitted but this was also closed in 1994.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	44	-	-[2]
1993	11	0	0
1994	1.4	0	0
1995	-	0	0

[1] Provisional.
[2] A moratorium was introduced by Canada on 2 July, 1992.



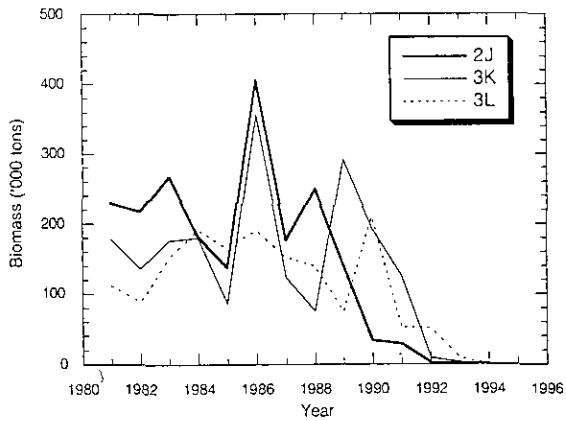
Data: A summary of some 30 documents presented elsewhere was the basis for this assessment.

Assessment: No analytical assessment was performed. Stock status was estimated based on survey abundance indices and biological data.

Fishing Mortality: Analysis of tagging data concluded, as did previous assessments, that fishing mortality in the late-1980s and early-1990s was high. The high fishing mortalities in the late-1980s estimated by other methods (VPA, tagging) were not evident in an examination of catch to survey ratios.

Recruitment: Estimates of the 1991-94 year-classes at ages 0-3, were obtained using a variety of indices. These indicated that the 1991 year-class was weakest and the 1994 strongest although absolute values could not be determined. It will be at least 4 years before the relative strengths can be verified from offshore surveys.

Biomass: Autumn research vessel survey indices of biomass and abundance have indicated severe declines in recent years and the 1994 estimates are the lowest in the time series. No aggregations of cod were found and there were virtually no fish older than age 7 in the 1993 and 1994 surveys.



State of the Stock: The stock remains at a very low level, probably in the order of 1% of that in the early-1980s. There has been a continued decline in the mean estimates of biomass. The stock also consists mainly of young fish.

Recommendation: Stock rebuilding will only be possible if the moratorium is maintained.

Special Comments: Some factors relative to the biology and ecology of cod from this stock are notable:

- The declining trend in condition of factors of cod which began in the late-1980s appears to have been reversed in 1993 and 1994, although this was not reflected in the feeding data.
- Since about 1990 average age at first maturity has declined, probably a response to population declines.
- Growth rates generally increased in 1993 and 1994.
- Ocean conditions in 1994 were closer to the long-term average than in recent years. This may be beneficial to biotic factors such as growth rates.

Sources of information: SCR Doc. 94/84, 95/2, 9, 12, 46, 60.

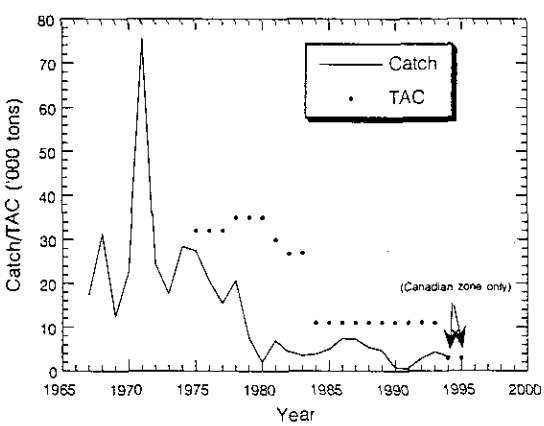
Roundnose Grenadier in Subareas 2 and 3

Background: It is believed that only one stock occupies the entire area including the Regulatory Area, although there are different areas of concentration.

Fishery and Catches: Although the traditional fishery was inside the Canadian zone, catches in recent years have been as by-catch in the Greenland halibut fishery in the Regulatory Area.

	('000 tons) Catch	TAC
1990	1	11
1991	1-10	11
1992	4[1]	11
1993	3[1]	11
1994	3[1]	3[2]
1995		3[2]

[1] Provisional.
[2] Canadian zone only.



Data: There are no recent commercial sampling data available. Survey data from results of Canadian deepwater surveys to Div. 3KLMN were available for 1991, 1994 and 1995.

Biomass: Estimates of trawlable biomass in Div. 3K, 3L and 3M declined by 60-80% between 1991 and 1995. The biomass was lowest in Div. 3N of all surveyed Divisions in 1994 and 1995, but no decline between years was observed.

State of the Stock: Not possible to fully evaluate. If decline between 1994 and 1995 in Div. 3K (70%) is real, it cannot be explained by the low catches.

Recommendation: The current TAC for all of Subareas 2+3 inside the Canadian zone (3 000 tons) is about 15% of the estimated biomass for Div. 3K in 1991 and 1994, where the traditional fishery was primarily prosecuted, and previously did not appear to be excessive (NAFO Sci. Coun. Rep., 1994, p. 113). This current TAC is about 50% of the 1995 estimated biomass in Div. 3K, and if the observed biomass decline between 1994 and 1995 is real, may be excessive.

Special Comments: The by-catches in the Regulatory Area contain a mixture of roundnose and roughhead grenadiers.

Sources of Information: SCR Doc. 95/48, 51, 61; SCS Doc. 95/4, 13, 15.

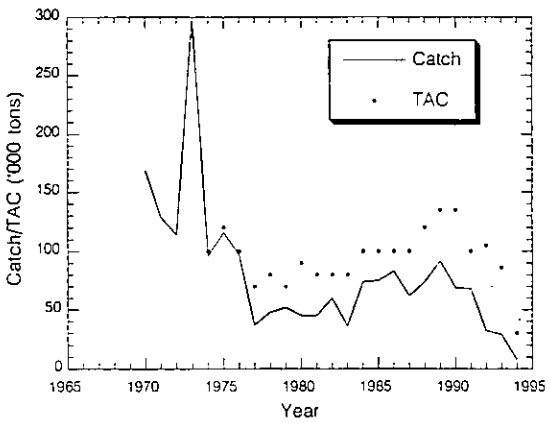
Silver Hake in Div. 4V, 4W and 4X

Background: Silver hake in these divisions are found in deep, warmer waters of the Scotia Shelf, generally off the continental shelf and in deep basins. This stock is considered to be separate from those of the Georges Bank and Gulf of Maine areas.

Fishery and Catches: The 1994 catch was substantially below the TAC due to reduced effort resulting from delays in allocation of catch opportunities. In 1994 regulatory measures were introduced to reduce by-catch by restricting the fishery to waters generally deeper than 190 m, and requiring use of a separator grate.

	('000 tons) Catch	TAC Set	Projected catch at $F_{0.1}$
1992	32	105	105
1993	29[1]	86[2]	75
1994	8[1]	30	51 (40)[3]
1995	16[4]	60	79 (59)[5]

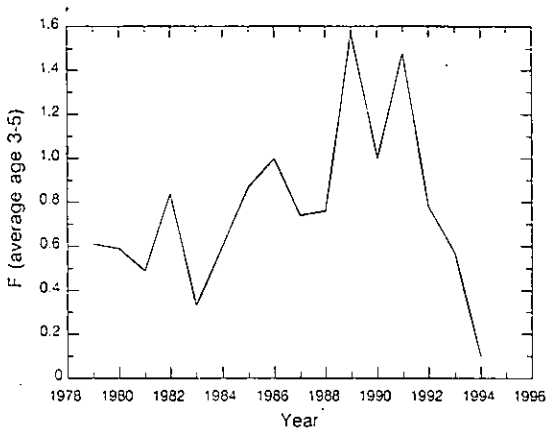
[1] Provisional.
[2] Includes additional 11 000 tons allocated by Canada in the expectation that not all allocations would be harvested.
[3] See special comments, NAFO Sci. Coun. Rep., 1993, pg. 153.
[4] Estimated.
[5] See special comments, NAFO Sci. Coun. Rep., 1994, pg. 31.



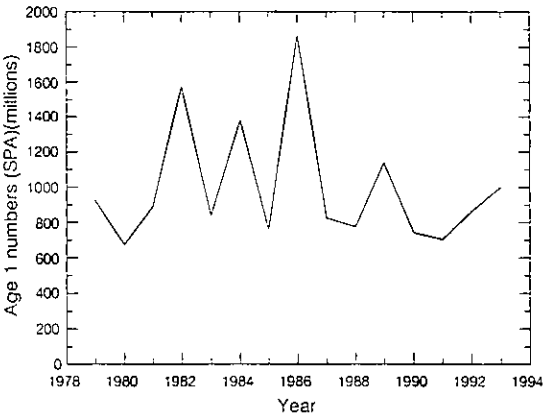
Data: Catch, effort and sampling data were collected from the commercial fishery by Canadian observers. Abundance and biomass by age were derived from the Canadian summer research vessel survey. An estimate of the 1994 year-class strength was obtained from the October Canada/Russia 0-group survey.

Assessment: Catch-at-age from 1979 to 1994 were included in a bias correcting formulation of ADAPT using research vessel surveys (0-group and 1+) and age disaggregated CPUE as tuning indices.

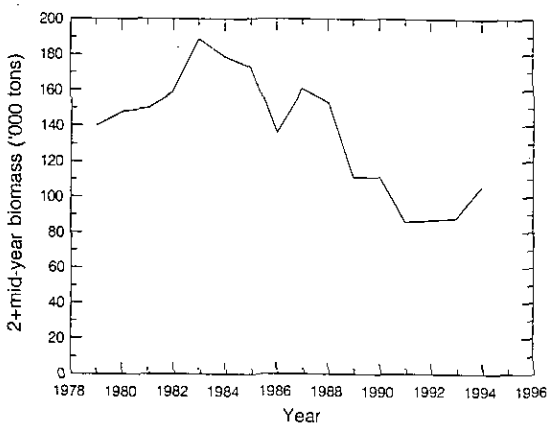
Fishing Mortality: Fully recruited F for ages 3-5 was estimated to be 0.1 in 1994.



Recruitment: The 1993 and 1994 year-classes, both estimated at approximately 0.8 billion fish from survey data, are slightly below the 10 year geometric mean of 1.0 billion.



Biomass: Spawning stock biomass has declined since 1983. The 1994 estimate showed a modest increase over 1991-93 levels.



Forecast:

Option Basis	Predicted catch (1996)	Predicted SSB (1.1.1997)
$F_{0.1}$ = 0.70	64 000	94 000

State of the Stock: Estimates of fishing mortality in 1994 were well below the $F_{0.1}$ level. Strength of incoming year-classes is estimated to be only slightly below average, while the spawning biomass showed a modest increase in 1994. Based on these factors, the stock appears to be rebuilding.

Recommendation: For silver hake in Div. 4VWX, the catch at a target fishing level of $F_{0.1}$ in 1996 is projected to be 64 000 tons.

Special Comments: The analysis using the bias correcting ADAPT framework appeared to reduce the retrospective pattern substantially compared to other methods; see special comments, NAFO Sci. Coun. Rep., 1993, pg. 153 and NAFO Sci. Coun. Rep., 1994, pg. 31. Commercial mean weight-at-age has dropped sharply since 1992. Projections were based on an average mean weight-at-age for the most recent three years (1992-94) only, as the year-classes presently observed to be small at age are expected to remain small at age throughout their lifespan.

Sources of Information: SCR Doc. 95/44, 53, 76, 80; SCS Doc. 95/4, 8.

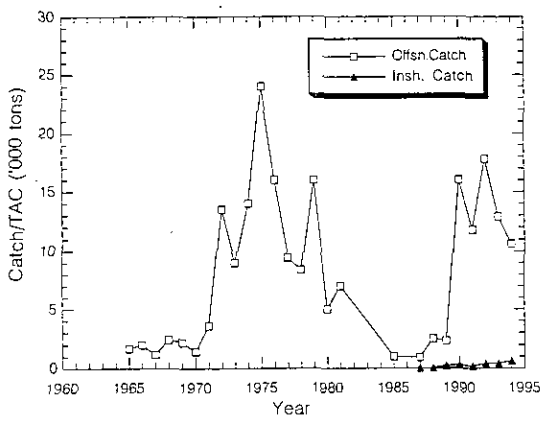
Greenland Halibut Subarea 0 + Div. 1B-1F

Background: Greenland halibut in Subarea 0 + Div. 1B-1F is part of a common stock distributed in Davis Strait and south to Flemish Cap in Subareas 0-3.

Fishery and Catches: Due to increase in offshore effort, catches increased abruptly from 2 000 tons in 1989 to 16 000 tons in 1990 and have remained above 10 000 tons since.

	('000 tons) Catch[1]	TAC Recommended	TAC Effective
1992	18		
1993	13		
1994	11		
1995	-	11	11

[1] Provisional.



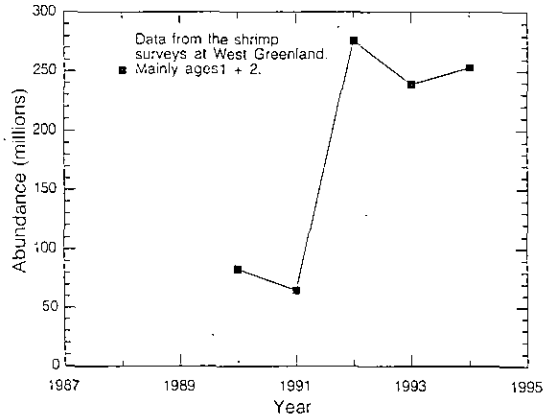
Data: Catch-at-age data were available for assessment but could not be used due to problems with age readings.

Standardized catch rates and survey biomass estimates were available from Div. 1B-1D.

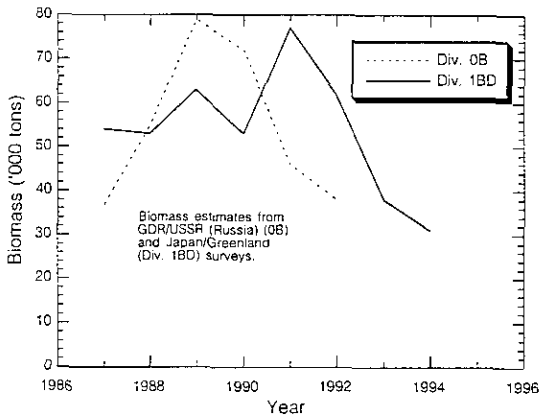
Assessment: No analytical assessment could be performed.

CPUE: Indices have declined about 30% from 1991 to 1993 in SA 0. Between 1992 and 1994 a 30% decrease was also seen in Div. 1CD. A shift towards younger fish in the catches was observed.

Recruitment:



Biomass:



State of the Stock: The stock appears to be declining. However, recruitment appears to be stable at precent.

Recommendation: No precise estimate of the appropriate catch level could be given.

TAC in 1996 should be set below 11 000 tons for Subarea 0 + Div. 1BCDEF in an attempt to halt the decline in the stock.

Special Comments: The possibility of the existence of an isolated inshore population in Cumberland Sound (Div. 0B) is under investigation (annual catch ca. 400 tons).

Sources of information: SCR Doc. 95/19, 23, 50, 68; SCS Doc. 95/4, 6, 8, 12, 14.

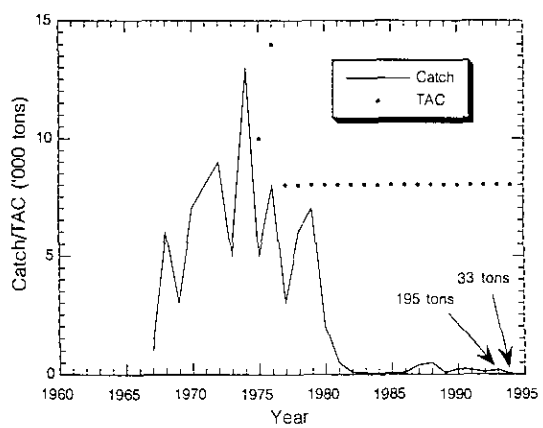
Roundnose Grenadier Subareas 0 + 1

Background: The roundnose grenadier stock in Davis Strait is probably connected to other stocks in the North Atlantic. The stock component found in Subareas 0+1 is at the margin of the distribution area. A Canadian survey in 1986 that covered both SA 0 and 1 showed that 90% of the biomass was found in SA 1.

Fishery and Catches: Recommended TACs have been at 8 000 tons since 1977. There has been no directed fishery for this species since 1978.

	('000 tons) Catch[1]	TAC Recommended	TAC Agreed
1992	0.1	8.0	
1993	0.2	8.0	
1994	0.0	8.0	
1995	-	8.0	

[1] Provisional.

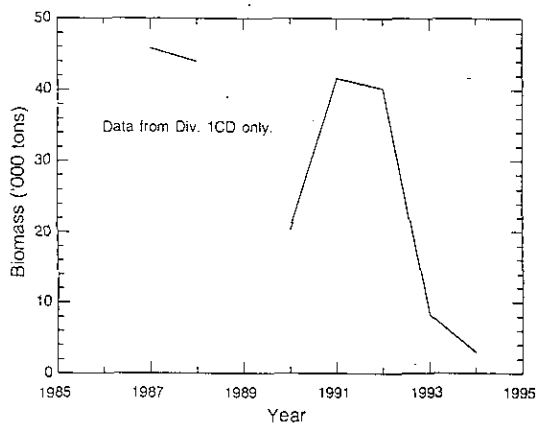


Data: Biomass estimates from surveys in Div. 1CD during the period 1987-94 was the only available time series. Estimated biomass declined from 40 000 tons in 1992 to 3 000 tons in 1994.

Assessment: No analytical assessment could be performed.

Fishing Mortality: Exploitation level considered to be low in recent years.

Biomass:



No roundnose grenadier were observed in Div. 1B.

State of the Stock: There are no recent estimates of biomass for the entire stock area. The stock seems to be at a very low level. The reason for the changes in the stock is not known.

Recommendation: There should be no direct fishing for roundnose grenadier in 1996 based on the distribution in the Canadian survey in 1986 and the development of the biomass index for Div. 1CD in resent years. Catches should be restricted to by-catches in fisheries targeting other species.

Sources of information: SCR Doc. 95/23; SCS Doc. 95/4, 6, 12, 14.

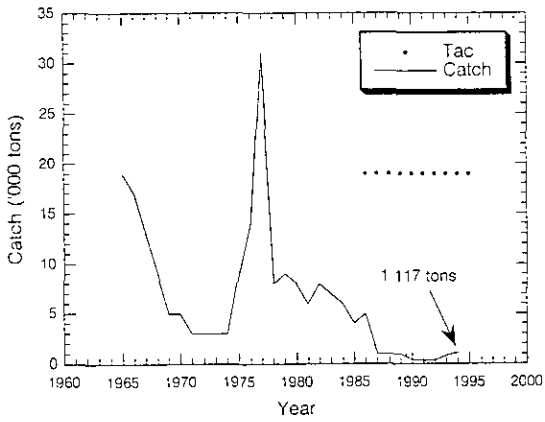
Redfish in Subarea 1

Background: There are two species of commercial importance in Subarea 1: golden redfish (*Sebastes marinus* L.) and beaked redfish (*Sebastes mentella* Travin). These two species are mixed in the catch statistics. Relations to other north Atlantic redfish stocks are unclear.

Fishery and Catches: Redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. No data to estimate the contributions of golden and beaked redfish to the total catches are available. Catch figures do not include substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp and cod.

	('000 tons) Catch[1]	TAC Agreed
1992	0.3	19
1993	0.8	19
1994	1.1	19
1995	-	19

[1] Provisional.

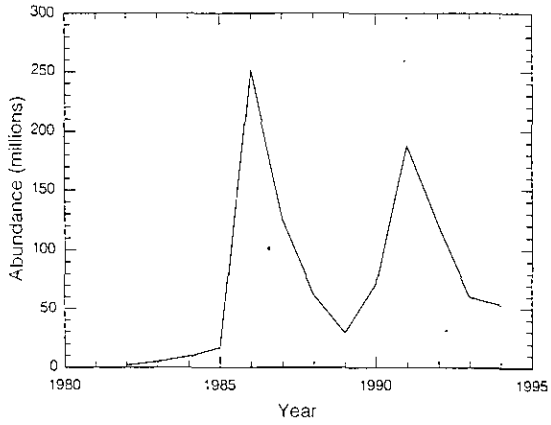


Data: Recent stock abundance, biomass and length structure were derived from annual groundfish surveys.

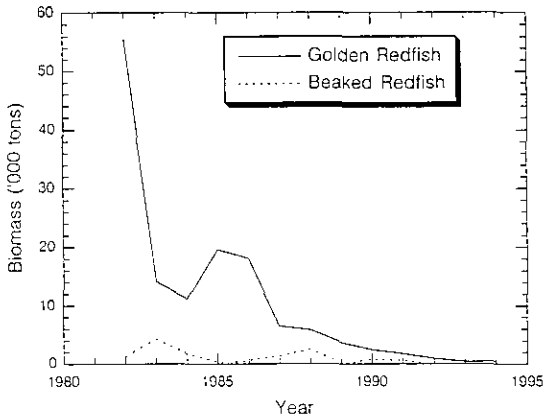
Assessment: Between 1962 and 1978 the mean fish size in the landings decreased by about 4 cm, the biggest reductions occurred in the late-1970s.

No analytical assessment was possible.

Recruitment: The origin of the very abundant pre-recruits (<17 cm), as indicated by the surveys, and their recruitment potential to the stocks under consideration is unclear.



Biomass: Survey results revealed dramatic declines in survey abundance and biomass indices of golden and beaked redfish (≥17 cm) to an extremely low level.



Forecast: Short-term recovery is very unlikely. Catches of commercial sized redfish will remain very low in the near future.

State of the Stock: Both stocks are considered severely depleted.

Recommendation: No directed fishery should occur until the stocks have recovered substantially.

Special Comments: Long-term recovery of golden and beaked redfish stocks in Subarea 1 from their severely depleted status depends on future recruitment. Any catches will reduce the probability of this event. The impact of the by-catch of Subarea 1 redfish taken by the shrimp fishery in substantial numbers could not be assessed. Scientific advice on stock and catch prognosis remains impossible until data on quantity and size composition of the redfish by-catch in the Subarea 1 shrimp fishery including discards are collected, and the stock origin of the juveniles is identified.

Sources of Information: SCR Doc. 95/3, 4, 23; SCS Doc. 95/6, 12, 14.

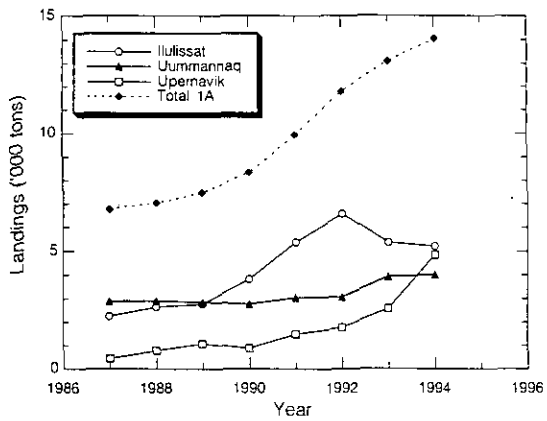
Greenland Halibut in Div. 1A

Background: The population occurs inshore in Div. 1A, and is considered to be recruited from the nursery grounds south-southwest of Disko Island and in the Disko Bay. Mature individuals do not contribute back to the spawning grounds. No TACs have been established for these populations.

Fishery and Catches: The fishery is mainly conducted with longlines, and to a varying degree gillnets. Effort has increased in all areas.

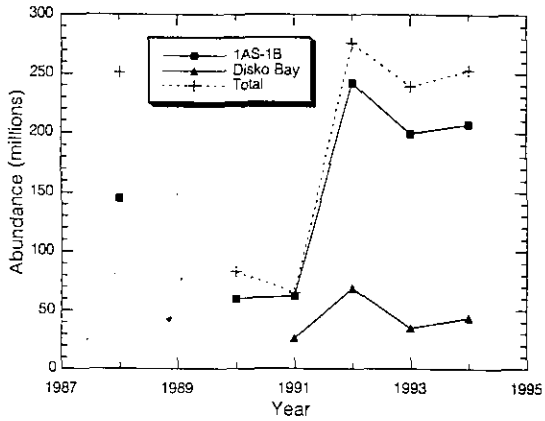
Area	Catches[1] 1992	1993	1994	TAC-95 Rec.
Ilulissat	6 577	5 367	5 201	-
Uummannaq	3 067	3 916	4 004	-
Upernavik	1 783	2 593	4 844	-
Total Div. 1A	11 800	13 092	14 049	-

[1] Provisional.



Data: Catch-at-age data were available for years 1988-94 at Ilulissat, and for most years in this period at Uummannaq and Upernavik. A recruitment abundance index was available from shrimp trawl survey. Catch rates and mean length were available from inshore longline survey.

Assessment: Catch curves and yield-per-recruit analysis were provided based on 1994 data, but were used only as an indicator due to age determination problems. However, indications of overfishing were suggested by longline survey data.



Recruitment: see state of the stock.

State of the Stock: The stock appears overexploited, however, recruitment appears to be stable. The 1991 year-class seems above average.

Recommendations: Separate TACs should be established for each of the three inshore areas.

Sources of information: SCR. Doc. 95/18, 19, 67; SCS Doc. 95/14.

Other Finfish in Subarea 1

Background: The resource of other finfish in Subarea 1 are mainly Greenland cod, American plaice, Atlantic and spotted wolffishes, starry skate, lumpsucker, Atlantic halibut and sharks.

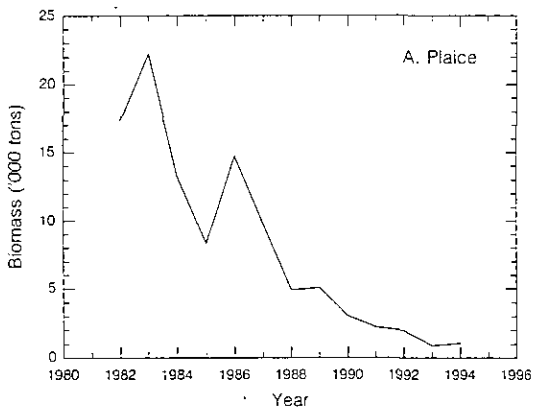
Fishery and Catches: Total combined annual catches of these species varied around 2 000 tons in recent years. They were taken by offshore trawl fisheries directed to shrimp, cod, redfish and Greenland halibut, by longliners operating both inshore and offshore and by pound net and gillnet fisheries in inshore areas only. The statistics of these by-catches seem to be poorly reported in general.

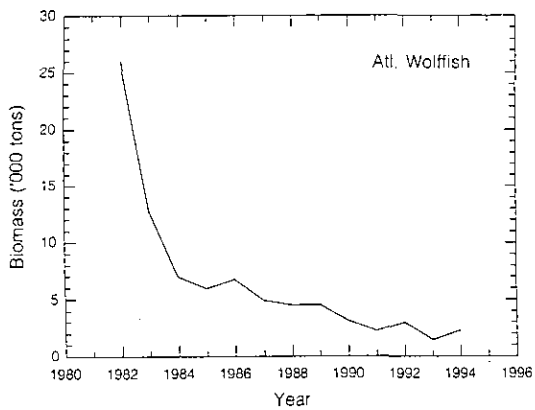
Data: There are no commercial data available on length and age structure for the stocks of Greenland cod, American plaice, Atlantic and spotted wolffishes, starry skate, lumpsucker, Atlantic halibut and sharks. Research survey data are available for American plaice, Atlantic and spotted wolffishes and starry skate.

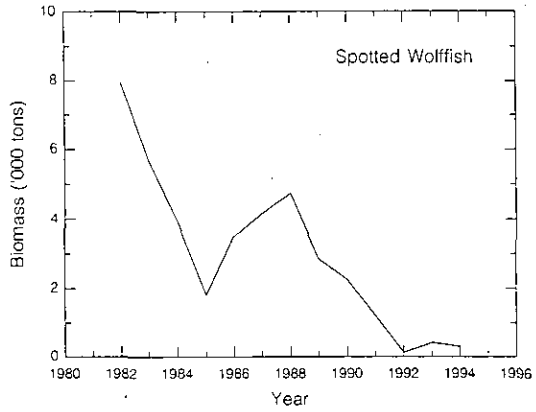
Assessment: No analytical assessment was possible for any of these stocks.

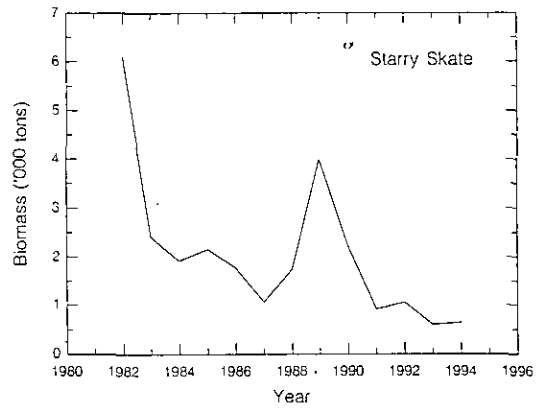
Recruitment: There are presently no indications for strong recruitment in the stocks of American plaice, Atlantic and spotted wolffishes and starry skate.

Biomass Indices:









State of the Stock: The demersal stocks of American plaice, Atlantic and spotted wolffish and starry skates are severely depleted. Catches of commercial sized fish will be very low in the near future.

Recommendation: No fishery should be directed towards the stocks of American plaice, Atlantic and spotted wolffishes and starry skate in Subarea 1 until these stocks have recovered substantially. No information can be provided for lumpsucker, Atlantic halibut and sharks.

Special Comments: Recovery of the stocks of American plaice, Atlantic and spotted wolffishes and starry skate in Subarea 1 from their severely depleted status depends on future recruitment. Any catches will reduce the probability of this event. Data on quantity and size composition of the by-catches including discards in the shrimp fishery in Subarea 1 should be collected.

Sources of Information: SCR Doc. 95/4, 5, 23; SCS Doc. 95/6, 12, 14.

b) **Responses to Special Requests by Coastal States for Management Advice on Fish and Invertebrate Stocks**

Canada with the concurrence of Denmark (Greenland) made special requests as regards to Greenland halibut and American plaice problems (see Annex 2, item 1, and Annex 2A of Agenda I, Part D, this volume). Denmark (Greenland) with the concurrence of Canada, made specific requests in regards to Greenland halibut (see Annex 3, Agenda I, Part D, this volume). With respect to the Greenland halibut stock in Subareas 0-3 the responses to the Canadian requests are given below under items i) to ix), and to the Denmark (Greenland) requests under item x.

i) **Provide an overall assessment of status and trends in the total stock throughout its range**

The Scientific Council addressed this question in June and September 1994 and reported, "Because of uncertainty in evaluating the magnitude of declines in survey results and CPUE series STACFIS is not able to accurately calculate appropriate TAC levels. This applies to all Subareas. However, STACFIS considers that the offshore effort levels in all Subareas are in excess of what the Greenland halibut stocks can sustain and STACFIS **advised** that the effort and catches throughout Subareas 0 to 3 in 1995 should be reduced compared to recent years." (NAFO Sci Coun. Rep., 1994, p. 108, item 6; see also p. 148).

No new information pertaining to the entire stock complex has become available since that time, however, see Section X.2.a and X.3.a of this report (above) for details on trends in abundance and biomass for Greenland halibut in Subarea 0+Div. 1B-1F and in Subarea 2+Div. 3KLMN.

To provide an overall assessment, a comprehensive and coordinated survey covering the entire area of distribution is required. Furthermore, the survey requires to be conducted for a number of years to establish a time series on the basis of which the status of and trends within the stock can be assessed. The present coverage requires better coordination - a task which has already been discussed within the Scientific Council (see STACREC Report, item 4d, in Appendix III). There is, however, no survey at present which covers Div. 0B and 2GH. These Divisions historically contained a very significant part of the Greenland halibut population and most of the recent Canadian fisheries occurred in these areas.

ii) **Comment on its management including any expansion of the responses to the questions asked in June 1993**

The Scientific Council has no new information available and could only repeat its comments made in 1994:

"STACFIS maintains (NAFO Sci. Coun. Rep., 1993, p. 104) that a single TAC for the entire stock area without consideration of effort distribution could lead to excessive effort being concentrated in different areas of distribution and this could lead to the collapse of important fisheries. STACFIS therefore **advised** that separate TACs be maintained for different areas of the distribution of Greenland halibut." (NAFO Sci. Coun. Rep., 1994, p. 108, item 5)

iii) **Advise on appropriate TAC levels separately for SA 0+1, for SA 2 + Div. 3K and for Div. 3LMNO**

This split could be based on the distribution of the stock biomass and abundance, and fishing conditions such as catch rates could also be taken into account. Distribution maps for some surveys were available to the Council but for other surveys, which were concluded only a few days before this June 1995 Meeting of the Council began, only preliminary reports were available. The Council therefore decided to postpone this discussion to its meeting of 9-15 September 1995, and noted that the Council had allocated two extra meeting days to deal with this question and the Fisheries Commission requests from its 7-9 June 1995 Meeting.

iv) **Recommend on the distribution of fishing effort within each of these three geographic areas**

The Council has previously noted that effort should be distributed throughout the range of distribution of Greenland halibut. The extent to which Greenland halibut exhibit a patchy distribution on a small geographical scale has not been established. If, however, this is the case, there is the danger that high fishing effort may be concentrated on localised concentrations of the species. Such concentrations would then be rapidly depleted and would not quickly recover. The overall effect would be to severely deplete the stock as a whole.

As noted in the response to *request iii) above, the Scientific* Council will take a more detailed look at the distribution of the biomass and abundance during its meeting in September 1995. This study may enable further commentary on the matters discussed on this question.

v) **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.

vi) **Provide information on the distributional variation of the *resource* in recent years**

The Council will not be able to answer this question in the foreseeable future, since a sufficiently comprehensive survey has not yet been established. However, as noted in the response to request iii) the Scientific Council may be in a position to provide further information based on a study to be presented at the September 1995 meeting.

vii) **Advise on appropriate changes in management of the fishery in 1995 and future years that would minimize catches of the 1990 year-class while it is young and allow it to make 25%, 50% or 75% of the contribution to future spawning biomass that it would if none of it was caught at immature ages**

The Scientific Council calculated the biomass of a recruit age 5 in 1995 reaching age 10 in the year 2 000, under the assumption that there would be no fishing on Greenland halibut during this period, and under the current exploitation pattern reduced by an overall effort level.

If it is assumed that management of the stock will be conducted under some system, such as TAC and quota, which regulates fishing effort over all age groups, TACs consistent with the following effort reductions would be required to achieve the objectives indicated in the request.

Relative Biomass age 10	Relative Effort
0.25	0.88
0.50	0.44
0.75	0.18

Thus, to ensure that the 1990 year-class at age 10 provides 75% of the spawning stock biomass, it will be necessary to impose TACs during the period 1995-99 which will bring about a reduction of 82% in fishing effort on Greenland halibut. To ensure that the 1990 year-class provides 25% or 50% of the spawning stock biomass at age 10 requires reductions in fishing effort of 12% and 56%, respectively.

At present, it is not possible to specify the level of TAC required to achieve any of these objectives.

A year-class which will not be fished before age 10 would under the present effort level contribute about 2 times as much to the age 10 biomass as under the current exploitation pattern.

viii) **Provide strategy options to rebuild the trawlable biomass in SA 2+3 and the percent mature in the population within 5 and 10 years to the approximate level of the mid-1980s**

The stock is believed to have changed its distribution between the early-1980s and early-1990s. It is therefore uncertain how the trawlable biomass observed in the Canadian autumn groundfish survey, which did not cover the current deep water fishing grounds in the mid-1980s, should be interpreted as an index of the total stock biomass. Given the redistribution of the stock it may even be questioned if for example, a ban on fishing for Greenland halibut would eventually reestablish the biomass levels previously seen in the Canadian autumn survey area. Until a better understanding is available of the stock structure and the mechanisms behind the changes in distribution, the Council is unable to provide a satisfactory answer to this question.

ix) **Provide advice on ways to eliminate or minimize by-catch of American plaice in Div. 3LNO**

Information reviewed in 1994 (SCR Doc. 94/65), as well as in 1995, suggested that American plaice distribution in deeper water is likely to be seasonal, i.e. in the winter-spring period only. These studies also suggest that few American plaice are found beyond 1 200 m. However, by-catch appears to be greatest in depths less than 1 000 m, where American plaice by-catch can be 10 to 30% of the Greenland halibut catch (SCS Doc. 94/13, 95/13). Thus, given their current distribution, one method of reducing the by-catch of American plaice in the Greenland halibut fishery would be to limit the amount of fishing

shallower than 1 000 m in Div. 3LNO, particularly in the first half of the year. Restricting the Greenland halibut fishery to these deeper areas should also decrease the proportion of small Greenland halibut in the catch, since large individuals are found in deeper water.

There appears to have been some directed fishing on this American plaice stock in 1994, although the proportion of the catch taken from directed fishing relative to that taken as by-catch could not be determined. Despite a moratorium on directed fisheries for American plaice in Div. 3LNO in 1994, the estimated catch was 7 378 tons, which was 2 578 tons higher than the TAC of 4 800 tons.

The distribution of Greenland halibut will be examined in more detail during the Council Meeting in September 1995, and their co-occurrence with American plaice should also be examined in more detail at that time.

x) **Denmark (on behalf of Greenland) made a special request with respect to Greenland halibut as follows:**

a) Allocation of TACs to appropriate Subareas (within Subareas 0 and 1)

b) Allocation of TAC for Subarea 1 inshore areas

c) Reproductive status of the inshore stock component in Subareas 0 and 1, and the influence of recruitment variability to these areas

d) The impact from the ongoing fisheries in Subareas 2 and 3, on the stock component in Subarea 1

Concerning a), no new data were available,since Subarea 0B was not surveyed in 1994 (see Appendix II, STACFIS report, Greenland halibut Subarea 0+Div. 1B-1F; and *NAFO Sci. Coun. Rep.*, 1994, p. 110).

Concerning b), 99% of the inshore catches in Subarea 1 are taken in Div 1A inshore areas. The Council recommended (see Council Report on Greenland halibut in Div. 1A), that separate TACs be established for each inshore area (Ilulissat, Uummannaq and Upernavik) but could not calculate appropriate levels. The stocks in Ilulissat and Uummannaq are overexploited. There are no biological data available pertaining to the inshore fisheries in Div. 1B-1F.

Concerning c), the Scientific Council noted that little or no spawning seems to take place in inshore areas in Div. 0B. Data presented in 1994 (NAFO Sci. Coun., 1994, p. 102) indicated that this also applies to the inshore stocks in Div. 1A for which no new information was available this year. No recent information was available for the inshore stock component in Div. 1B-1F. The recruitment levels seemed to be stable but no information was available on the relation between the offshore recruitment and the recruitment to the inshore areas.

Concerning d), Greenland halibut in the Northwest Atlantic are considered to belong to a single stock. The ongoing fishery in Subareas 2 and 3 probably affects the stock component in Subarea 1, but no data were available that could quantify this effect.

c) **Denmark (Greenland) with the Concurrence of Canada Requested Advice on Harp and Hooded Seals as follows:**

Harp and Hooded 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.**

* Discussion of this agenda item was postponed to the September 1995 Scientific Council Meeting when material presented at the 6-8 September 1995 Symposium would be reviewed.

The Scientific Council called a meeting of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. This Group met at the Keddy's Dartmouth Inn, Dartmouth, 5-9 June 1995 and the report (SCS Doc. 95/16, Serial No. 2969) was presented by the Chairman, G. B. Stenson (Canada) to the Scientific Council on 9 June 1995.

Noting that the request for advice refers to the NAFO area, the Scientific Council reviewed the Working Group report and the catch options presented below pertain only to the Northwest Atlantic stocks of harp and hooded seals, taken from the relevant sections (3.1-3.2 and 4.1-4.2) of the report (SCS Doc. 95/16).

The catch options are calculated as replacement yields. This is the catch which can be taken from the population in 1996 with the object of retaining the population constant for the next year, after allowing for pup production.

Harp Seal (*Phoca groenlandica)* in the Northwest Atlantic

Stock Structure

Three different stocks have been identified in the North Atlantic

- The Northwest Atlantic Stock (NAFO Subareas 0-4, mainly SA 0-3)
- The Greenland Sea Stock
- White and Barents Seas Stock

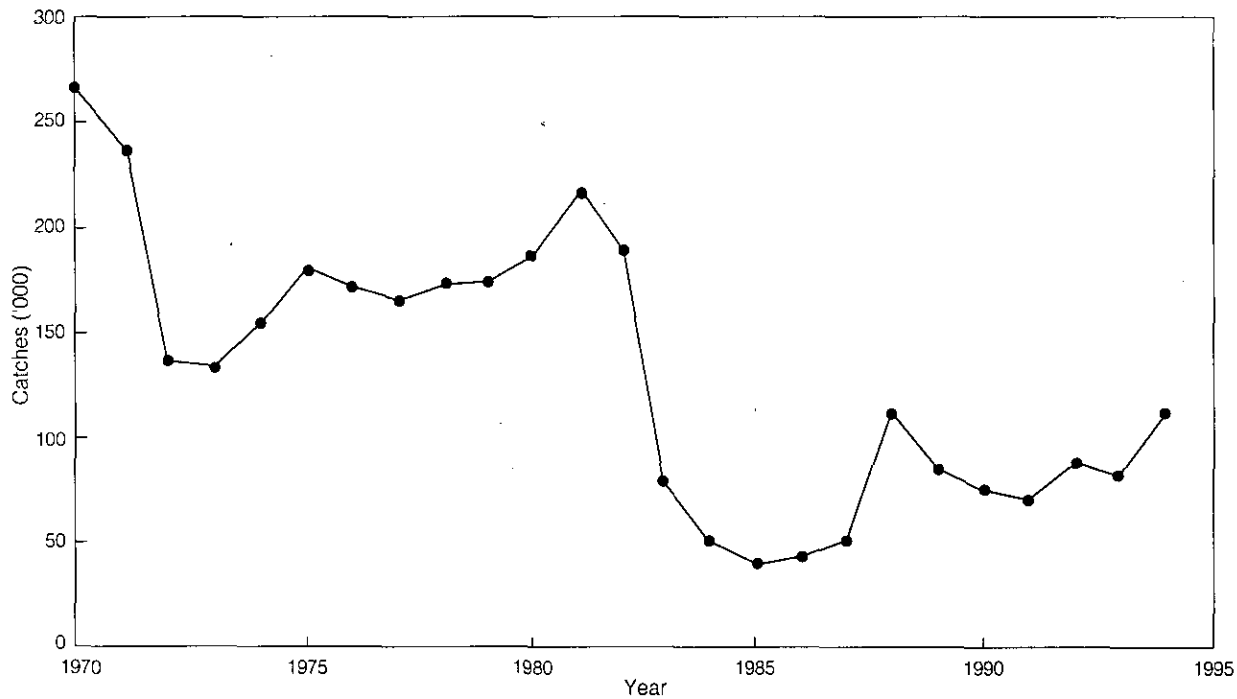
The stock structure was reviewed and it was agreed that this separation reflected the available scientific information and this would be a satisfactory basis for the advice on catch options. The Northwest Atlantic stock overlap with the other stocks to some extent during summer in Subarea 1 and in ICES Div. XIV, but there was no evidence of overlapping during the breeding period. Satellite tagging data are currently providing new details on distribution and migration.

Catches

The catches (in numbers of seals) in southern Canadian waters in 1994 (61 184) were at the same level as in the period 1989-92 (53 000-68 000), following a low catch in 1993 (26 884). There were no recent estimates of catches in the Canadian Arctic.

The recent catches of harp seals in Greenland were estimated to be about 45 000-55 000 annually, which is an increase from the reported catches of the mid-1980s. However, the Greenlandic reporting system has changed appreciably since the mid-1980s and the estimates were judged to be not comparable.

The total estimate of the 1994 catches was around 115 000 individuals. The best "scientific" estimates of harp seal catches (in numbers) during 1970-94 are shown in the figure below.



Population Estimates

Estimates of the total population declined during the 1960s, reached a minimum in the early-1970s, and then increased steadily to the present. The total population was 4.5 million individuals assuming pup mortality was three times that of older seals, which is considered a conservative estimate, or 4.8 million if it is assumed that the natural mortality for pups and older seals were the same. Since 1990 the population has been growing at approximately 5% per year.

The overall pregnancy rate (the number of mature females pregnant in a sample regardless of age) has dropped from 95% in the 1960s to approximately 70% in the 1990s. The timing of the decline is not well known but likely to have started in the mid-1980s. The mean age at sexual maturity which was 5.8 years in the mid-1950s, dropped to 4.6 years in the early-1980s and then increased to 5.4 years in the early-1990s.

Replacement Yields

Replacement yields under three different harvest scenarios are presented below. The critical element was the proportion of pups in the harvest. The natural mortality of pups was unknown but an upper limit of three times the natural mortality of older seals was used in the calculations. This provided a conservative estimate of the replacement yield.

The first scenario assumes that the age structure of the catch was the same as the most recent year available when pups accounted for 49% of the catch.

The second scenario assumes a harvest regime with the proportion of pups in the catch similar to the average seen in the last five years (57% pups).

To further illustrate the influence of the age composition of the catches, a calculation was done using a catch consisting of only seals 1 year of age and older (i.e. no pups). This was believed to be an unrealistic extreme since the young of the year will be part of the catches in Greenland, but was presented for comparison with the other scenarios.

The estimated 1996 harp seal replacement harvest ('000 tons) are as follows:

Harvest regime % pups in the catch	Replacement yield 1996
49	275
57	285
0	222

The estimated 1996 population is 4.6 million under the assumption of natural mortality of 0.1 per year based on an estimate of 4.5 million in 1994.The model assumes that no density dependent changes in the population are occurring; if natural mortality or vital parameters change, the estimates provided here will be invalidated. Since changes in reproductive rates have been shown to occur historically in harp seals, it is important that vital parameters continue to be monitored and new estimates made on a periodic basis.

Hooded Seals (*Cystophora cristata)* in the Northwest Atlantic

Stock Structure

Two stocks of hooded seals in the North Atlantic have been identified

- The Northwest Atlantic Stock (Subareas 0-3 and ICES XIVb)
- The Greenland Sea Stock

The stock structure was reviewed and it was agreed that this separation reflected the available scientific information and this would be a satisfactory basis for the advice on catch options. The present evidence suggests that the majority of northwest Atlantic hooded seals moult in the Denmark Strait (ICES Div. XIVb), but that some hoods may moult in the region north of Jan Mayen in the Greenland Sea and some in Baffin Bay.

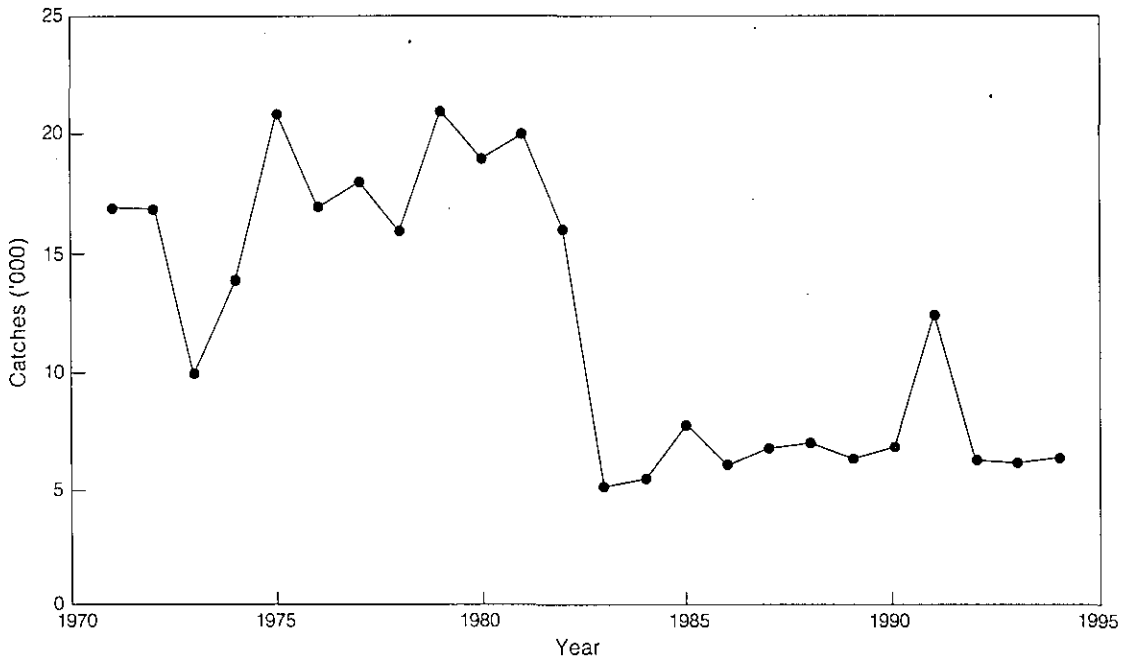
Northwest Atlantic hooded seals whelp on the ice in 3 areas; off Newfoundland ('Front'), in the Gulf of St. Lawrence ('Gulf') and in the Davis Strait. The extent to which seals whelping in the three areas mix is unknown.

Catches

Catches of hooded seals in southeastern Canada (Gulf and Front) remained at a very low level in 1993 and 1994: 38 and 221, respectively, part of which were research catches (19 and 72, respectively).

Catches in Greenland remained at about 6 000 individuals annually during the period 1976-85. For the years 1986-92 information on the catch of hooded seals in Greenland was insufficient or lacking. Under the new data collection system (see section on harp seals above) the catch of hooded seals in Greenland was 6 906 in 1993 and 6 772 during the first nine months of 1994, which indicated that the present catches of hooded seals in Greenland are at the same level observed in the late-1970s and early-1980s.

The best "scientific" estimates of hooded seal catches (in numbers) during 1970-94 are shown in the figure below.



Population Estimates

The total pup production for the northwest Atlantic stock is unknown because the three whelping areas have not been surveyed in the same year and estimates obtained in different years cannot be combined without information on the degree of mixing. In the absence of such information, a minimum estimate of pup production of 84 000 was obtained by combining estimates obtained from the Front and Gulf in 1990 recognizing that this does not account for whelping in Davis Strait in 1990. This estimate pertaining to 1990 was used for the calculation of replacement yield for 1996 and ignores any changes in the total pup production since then.

Replacement Yields

Presently, there is no population model available to estimate total population. Replacement yields were estimated using a model assuming constant reproductive rates and mortality.

Recent estimates of natural mortality are not available. The likely range of natural mortality for the older animals was considered to be 0.07 and 0.13 (NAFO Sci. Coun. Rep., 1983) and M = 0.1 per year was used for the simulations. The pup mortality was assumed to be three times the mortality of older seals. Hunting mortality on older seals was assumed to be equal at all ages.

Replacement yields were estimated as a ratio of catch to total pup production under three harvest regimes: 1) pups only, 2) 60% pups, 40% older and 3) only 1+ animals.

The estimated replacement yields ('000s) for three harvest regimes are as follows:

Harvest regime % pups in the catch	Replacement yield
100	34
60	29
0	24

The harvest was assumed to be taken equally from all three whelping areas in proportion to their pup production, if the whelping areas are discrete. If this is not the case, then knowledge of the relative combination of each stock unit is necessary, and calculation of replacement yields should be carried out for each stock unit separately. Currently, the largest harvest occurs in Greenland where seals from all areas are taken in unknown proportions.

The Scientific Council concluded that the estimates of replacement yield provided by this model should be used with caution.

XI. OTHER MATTERS

There were no other matters considered at this meeting.

XII. ADOPTION OF REPORTS

At its session on 21 June 1995, the Council considered the reports of STACFEN, STACFIS, STACREC and STACPUB and **adopted** each of them on the understanding that minor editorial changes would be done as appropriate, before the reports were issued. The report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals will be issued as an SCS Document (SCS Doc. 95/16).

XIII. ADOPTION OF SCIENTIFIC COUNCIL REPORT

At its concluding session on 21 June 1995, the Council considered the draft report of this meeting. The Report of the Scientific Council was **adopted** on the understanding that minor editorial changes would be done as appropriate, before the report was issued.

XIV. ADJOURNMENT

The Chairman thanked the members of the Council for their hard work during this meeting and in particular the Chairmen of the Standing Committees (C. A. Bishop, W. R. Bowering, W. B. Brodie and M. Stein) who guided their Committees through the agendas. He further thanked the Secretariat for continued help and efforts. He further thanked the Assistant Executive Secretary for his help. He extended special thanks to C. A. Bishop, who will retire soon, for his contributions to NAFO over the years. Wishing everybody a safe journey home, he closed the meeting.

APPENDIX I. REPORT OF STANDING COMMITTEE ON FISHERIES AND ENVIRONMENT (STACFEN)

Chairman: M. Stein Rapporteur: K. F. Drinkwater

The Committee met at the Keddy's Dartmouth Inn at 9 Braemar Drive, Dartmouth, Nova Scotia, Canada, on 8 and 17 June, 1995, to consider environment-related topics and report on various matters referred to it by the Scientific Council. Scientists attended from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), European Union, Japan and Russia, and an observer from the United States of America.

The Committee reviewed the following documents: SCR Doc. 95/2, 7, 11, 14, 15, 24, 32, 33, 43; SCS Doc. 95/4.

1. Chairman's Introduction

The Chairman welcomed the members and noted that this was the first meeting of STACFEN, which in 1994 replaced the Environmental Subcommittee under STACFIS. He looked forward to working with all members to enhance the environmental studies within the NAFO Scientific Council.

2. Review of the Terms of Reference of STACFEN

The Chairman reviewed the terms of reference of the STACFEN as referred to in Rule 5.1.d of the Rules of Procedure of the Scientific Council. These are:

a) to develop and recommend to the Scientific Council policies and procedures for the collection, compilation and dissemination of environmental information from oceanographic investigations,

b) to provide reviews of environmental conditions and advise the Scientific Council on the effects of the environment on fish stocks and fisheries in the Convention Area, and

c) to encourage and promote cooperation among Contracting Parties in scientific research designed to fill the gaps in knowledge pertaining to the effects of the environment on fish stocks and fisheries as identified by the Scientific Council.

The Chairman expressed the hope that this Standing Committee would continue to improve cooperation between oceanographers and fisheries scientists.

3. Invited Lecture on Remote Sensing

The Chairman introduced Dr. Andrew Thomas from the Atlantic Centre for Remote Sensing of the Oceans (ACRSO), Bedford, Nova Scotia. ACRSO is a non-profit association which supports development of the marine remote sensing community through cooperative work with industry, universities and government.

Dr. Thomas provided a general overview of the marine remote sensing field and the numerous opportunities that it provides. He began his talk by discussing the various types of data that can be measured by satellites (e.g. temperature, temperature gradients, colour, chlorophyll, ice and ice drift, winds, currents) the spatial and temporal resolution of the observations and some of the problems encountered (e.g. atmospheric corrections, ground truthing, cloud coverage). He also mentioned data accessability and the potential for increased data quantity in the future with the projected increase in the number of satellites. He discussed numerous applications of remote sensing using satellite imagery primarily from the NAFO area. These included examples of atmospheric and oceanic variables. Remote sensing is also used to detect biological information. Chlorophyll concentration can easily be measured, and present research is focused upon remote sensing of phytoplankton production. There is currently no colour sensor on a satellite in order to detect plankton, but the SEAWIFFS satellite which is scheduled to be launched in the beginning of 1996 will have a colour sensor and is an improvement over previous instruments. In particular, it will be able to distinguish between plankton and turbidity in the water which previous sensors had difficulty with. During the questions following the talk, he noted that detection of the distribution of some pelagic fish or mammals that swim at, or break the surface, may be possible. Asked if satellites could detect bioluminescence of surface swimming fish, Dr. Thomas was unsure but noted that it was an interesting possibility.

The Chairman thanked Dr. Thomas for a very informative talk and felt that he had provided much food for thought to the Committee regarding the use of remote sensing to address some of NAFO's environmental issues.

4. **NAFO Special Session in 1996**

The Committee was informed that the Symposium originally scheduled for 1996 on "What Future for Captive Fisheries in the Northwest Atlantic" has been postponed until 1997 and in its place there is a proposal to hold a workshop on computing abundance estimates from surveys. The Committee felt that such a workshop is timely, given that surveys are now all that are available to obtain abundance estimates of several of the important commercial groundfish species in the NAFO region. The Committee noted that the Scientific Council would discuss this further and emphasized that such a workshop should include the interrelation between the fisheries and environment data.

5. **Marine Environmental Data Service (MEDS) Report for 1994** (SCR Doc. 95/7)

a) **Data Collected in 1994**

Data from 878 oceanographic stations collected in the NAFO area were sent directly to MEDS in 1994. An additional 5 557 stations were received through IGOSS (Integrated Global Ocean Service System). The exact number of stations occupied was not certain because all the data had not been received by MEDS. The number of stations received directly by MEDS was only 50% that obtained last year, while the number of stations obtained through IGOSS increased for the second year in a row by nearly 1 000.

b) **Historical Data Holdings**

Data from 5 569 oceanographic stations collected prior to 1994 were obtained during the year, down by approximately a factor of 5 over those obtained during 1993-94, but similar to other previous years.

c) **Drift-buoy Data**

A total of 88 drift-buoy tracks were received by MEDS during 1994 representing 142 buoy months. The total number of buoys was similar to 1993 (86) but the number of buoy months was almost twice that recorded in 1993. Plots of the buoy tracks by season were presented.

d) **Wave Data**

Over 90 000 wave spectra were processed in 1994, mostly from the permanent network of moored wave buoys in the area.

e) **Environmental Conditions**

Owing to the improvement of the regional reviews, MEDS efforts since its last report to the Scientific Council in June 1994 have been directed to providing data in a timely fashion to other agencies.

6. **Review of Environmental Studies in 1994**

a) **Subareas 0 and 1** (SCR Doc. 95/14, 24, 32)

Increasing longevity and slower growth rates of northern shrimp (*Pandalus borealis*) at higher latitudes and decreasing temperatures were reported from a study in the vicinity of Iceland (SCR Doc. 95/14). This study also found an inverse relationship between temperature and size at first spawning.

Monthly air temperature anomalies at three sites in Greenland and changes in the ice cover in the northern North Atlantic were described (SCR Doc. 95/32). Extremely cold air temperatures (monthly mean anomalies of up to -6K) were observed in winter off West Greenland while above normal air temperatures persisted in the summer at Egedesminde, but were near normal at Nuuk. Similar cold conditions in winter were observed last year and during most of the previous decade. The cold

winter was responsible for below normal annual mean temperatures in the region and continued the cooling trend at Nuuk on West Greenland which began in the 1960s. However, the annual mean air temperature was 1K warmer than 1994. On the east coast of Greenland, at Angmagssalik, temperatures were near normal except for below normal conditions in January, October and December. Examination of the long-term seasonal trends showed maximum variability and cooling since the 1960s during winter (January-March). In contrast, the autumn (October-December) temperatures were warmer-than-normal at Nuuk, showed delayed cooling through into the 1980s before declining below normal. In spite of the cold air in winter around West Greenland, ice cover was not extensive in 1994. Maximum ice extent occurred in February with more ice than normal occurring in the vicinity of Nuuk and in the Julianehaab Bight/Southwest Greenland region. Unusual amounts of ice were also observed during July off Cape Farewell and in early August off Baffin Island. Ocean temperatures at Station 4 on Fylla Bank in autumn were above normal (by over 1K averaged over the top 50 m and 0.8K over 0-200 m) and were slightly warmer than last year. Salinities were also above normal and increased since last year. Warm, salty conditions are believed due to a reduced influence of the East Greenland Current off West Greenland. The seasonal variability of the hydrographic properties off West Greenland through an analysis of historical data collected between 1920 and 1988 was also described (SCR Doc. 95/24). The near surface temperatures showed seasonal atmospheric heating and cooling with maximum temperatures in August except off Cape Farewell where they appeared in September. Waters below 50 m peaked during September-November which was believed to be related to advection of offshore waters. The time of the monthly mean near-surface salinity minimum occurred progressively later from south to north along southwestern Greenland, in August off Cape Farewell to October in the Davis Strait region. This salinity minimum reflected ice melt off East Greenland which was advected northward along West Greenland by the residual current.

A northward velocity of approximately 0.16 m/sec was estimated from the timing of the salinity minima along the coast, which closely matched that of the observed speeds over the shelf.

b) **Subareas 2 and 3** (SCR Doc. 95/2, 11, 33; SCS Doc. 95/4)

Oceanographic data from the Grand Bank, northeast Newfoundland Shelf and the Labrador Shelf were used to determine variability in the cold intermediate layer (CIL) during the summer and autumn periods in relation to the long-term average (SCR Doc. 95/33). The summertime area of the CIL across the Newfoundland Shelf returned to near the long-term mean during 1994 at Bonavista but remained above normal on Hamilton Bank and on the Grand Bank. The variability in CIL volume matched closely that of the variability in the CIL cross sectional areas along widely separated transects. The volume of CIL waters (subzero temperatures) has been slowly decreasing since 1991. A significant south to north temperature gradient (warmer in the north) within the CIL was believed to be a result of the insulating effect of the winter ice cover.

Russian scientists reported the results of oceanographic observations taken at a total of 102 stations on the Grand Banks during June and July of 1994 (SCS Doc. 95/4). The CIL waters occupied most of the near bottom waters over the shelf except over the Southeast Shoals and along the southern edge of the Grand Bank. The latter had above normal bottom temperatures, whereas in the northern Grand Bank area they were below normal. Near-bottom salinities were generally below normal over the entire Grand Bank. Bottom temperatures averaged over Div. 3L and 3NO, and both showed an increase in temperature and decrease in salinity over last year. Based on previous temperature trends, continued slow warming and freshening was predicted.

A study of witch flounder in Div. 3LNO and their possible relation to water temperatures was reported in SCR Doc. 95/11. A weak negative correlation was observed between water temperatures in the 50-200 m layer on the Hamilton Bank Section (8-A) and witch flounder biomass in Div. 3L from Russian surveys over the period 1980-1994. Using near-bottom temperatures within each division and smoothing the data, correlations accounting for greater than 57% of the variance in biomass were found. However, the relationship with temperature differed in form in each area, being negative in Div. 3O, positive in Div. 3N and parabolic in Div. 3L. No explanation for the difference between areas was given.

A Russian study on possible environmental factors affecting cod recruitment in Div. 2J3KL and Div. 3NO suggested the recent decline in cod recruitment may have been caused by a weakening of the Gulf Stream and immigration into more southern areas due to an intensification of Labrador Current waters (SCR Doc. 95/2). It was unclear to the Committee what mechanisms the authors were proposing to relate the Gulf Stream to the changes in cod recruitment. It was requested that the Committee's concerns be conveyed to the authors with the suggestion to resubmit the paper in a more clearly written and concise form at a future meeting.

c) **Subareas 4, 5 and 6** (SCR Doc. 95/15; SCS Doc. 95/4)

No research cruises were undertaken in the Scotian Shelf area during 1994 by Russian scientists, however, analysis of SST data and historical oceanographic and silver hake data were carried out (SCS Doc. 95/4). From the analysis of SST data, positive anomalies were observed during 1994 on the shelf slope and on the central Scotian Shelf throughout most of the year. In the eastern shelf low negative anomalies were found in winter and spring but they became strongly positive in summer and autumn. During the last 5 years, SSTs have generally been on the rise. Also in 1994 the shelf/slope front was northward of its long-term mean position during January to May and near the mean from June to December. Based on these data and previous associations, it was concluded that 1994 was favourable to a fishery on silver hake and squid aggregations but unfavourable to hake spawning. Studies were also carried out on data collected during June-July of 1990 from environmental and silver hake surveys. The near-bottom temperature, salinity, nutrients, circulation and zooplankton were compared to silver hake catch distributions. Surveys confirmed that the feeding and prespawning silver hake were on the warm side of the shelf/slope front.

Monthly monitoring of surface and bottom temperatures on a transect across the Middle Atlantic Bight showed generally warmer-than-normal surface conditions but cooler-than-normal near-bottom temperatures (SCR Doc. 95/15). Above-normal surface temperatures were also found in the Gulf of Maine. Surface salinities along the Middle Atlantic Bight transect were above the long-term mean. No surface salinities were taken in the Gulf of Maine.

7. **Overview of Environmental Conditions in 1994** (SCR Doc. 95/43)

A review paper was presented based on several long-term oceanographic and meteorological data sets as well as summarized results from available research documents. Highlights not covered in Section 6 are listed below.

a) Extremely cold air temperatures were again observed over southern Labrador and Newfoundland in winter, due to an intensification of the atmospheric circulation pattern as indicated by a strongly positive North Atlantic Oscillation (NAO) index. Air temperatures warmed to above normal values during the summer and autumn although the annual means remained slightly below normal.

b) Similar to last year, ice formed early, spread more rapidly, was of greater concentration and lasted longer than normal off southern Labrador, Newfoundland, in the Gulf of St. Lawrence and on the Scotian Shelf.

c) The number of icebergs to reach south of 48°N during 1994 was similar to 1993, but was slightly less than the maximum in 1991. It was the third highest number of bergs detected since 1945.

d) Below normal temperatures were observed throughout most of the water column at Station 27 in winter and in the deep waters during the entire year. The latter continued a trend that has lasted over ten years. By the summer, however, the surface waters had increased upwards of 2K above normal.

The areal extent of the CIL water in summer was slightly above or near normal and had decreased since 1993.

e) The CIL temperatures in the Gulf of St. Lawrence were well below normal continuing the trend of the past decade. Also larger areas of the Magdalen Shallows were covered by waters of less than 1K than usual. This has persisted since 1990.

f) Annual coastal sea temperatures at Boothbay Harbor and St. Andrews were above normal whereas at Halifax they were below normal in 1994.

g) Deep water temperatures on the Scotian Shelf (Emerald Basin) and in the Laurentian Channel at Cabot Strait were above normal. They were similar to or slightly below 1993 temperatures, respectively. These conditions reflected the influence of warm offshore slope waters.

h) Cold waters continued in the 50-100 m depth range over the Scotian Shelf and in the deep waters of the northeastern Scotian Shelf. The negative anomalies in some regions were near to those recorded in the 1960s. The decline in temperature had begun in the mid- to late-1980s but this year temperatures again appear to be on the increase. An exception to the below normal temperatures at intermediate depths was over Emerald Basin due to the mixing with the warm deep waters.

i) Warm conditions were observed throughout most of the Gulf of Maine during 1994 from XBT transects, coastal SSTs and deep hydrographic stations. Increases in salinities at the mouth of the Bay of Fundy provide evidence that this warming was due to an increased influence of offshore slope waters.

j) The Shelf/Slope front and the Gulf Stream were both north of their long-term mean locations and large numbers of Gulf Stream rings were observed.

8. **National Representatives**

No changes were reported to the national representatives responsible for submitting oceanographic data to MEDS. The representatives are: G. Glenn (Canada), R. Dominguez (Cuba), E. Buch (Denmark), A. Battaglia (France), F. Nast (Germany), R. Leinebo (Norway), A.J. Paciorkowski (Poland), F. Troyanovsky (Russia) and G. Withee (USA). The representative for the United Kingdom is unknown.

9. **Joint Russian/German Data Evaluation** (ICNAF/NAFO data, status report)

An update was given by the Chairman on the joint study by German and Russian scientists to evaluate and retrieve hydrographic data from the Russian central archives. The Chairman reported that the 3-year program that was funded in 1994 was now underway. He reported on data from the Labrador Sea that have been extracted from the German Oceanographic Data Centre. It showed strong cooling and freshening of the deep waters during the early-1970s with maximum changes on the western side of the Labrador Sea These data will soon be compared with Russian data from the same area. A report on the results will be published upon completion of the project.

10. **Acknowledgements**

There being no other matters of business, the Chairman closed the meeting by thanking the participants and the staff of the NAFO Secretariat for their contributions and cooperation.

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

Chairman: W. B. Brodie Rapporteurs: Various

I. OPENING

The Committee met at the Keddy's Dartmouth Inn, Dartmouth, Nova Scotia, Canada during 7-21 June 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 from Canada, Cuba, Denmark (in respect of the Faroe Islands and Greenland), European Union (Denmark, France, Germany, Portugal, Spain and United Kingdom), Japan and Russian Federation were in attendance, as well as an observer from the United States of America. Various scientists assisted in the preparation of the reports considered by the Committee.

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

II. GENERAL REVIEW

1. **General Review of Catches and Fishing Activity**

Because a large number of countries had not yet submitted STATLANT 21A data for 1994, it was not possible to prepare a meaningful tabulation to observe overall trends in catches and fishing activity. Therefore, under this heading, STACFIS agreed to have only a general review of catches in the NAFO Regulatory Area of Subarea 3 in 1994. A representative from Canadian Surveillance was present to address specific questions relating to catch estimates.

Various estimates of national catches in 1994 in the NAFO Regulatory Area in Subarea 3 were examined. These included figures from Canadian Surveillance authorities, from scientists of particular countries, and from the STATLANT 21A forms submitted to the Secretariat. The following decisions were made concerning these catches, for use in the STACFIS June 1995 assessments:

- Use the Canadian surveillance estimates when it was the only one available, i.e. for non-Contracting Parties, including those yet to report their catches, such as USA, Faroes, and Lithuania. There may be a tendency of Canadian surveillance to slightly underestimate the cumulative catch, due to the estimate used for vessel down-time.

- Use STATLANT 21A catches for Japan, Estonia, Latvia, and Russia, as there were no indications of problems with these data.

- Use other sources of information for some Contracting Parties, as it was concluded that these data were the most appropriate.

There was little or no fishing activity by Canada in the NAFO Regulatory Area for all groundfish stocks considered.

There were considerable discrepancies in some estimates of catch by species and Division, but there was reasonable agreement on the overall level of the groundfish catch in the NAFO Regulatory Area in 1994 in SA 3, around 125 000±5 000 tons (Table 1). In the discussion of catches in each assessment affected by these estimates, the range of possible catches is to be pointed out. Where possible, steps should be taken before the June 1996 Meeting of the Scientific Council to explain these discrepancies, such as obtaining species composition of catches labelled as "OTHERS", and by checking on the availability of independent data on fish production or fish sale. STACFIS noted with concern that the annual process of compiling catches by species, country and area continues to be difficult and time-consuming, and still produces some estimates which have a considerable degree of uncertainty.

Table 1. Estimates of catches in the NAFO Regulatory Area in Subarea 3 in 1994, for use in STACFIS stock assessments of June 1995.

Species	Area	Totals
Cod	3L	1 441
	3M	32 255
	3N	462
	3O	49
	3NO	2 702
TOTAL		36 398
Redfish	3L	893
	3N	3 829
	3LN	6 974
	3O	3 898
	3M	11 315
TOTAL		22 187
American plaice	3L	1 069
	3N	4 209
	3O	270
	3LNO	7 378
	3M	669
TOTAL		8 047
Yellowtail flounder	3L	0
	3N	719
	3O	0
	3LNO	2 069
	3M	0
TOTAL		2 069
Witch flounder	3L	360
	3N	1 066
	3O	53
	3NO	1 119
	3M	31
TOTAL		1 510
Greenland halibut	3L	18 246
	3N	12 451
	3O	4 041
	3NO	17 468
	3M	9 317
TOTAL		45 031

Total catches do not include skate or "other species".

III. REVIEW OF RECOMMENDATIONS FROM 1994 MEETINGS

A brief review of recommendations from 1994 was made. Where work had been completed, STACFIS agreed to review this during the stock assessments.

IV. STOCK ASSESSMENTS

1. **Cod in Divisions 2J, 3K, and 3L** (SCR Doc. 94/84, 95/2, 9, 12, 46, 60)

a) **Introduction**

In the 1994 assessment of the stock STACFIS was unable to determine the absolute stock level based on an analytical assessment, but based on available data it was considered that it was at an all time low.

For the current assessment additional biological data and abundance indices relative to the status of the stock were considered and the results are summarized in this report under various headings.

b) **Description of the Fishery**

Prior to the 1960s the Div. 2J+3KL cod stock supported fisheries catching from 200 000 to 300 000 tons annually. During the 1960s good recruitment along with high exploitation rates saw catches averaging about 580 000 tons (Fig. 1). However, the stock was in a period of decline from the 1960s until the mid-1970s. Reduced exploitation and some improved recruitment after that time allowed the stock to increase until the mid-1980s, when catches were about 230 000 tons. With the subsequent stock decline catches were reduced to 44 000 tons in 1992 reflecting management actions. The commercial fishery was eventually closed in mid-1992. A Canadian food and subsistence fishery was permitted in 1993 and part of 1994. This fishery was generally considered a failure with catch rates being low and cod generally small. The 1994 catch totalled about 1 800 tons and was taken mainly in Div. 3L (500 tons) and Div. 3K (932 tons) (Fig. 2).

Catch beyond the 200-mile line in Div. 3L in 1994 was estimated at about 500 tons.

Recent catches and TACs ('000 tons) are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Fixed Gear Catch	80	72	79	101	103	113	60	12[1]	9[1]	1.3[1]	
Offshore Catch	151	179	156	168	151	106	90[2]	32[1,3]	2[1]	0.5[1]	
Total Catch	231	252	235	269	253	219	150	44[1]	11[1]	1.8[1]	
TAC	266	266	256	266	235	199	190	120[4]	[4]	[4]	[4]

[1] Provisional.
[2] Canadian surveillance estimate was 111.
[3] Fishery closed by EU in June 1992.
[4] Moratorium on Canadian fishing became effective in July 1992.

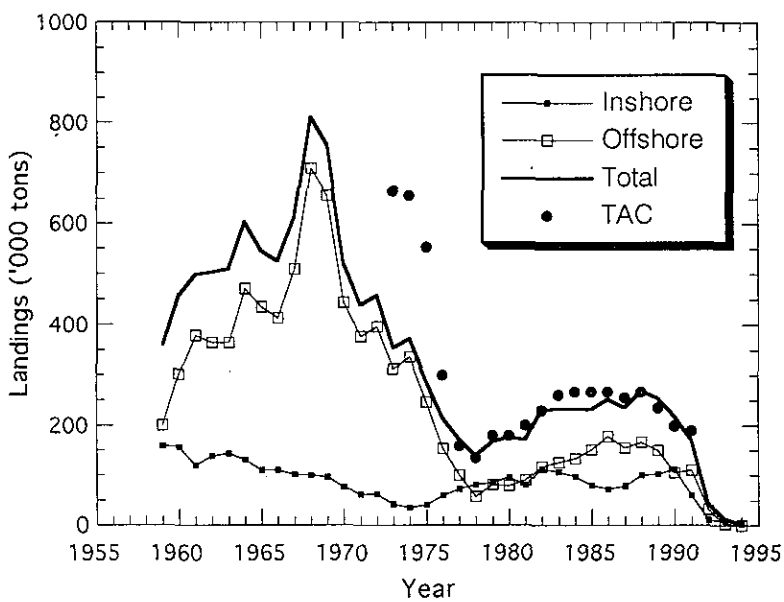


Fig. 1. Cod in Div. 2J+3KL: inshore and offshore landings and TACs.

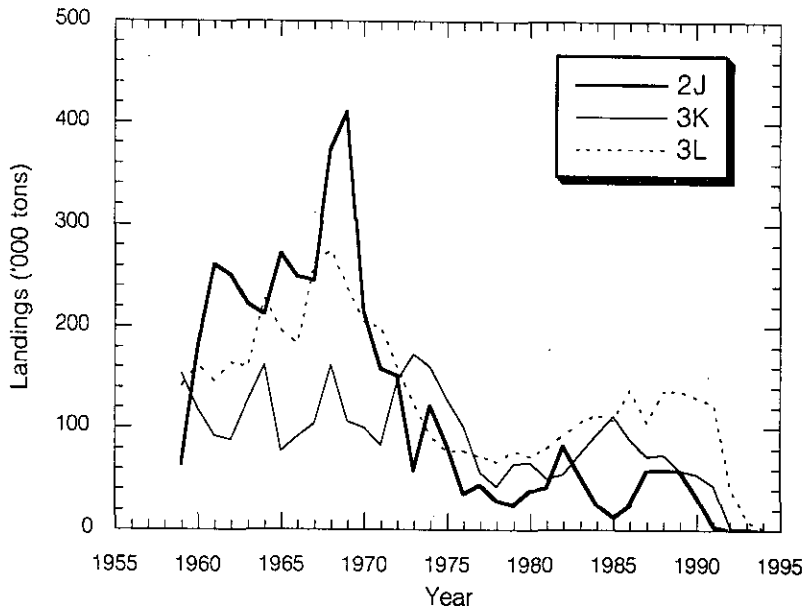


Fig. 2. Cod in Div. 2J+3KL: landings by Division.

c) **Physical Environment**

Since the relatively warm period from the early-1950s to late-1960s the oceanic conditions in the Newfoundland region have been characterized by three cold periods; early-1970s, mid-1980s and the early-1990s. During 1991 the total heat content of the water column was the lowest ever recorded on the Newfoundland Shelf. These cold episodes resulted from the large scale winter atmospheric circulation over the Northwest Atlantic which brought cold Arctic air further south than normal resulting in increased ice cover and a colder and fresher water mass on the Newfoundland Shelf.

During 1994 the annual air temperatures had increased in comparison to recent years. However, seasonally, the winter temperatures were below normal causing ice to form early, be of greater areal extent and last longer than normal off northern Newfoundland and southern Labrador, although ice conditions off southern Newfoundland at the beginning of April were less than recent years. As a result, ocean temperatures on the Newfoundland Shelf measured at Station 27 off St. John's were below normal during the winter over all depths but by July they had warmed to 2.0°C above normal in the upper water column and increased to near normal in the bottom layers by late-autumn. The summer area of the Cold Intermediate Layer of the Labrador Current along the Bonavista transect (Div. 3KL) has returned to near normal but remained above normal across Hamilton Bank (Div. 2J) and the Grand Bank (Div. 3L). The July-August upper layer (0-50 m) was fresher than normal in 1994.

Ocean conditions in 1994 were closer to the long-term average than in recent years. This may be beneficial for biological factors such as growth rates.

d) **Stock Structure**

Cod in Div. 2J+3KL are considered as a stock complex in which the existence of substocks or stock components has long been suspected. Most attempts to distinguish individual components have been complicated because of extensive annual migrations undertaken within the stock, particularly the inshore-offshore migration.

Recent research with micro-satellite DNA and blood antifreeze protein levels have indicated that cod overwintering in a deep water bay in Div. 3L were genetically distinguishable from cod overwintering offshore along the shelf-break of the Grand Bank (Div. 3L). This difference occurred even though cod from the two areas intermingle during most of summer and autumn as a result of the inshore feeding migration by offshore individuals.

Similar analyses to determine differences between offshore components throughout their range have not been conclusive. Some of the problems encountered may have been related to timing of sampling or to movements of cod within the area. The identification of substocks or stock components would be important for the future management of this stock.

e) **Spatial Patterns of Abundance and Distribution**

i) **Temporal changes**

A more southerly distribution of cod, three years of age and older has been reported previously and reportedly began in 1989. Different reasons for the apparent southward shift in distribution have been hypothesized: 1) it was a direct result of colder ocean climate conditions; 2) it was a direct result of the more southerly distribution of capelin; 3) the changing pattern in distribution was actually not a 'shift' but a result of high fishing mortality in the northern areas; 4) it was a combination of fishing mortality and ocean climate factors.

Recent work examining fishing mortality based on tagging data for the period 1954-91 concluded that fishing mortality was higher in Div. 3K than in Div. 3L. There was no comparable tagging data in Div. 2J in the late-1980s and early-1990s with which to make a similar comparison. Higher fishing mortality in more northerly areas was consistent with the hypotheses stated above. The lack of comparable data from Div. 2J and the observation that cod straddled the Div. 3K/3L border during the late-1980s limited the interpretation of these results.

Acoustic data collected in an area straddling the boundary of Div. 3K and 3L from 1983-94, demonstrated an increase in density within the study area during 1990-92, compared to 1983-89 and 1993. These results were consistent with the hypothesis that there was an increase in local density during 1990-92, in association with the decline of cod abundance in the north (Div. 2J+3K). The decline in local density in 1993 was hypothesized to result from a further southward shift in distribution of cod to the northern part of Div. 3L, outside Canada's 200-mile line. Density continued to decline within the study area in 1994.

ii) **Distributional studies in 1994**

Acoustic data were collected in June 1994 from four specific areas, ranging from northern Div. 3L in the south to Hawke Channel (Div. 2J) in the north. Cod densities were very low compared to observations made during previous spring acoustic sampling. Although densities were similar in the north and south, it was the first year that the northern area had been included in this acoustic survey, and it was noted that the results represent partial coverage for the stock area. Cod were in poorest condition (K_f) in the southern most region (northern Div. 3L). Adults sampled in the Div. 2J region were largely spent, indicating that spawning had occurred prior to June.

Pelagic juvenile cod were found extensively over the NE Newfoundland Shelf in surveys conducted during late-August, indicating that successful spawning of cod occurred in spring off Labrador in 1994. This observation agrees with the June acoustic survey which only found adult cod only in the north (southern Div. 2J). Comparisons to previous surveys were restricted by the fact the 1994 survey was the first time coverage was extended to the north. Comparing similarly surveyed areas offshore in 1994 to 1993 indicated there were more pelagic offshore juvenile cod in 1994. Pelagic juvenile cod were also distributed throughout the surveyed inshore areas during 1994, consistent with previous surveys.

iii) **Population contraction**

The autumn 1994 Canadian research vessel survey did not locate any significant concentrations of cod within the survey area. Spatial concentration of cod increased from low values during 1981-87, reaching a peak in 1992. Since then, it has decreased to levels common in the early-1980s.

A comparison of population concentration with population size (from autumn surveys) demonstrated that the spatial distribution of cod began to contract systematically from 1987 through to 1990, with no change in population size during this period. There was a continued concentration of the population from 1990 to 1992, at a lower rate, as the population abundance declined. As the research vessel abundance index decreased further in 1993 and 1994 the remnant population had no dense spatial concentrations. The spatial concentration index appeared to quantify a contraction in distribution that occurred initially independent of the population abundance. The lack of spatial concentration in 1994 appeared to reflect that there were no aggregations of cod remaining within the survey area.

iv) **Juvenile cod**

Juvenile cod surveys conducted between 1992-94 demonstrated that cod ages 0-3 years occurred throughout the inshore areas along the east coast of Newfoundland.

Pelagic and demersal juvenile cod surveys demonstrated strong cross-shelf gradients in abundance, where the inshore areas typically had the highest concentrations. With the exception of 1994, the spatial distribution of pelagic juvenile cod was largely confined to the inshore areas. This distribution was confirmed by demersal sampling conducted in the same year after the cod had settled. In the 1994 pelagic juvenile survey, cod were more abundant offshore than in 1993. Demersal sampling in the late-autumn of 1994 did not sample 0-group cod on the bottom offshore. It was not possible to ascertain if the pelagic juvenile cod sampled offshore in 1994 migrated inshore or remained undetected offshore during their first winter of life.

Beach seine sampling has demonstrated the abundant occurrence of 0-group and 1-group cod below the inter-tidal range to depths of 5-7 m. A nearshore trawling experiment carried out in November 1993 demonstrated that 0-group and 1-group cod were abundant out to depths of 40 m, approximately 2-3 km from shore. Older cod (ages 2 and 3) were less abundant at depths <40 m and more abundant at greater depths.

f) **Changes in Maturity, Weight, Age Composition and Condition**

Observations from autumn and spring surveys indicated that both males and females have shown an increasing proportion mature at younger age and smaller size since 1990-91 with the current estimates being the highest in the time series. The trends observed were evident in all Divisions.

Micro-otolith age determination of pelagic juvenile cod in 1994 demonstrated that cod larvae hatched primarily in June, with spawning extrapolated to have occurred during May, and possibly late-April. There was no evidence of spawning after this time in 1994. This observation contrasted with samples from 1992 and 1993 which demonstrated that successful spawning occurred primarily during June and July.

Condition factors, as measured by body weight relative to length, fluctuated without apparent trend from 1977 until 1989 after which they declined through 1992 in Div. 2J and to a lesser extent in Div. 3K. There was no apparent decline in Div. 3L. This pattern was supported by estimates of the overall level of feeding of cod during the same time period, particularly for Div. 2J. However, the declining trend in condition was reversed in 1993 and 1994. This was not reflected in feeding success data for the same period.

Changes in growth rate and proportion mature-at-age are important in the determination of the amount of recruitment necessary for spawner biomass replacement, i.e. for year-classes to produce sufficient spawner biomass to equal that of their parents. Using the most recent assessment results, obtained using the ADAPT framework, it was concluded that the decrease in recruitment and growth over the 1980s played a major role in the stock decline.

The rate of population growth of Atlantic cod is strongly related to age-at-maturity and this is influenced by temperature.

Autumn survey average lengths and weights-at-age for the dominant age groups (4-7) declined for most years from the late-1970s to early-1980s until 1992 with declines most pronounced in Div. 2J. The 1993 and 1994 values have shown general increases. Cod older than age 7 were virtually absent in the autumn surveys of 1993 and 1994.

g) **Spawning Locations**

The areas where the most intensive spawning occurs for this stock has been variously reported as the outer slopes of the Banks and more recently the shallower waters of the Shelf. Recent analysis of data from Russian surveys suggested that spawning occurs earlier on the slopes than on the shelves. In the past, spawning was earlier and more intensive on the northeastern slopes than on the shelves. More recently most of the spawning was observed on the shelves and in shallower waters. It was indicated that changes in spawning locations may have been influenced by changes in stock abundance, and probably by oceanographic conditions.

h) **Fishing Mortality**

A history of exploitation of Div. 2J+3KL cod since 1954 was estimated using tag return data from 122 tagging experiments. Very high rates of exploitation in the late-1980s and early-1990s were estimated.

A separate analysis of inshore components of the Div. 2J+3KL stock complex using tagging data indicated that fishing mortality had been very high on the inshore components of the cod stock since the late-1940s, when the estimated fishing mortality was greater than 0.5.

By-catch of cod in the shrimp fishery was estimated and appeared to be small in 1994, apparently as the result of increased use of the Nordmore grate.

An analysis of the ratio of the catch to estimated biomass from the research survey indicated: 1) that the fishing mortality from the very limited food fishery in recent years and offshore international catch was significant, and 2) the high fishing mortalities estimated for the early-1990s by other methods, were not observed.

i) **Natural Mortality**

An analysis was presented which suggested that the drastic stock decline since the late-1980s was caused by a sudden increase in natural mortality (m) in the winter of 1991 to a level of 2.2 as opposed to the usual assumed value of 0.2. However, the validity of this analysis could not be determined at this time as several questions could not be answered relative to some of the model parameters. This included, the method used to obtain the regularization parameter including the derivation of q, "the catchability rate". Other published analyses have indicated that there was no sharp increase in natural mortality at that time.

j) **Predator-prey and Competition Interactions**

Cod are eaten by a variety of predators, including seabirds, squid and various fish, including cod itself (cannibalism), but the non-human predator attracting attention in recent years has been the harp seal. The harp seal population which is seasonally present in the Div. 2J+3KL cod stock area has been increasing and was now estimated to number about 4.5 million. Although cod has been determined to be a minor component (3%) of the harp seal diet, the impact of this removal on the dynamics of the cod stock has not been assessed. Cod eaten by seals are mainly aged 0-2 years.

Arctic cod, capelin, herring and cod accounted for about 75% of the harp seal diet. The biological interactions among capelin, Arctic cod, cod and seals may be complex. Capelin is consumed by the other three species. Arctic cod is consumed by seals and cod. Cod is consumed by seals and by larger cod. In addition, capelin, Arctic cod and juvenile cod have similar food requirements, so there is potential for competition among them.

k) **Feeding**

The temporal pattern of change in stomach contents of cod has varied by Division. In Div. 2J, the average quantity of capelin in stomachs was nil or low during 1991-94, reflecting the absence or low abundance of capelin in Div. 2J as determined during acoustic surveys. The condition (somatic and liver indices) of the few cod remaining in Div. 2J also declined in 1991 and 1992, but the somatic condition index recovered in 1993 and 1994.

In Div. 3K, the average quantity of capelin and other food in stomachs was relatively high in 1993, but the quantity of capelin declined in 1994. There was no corresponding decline in somatic condition. In Div. 3L, neither stomach contents nor somatic condition declined in 1993 and 1994.

l) **Changes in Co-occurring Groundfish Species**

Witch flounder biomass estimates from Div. 2J+3KL have declined from 45 000 tons in 1983-84 to an all time low of 900 tons in 1994. American plaice biomass from Div. 2J+3K has also declined over the same temporal period from approximately 120 000 tons in 1982-83 to 5 000 tons in 1994, as well, the lowest in the time series. The depth distribution of witch flounder and American plaice has changed from the 1980s to the 1990s with the proportion of the biomass increasing since 1989 in deeper water. The age composition of American plaice has narrowed from a maximum age in autumn surveys of 16 in 1989 to a maximum age of 12 in 1993. Age compositions were not available for witch flounder for the past two years but previous analyses have shown a decline in maximum age from 26 in the mid-1970s to 17 in 1981, and further to 14 from 1986-92.

The declining biomass trends in these two species in Div. 2J+3K could not be explained by the removals from the commercial fishery. The ratio of annual catch/survey biomass, a proxy for exploitation rate, never exceeded 9% for American plaice. The situation was not as clear for witch flounder because of uncertainties with survey coverage of the stock area and a fishery concentrating on pre-spawning aggregations.

There were similarities in the abundance and distribution patterns of cod, American plaice, and witch flounder. All have shown declining trends over the same time period and a tendency to be found in deeper water. Unlike cod, there was no evidence for a change to a more southerly distribution for American plaice.

m) **Recruitment Trends**

Recruitment to fishable sizes (approximately age 3) was compared using research surveys and reconstruction of recruitment from catch data (VPAs). In 6 different cod stocks from 1980 onward the VPA based trend in recruitment declined, while the research vessel estimates did not decline. This can result from increased discarding and high-grading, such that juvenile fish are under-estimated by VPA reconstruction. In each of the 6 stocks, high juvenile mortality was associated with high adult mortality, consistent with the hypothesis of discarding. Based on VPA reconstruction calibrated against research surveys (ADAPT) recruitment fell below replacement levels in the early-1980s. The recruitment required to replace spawner stock rose during this period due to increased fishing mortality and declining weights-at-age.

Abundance estimates from the autumn survey declined for fish at ages 2, 3 and 4 in 1994, compared to 1993 and 1992 in Div. 2J+3KL. This points to a continuing decline in recruitment to fishable size classes due to weak year-classes in 1990-1992. The catch rates of age 1 through 4 cod from inshore pelagic traps were higher in 1994 at a site in Div. 3L but lower at another site in Div. 3K.

A number of different indices have been used to determine trends in year-class strength. These include; pelagic density and distribution, beach seine surveys of young cod in shallow water, surveys in deeper water using a small mesh Campelen trawl, catches in inshore pelagic traps, and incidental catches in commercial capelin traps.

The 1994 year-class appeared to be stronger than the 1993 and 1992 year-classes, based on several of the indices at age 0+. The 1993 year-class also appeared to be stronger than the 1992 year-class, based on indices at age 0+ and at age 1+. In most instances the 1991 year-class ranked lowest in abundance. It will be at least 3 years until it is known whether this trend is reflected in the annual autumn biomass survey. The beach seine survey was considered to be a reliable indicator of relative cohort strength, with precision similar to that of the autumn research survey. The precision of the other indices needs further evaluation.

n) **Biomass Trends**

Autumn research vessel survey estimates of biomass and abundance in Div. 2J+3KL have shown severe declines in recent years and the 1994 point estimate was the lowest in the series. No aggregations of cod were found.

Estimates from Canadian spring and Russian spring and summer research vessel surveys in Div. 3L have also declined substantially in recent years.

Anecdotal information from the Canadian food and subsistence fishery in September of 1994 indicated that there were no areas with reports of 'good' catch rates comparable to that experienced in the years prior to 1992. The June 1994 acoustic survey had no large catches comparable to those obtained during 1990-93 surveys. No high density aggregations of adults were located as had been the case in previous years.

Given the levels of precision in spring and autumn surveys it was not possible to conclude that the decline in biomass and abundance from 1993 to 1994 was significant. However, all indices indicate that this stock is at an extremely low level.

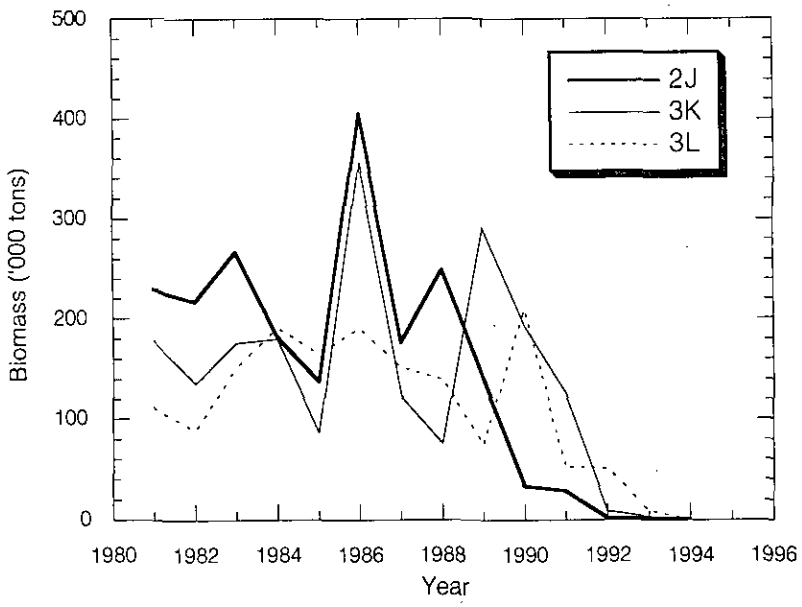


Fig. 3. Cod in Div. 2J+3KL: biomass estimates from surveys.

o) **Summary**

The Div. 2J+3KL cod stock remains at a very low level, probably in the order of 1% of that in the early-1980s. The stock consists mainly of young fish. Stock reduction since the moratorium has occurred although catches have been much reduced. The majority of the catch since the moratorium has come from inshore areas where it has been shown that separate stock components are likely to exist, mainly in the deepwater bays.

The reasons for the drastic decline in this stock remain unresolved. Hypotheses suggest a variety of potential causes, such as, adverse environmental conditions, underestimation of fishing mortality, and increased predation. Although water temperatures were anomalously low during the early-1990s, there are indications of a return to more normal conditions. Analysis of tagging concluded, as did previous results from VPA analysis, that fishing mortality in the late-1980s and early-1990s was high, assuming a constant rate of natural mortality. Since the moratorium, fishing mortality would have been reduced in the offshore areas as catches were very small. By-catch mortality of cod in the northern shrimp fishery declined from 1992-94 with the introduction of the Nordmore grate. Harp seal numbers have increased substantially since the early-1980s and their consumption of cod as well as other fish species has increased.

Since 1990-91 cod have shown an increasing proportion mature at younger ages with the proportion for 1994 being the highest in the time series. This may be a response to population declines. Estimates of the abundance of pre-recruits (ages 0-2) have been obtained in recent years using a variety of indices. The abundance in 1994 at age 0 was greater than in 1992 and 1993.

2. **Cod in Division 3M** (SCR Doc. 95/26, 30, 73 (revised), 75, 77; SCS Doc. 95/13, 15)

a) **Introduction**

i) **Description of the fishery**

The cod fishery on Flemish Cap has traditionally been a directed fishery by Portuguese trawlers and gillnetters, Spanish pair-trawlers and Faroese longliners. Cod was also being caught in the past as by-catch in American plaice fishery conducted by Spanish trawlers, as well as in redfish fishery by Portuguese trawlers. Insignificant amounts of cod are taken as by-catch in the Russian pelagic fishery for redfish. The fleet currently operating in Div. 3M includes vessels from non-Contracting Parties.

ii) **Nominal catches**

From 1963, when the improved statistical system was introduced, to 1979, the mean reported catch was 32 000 tons, with high variation between years. Catches declined after 1980, when a TAC of 13 000 tons was established, but Scientific Council regularly expressed its concern about the reliability of the reported catches in the period. New estimates of the annual total catch since 1988 were available after revision using information from logbooks from a high proportion of vessels fishing in the area (Fig. 4). The revisions were substantial in some years, for example 1988.

Recent TACs and catches ('000 tons) are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	13	13	13	0	0	0	13	13	13	11	11
Catch	14	15	11	29[1]	48[1]	41[1]	16[1]	25[1,2]	16[1,2]	30[1,2]	

[1] Includes estimates of misreported catches and catches of non-Contracting Parties.
[2] Provisional.

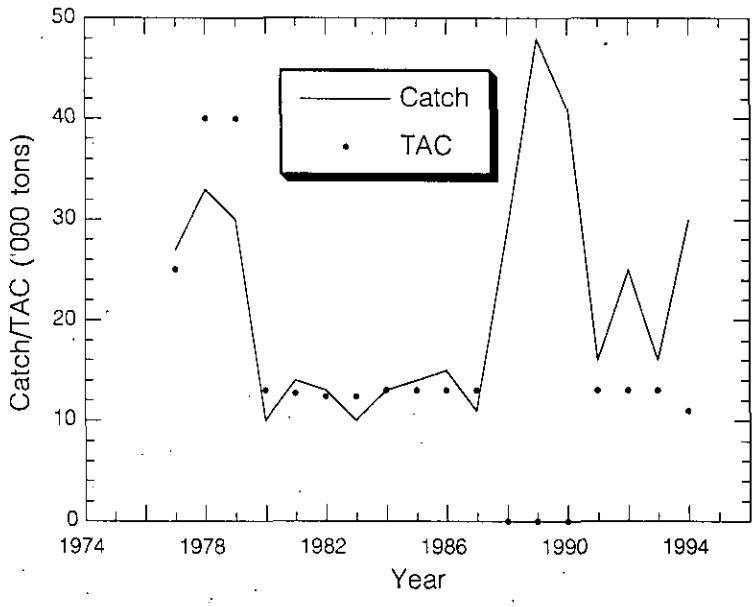


Fig. 4. Cod in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Sampling data for 1994 were available for Portuguese trawlers and gillnetters and Spanish pair-trawlers. Samples were selected from the whole catch before it was sorted and discarding occurred. Trawler catches were dominated by the 1990 and 1991 year-classes as were pair-trawl catches. Gillnetter fleet catches were dominated by 1990 and 1989 year-classes.

ii) **Catch rates**

Catch-rate data from Spanish pair-trawlers for 1993 and 1994 were not representative due to the small amount of data available. Two models used to analyze the Portuguese CPUE data gave inconsistent results for 1993. Both analyses showed an increase in catch rates in 1994 compared to 1988-92.

iii) **Research survey data**

Biomass and abundance estimates were available from research vessel bottom trawl surveys conducted by USSR/Russia from 1977 to 1993 (Fig. 5), with concurrent acoustic surveys from 1985 onwards. The estimates of trawlable biomass showed a maximum level of 37 000 tons in 1989, a decline to 3 900 tons in 1990 and an increase to 13 000 tons in 1993. There were no comparable surveys in 1992 and 1994.

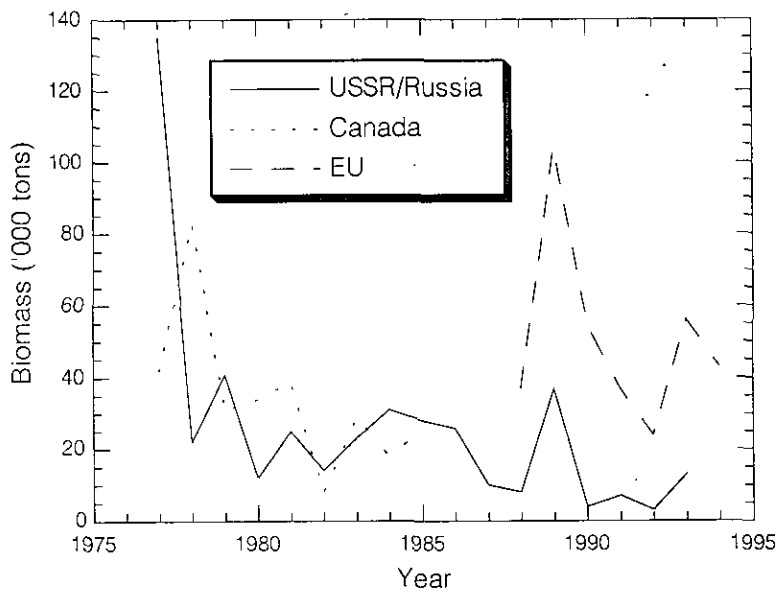


Fig. 5. Cod in Div. 3M: total biomass estimates from surveys.

Stratified-random bottom trawl surveys were conducted by the EU from 1988 to 1994. The surveys also showed a decline of trawlable biomass from a peak of 104 000 tons in 1989 to 24 000 tons in 1992, an increase to 56 000 tons in 1993, and a decrease in 1994 to 43 000 tons.

The maximum stock biomass in 1989 indicated by surveys was produced by the relatively abundant 1985 and 1986 year-classes when aged 4 and 3 years, respectively. The increase in biomass from 1992 to 1993 was attributed to the contribution of the relatively abundant year-classes of 1990 and 1991 which constituted 89% of the total biomass in the 1993 EU survey. These year-classes constituted 93% of the total biomass in the 1994 EU survey.

c) **Estimation of Parameters**

A sequential population analysis was carried out for ages 1 to 8+ and years 1988 to 1994. Catch-in-number data correspond to the revised estimates of total annual catch.

Natural mortality was set at 0.2. The partial recruitment-at-age vector was determined by the Extended Survivors model used in the analysis.

The analysis was tuned with the results of the EU survey from 1988 to 1994. Alternate analysis including catch-at-age and effort data of the Spanish pair-trawlers from 1988 to 1992 and of the Portuguese trawlers from 1988 to 1994 for the tuning process were also considered. However, it was observed that the weight attributed to those data in the analysis was low due to their low concordance with survey and catch inputs. Consequently, the results were similar in all the runs performed.

d) **Assessment Results**

STACFIS stressed that because of uncertainties associated with the input catch-at-age data and the fit of the Extended Survivors model, the results of the analysis can only be used to infer trends in biomass and fishing mortality and at present, could not be used as a basis for any catch prediction.

Estimated fishing mortality was very high, exceeding 1 in more recent years, which was consistent with estimates from previous analysis (Fig. 6).

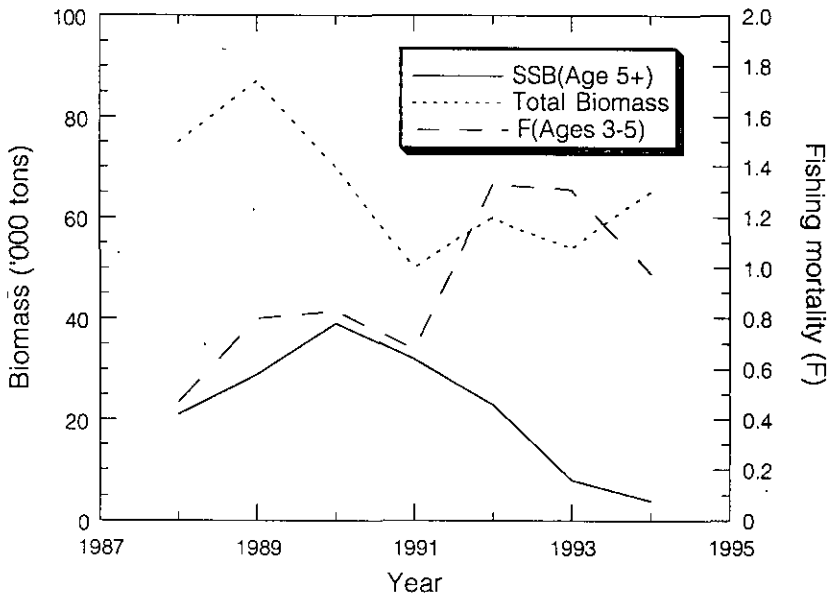


Fig. 6. Cod in Div. 3M: results from XSA model, believed by STACFIS only to reflect trends (for discussion SSB see Section e below).

The 1985 and 1991 year-classes were the most abundant over the period, and those from 1993 and 1994 seemed to be weaker. Total biomass in the period 1988-94 was highest in 1989 and in 1994 due to the contribution of the 1985 and 1991 year-classes, respectively. On both occasions, the increased cod abundance on Flemish Cap attracted more fishing effort, resulting in early exploitation of the cohorts and a decrease in their potential yield.

e) **Spawning Stock Biomass**

Spawning of cod on Flemish Cap generally begins at age 5. Spawning stock biomass, assumed to be age 5+ biomass, decreased since its recent peak in 1990. The latest study of cod maturation indicated that age 4 fish were mature in 1994. The increase of the spawning capacity of the stock was interpreted as a reaction of the population to the decline of the adult stock.

3. **Cod in Divisions 3N and 3O** (*SCR Doc. 95/55, 70; SCS Doc. 95/13*)

a) **Introduction**

i) **Description of fishery**

Nominal catches increased during the late-1950s and early-1960s, reaching a peak of about 227 000 tons in 1967, and subsequently declined to lows of 9 728 tons in 1993 and 12 561 tons in 1992 (Fig. 7).

Recent TACs and catches ('000 tons) are as follows:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Recommended TAC					Same as agreed					
Agreed TAC	33	33	40	25	18.6	13.6	13.6	10.2	6	0
Reported Catches	51	42	43	33	18	17	10.1[1]	9[1]	1.9[1]	
Non-reported Catches	-	-	-	-	11	12	2.5	0.7	0.8	
Total Landings	51	42	43	33	29	29	12.6[1]	9.7[1]	2.7[1]	

[1] Provisional.

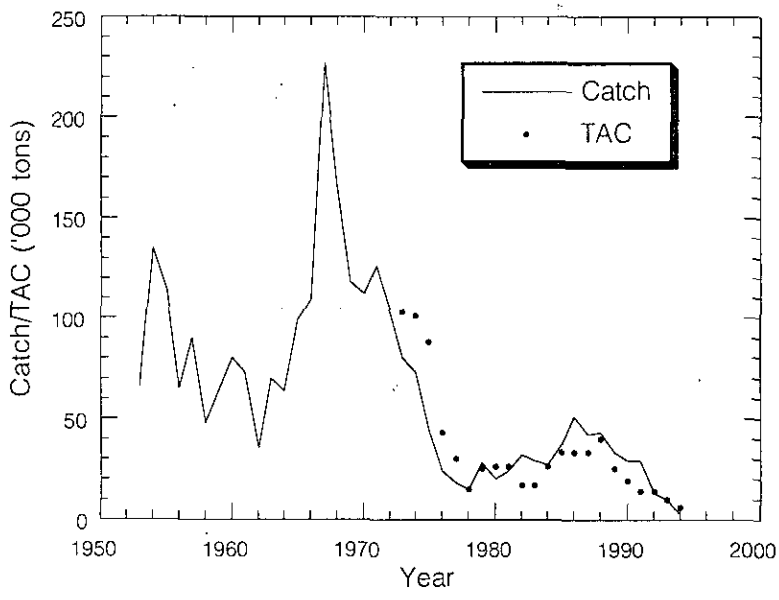


Fig. 7. Cod in Div. 3NO: catches and TACs.

From 1979 to 1991 catches have ranged from 20 000 to 50 000 tons. The continued reduction in recommended TAC levels have contributed to reduced catches in recent years to a level of about 10 000 tons in 1993. Directed fisheries on this stock ceased about mid-year in 1994 and there are to be no directed fisheries during 1995.

Landings during 1994 were mainly from the Regulatory area by the EU and non-Contracting Parties (2 655 tons) while the Canadian fishery obtained about 47 tons.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. The Portuguese otter trawl catch rates declined from 1990 to 1992 consistent with the impact of low recruitment levels during the mid to late-1980s. There was an increase in 1993 as a result of incoming relatively strong recruitment (1989 and 1990 year-classes) but a decline again in 1994 as the abundances of these year-class declined. The Portuguese fishery also found cod in deeper waters in recent years.

Catch-at-age. Biological sampling data was available only for the Portuguese fisheries and an estimate of total removals-at-age were obtained from these data. The 1989 and 1990 year-classes (ages 4 and 5) were most numerous in the catch in 1994. These were also the most numerous year-classes in the catches from 1991 to 1993 (ages 2-4).

There appeared to be a decline in mean weights-at-age from 1993 to 1994 although this may have resulted from the area sampled (only from the Regulatory Area), time of the year (first half of the year only),and small sample size at older ages.

ii) **Research survey data**

Stratified-random research vessel surveys have been conducted by Canada in Div. 3N for the 1971-95 period, with the exception of 1983, and in Div. 3O for the years 1973-95 with the exception of 1974 and 1983. Surveys prior to 1991 generally had a maximum depth of 366 m. For 1991-95 the depth range has been extended to at least 731 m in each survey. Biomass estimates for Div. 3N and 3O combined, gradually increased from the early-1970s to the early-1980s and increased considerably between 1982 and 1984. Another sharp increase occurred in 1987 but survey biomass then declined until 1992 when it was the lowest observed since 1982. Estimates of the Div. 3NO biomass in 1993 increased to about 74 000 tons. The 1994 and 1995 biomass estimates declined further to 17 000 tons and 9 000 tons, respectively, the lowest in the time series.

Abundance estimates for Div. 3NO suggested similar trends to those observed for biomass. The abundance estimates for the 1988 to 1992 period were among the lowest in the time series but the 1993 estimate was considerably higher (Fig. 8). Abundance was much lower in 1994 and 1995 with the latter being by far the lowest in the time series.

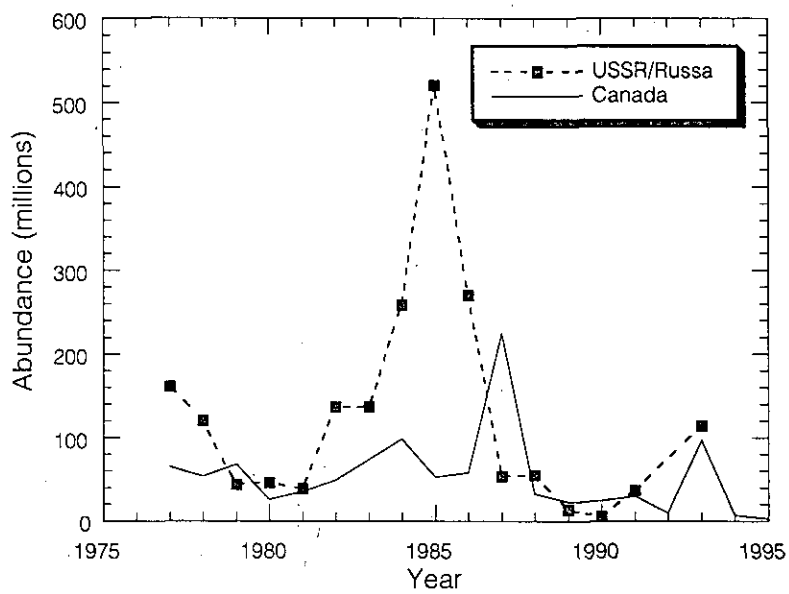


Fig. 8. Cod in Div. 3NO: abundance estimates from spring surveys.

Abundance estimates-at-age indicated that the 1983 to 1988 year-classes (ages 6 to 11 in 1994) were among the lowest observed in the time series. The dominant ages in the 1994 survey were 4 and 5 (the 1990 and 1989 year-classes).

Additional stratified-random surveys have been conducted by Canada during autumn in 1990-94 with 731 m being the maximum depth in 1993 and 1994. Biomass and abundance estimates for Div. 3NO declined from 1991 to 1994 (Fig. 9). The 1989 year-class was abundant in the 1991 and 1992 surveys but declined drastically in 1993 and further in 1994.

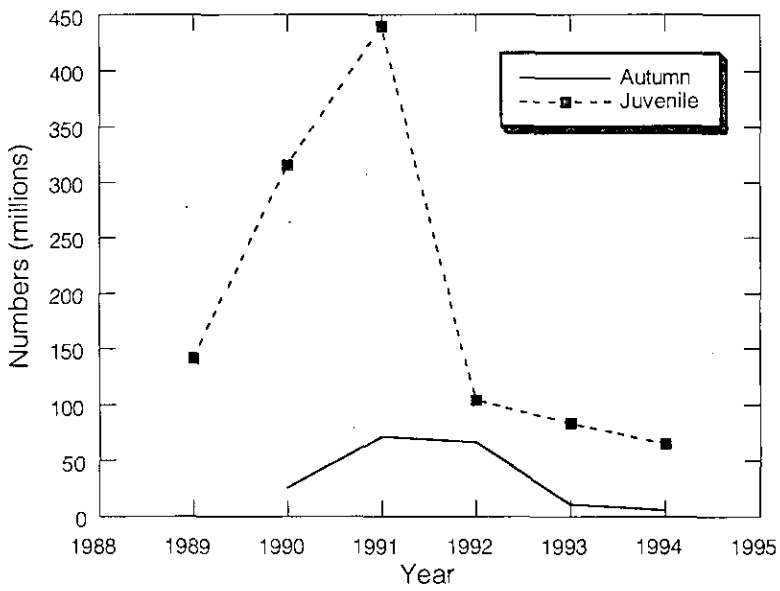


Fig. 9. Cod in Div. 3NO: abundance estimates from autumn and juvenile surveys.

Canada has conducted stratified-random surveys during the August-September period in Div. 3NO since 1985 for the purpose of estimating abundance of juvenile as well as adult groundfish. The surveys since 1988 have covered depths to 275 m. Biomass and abundance increased from 1989 to 1991 but have since generally declined. The decline indicated a substantial reduction in the abundance of the 1989 and 1990 year-classes.

A stratified-random survey conducted by EU-Spain in May of 1995, only in the Regulatory Area to a maximum depth of 731 m, estimated cod biomass at about 7 200 tons. Most were found in one stratum at depths ranging from 185-275 m. Cod lengths ranged from 24 to 60 cm (peaking between 45 and 51 cm).

c) **Estimation of Parameters**

i) ***Sequential population analysis***

Formulations of the adaptive framework (ADAPT), including Canadian spring, autumn and juvenile groundfish surveys and Russian RV survey data, were used for the determination of stock size for 1994. Results from ADAPT indicated that coefficients of variation (CVs) were relatively high and that year effects in the residual pattern suggested some uncertainty in the calibration analysis. It was considered that some of the uncertainty may have resulted from inclusion of data from the 1993 Canadian and Russian spring surveys. These have previously been considered to be outliers in their respective time series as both estimates were very high relative to previous surveys and had large variances associated with their estimates. The low biomass and abundance from the 1994 and 1995

surveys were a further indication that the 1993 values were anomalous. An ADAPT analysis was conducted using survey data with the 1993 values omitted to determine their impact.

The statistics describing the parameter estimates generally indicated a better fit when the 1993 data were omitted from the analysis.

Regardless of the ADAPT analysis considered, CVs were high on most abundance estimates and the patterns observed in the residuals suggest some uncertainty with the results of the analysis. This could be the result of highly variable survey indices as well as poorly estimated removals at age.

d) **Assessment Results**

Population numbers (age 3+) from ADAPT have been declining for most years since the mid-1980s. Estimates increased slightly after 1991 with the appearance of the relatively strong 1989 and 1990 year-classes. Population (age 3+) biomass estimates have declined steadily since 1987 and in 1994 were the lowest in the time series (Fig. 10). The spawning stock biomass has also declined substantially since the relatively high levels in the mid-1980s and is also the lowest in the time series. Fully recruited fishing mortality (ages 7-10) has declined since 1991, whereas fishing mortality (F) on ages 3-4 has increased. Fs on ages 5-6 during the same period have been variable.

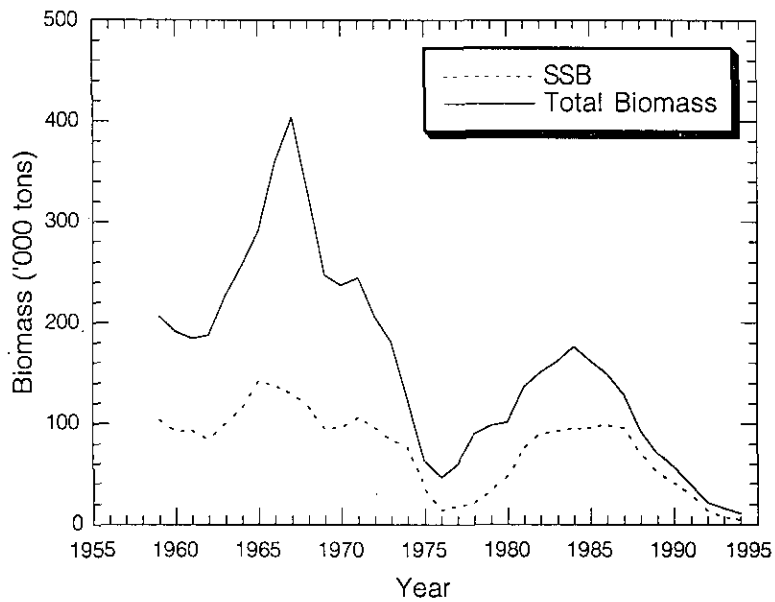


Fig. 10. Cod in Div. 3NO: biomass estimates from ADAPT.

The stock in 1994 was represented mainly by the 1989 and 1990 year-classes. The current estimates for the size of the 1989 year-classes are much lower (17 million) than that estimated during the 1993 (38 million), and 1994 (47 million) assessments. Although it was not as well estimated, the size of the 1990 year-class appears to be much weaker than previously estimated. Survey data suggest that year-classes since 1990 may be weak.

4. **Redfish in Subarea 1** (SCR Doc. 95/3, 4, 23; SCS Doc. 95/6, 12, 14)

a) **Introduction**

Historically, redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. Landings were considered to be almost exclusively golden redfish (*Sebastes marinus* L.) until 1986. It is believed that subsequently the portion of beaked redfish (*Sebastes mentella* Travin) represented

in the catches increased, and since 1991, the majority of redfish catches are considered to be beaked redfish. In 1977, total reported catches peaked at 31 000 tons (Fig. 11). During the period 1978-83, reported catches of redfish varied between 6 000 and 9 000 tons. From 1984 to 1986, catches declined to an average level of 5 000 tons due to a reduction of effort directed to cod by trawlers of the EU-Germany fleet. However, occasionally in this period, a directed fishery on redfish could be observed for this fleet. During the same time, a directed redfish fishery was initiated by Japanese trawlers, but they only partly compensated the reduction in the catches of EU-Germany. With the closure of the offshore fishery in 1987, catches decreased further to 1 200 tons, and remained at that low level in spite of increased effort by trawlers from Greenland and EU-Germany after the reopening of the cod fishery in 1988. Since 1991, fishing effort was directed to shrimp or Greenland halibut only.

Both recent and historical catch figures do not include substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp and cod.

Recent catches ('000 tons) are as follows (includes some but not all discards):

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Catch	4	5	1	1	1	0.4	0.3	0.3[1]	0.8[1]	1[1]

[1] Provisional

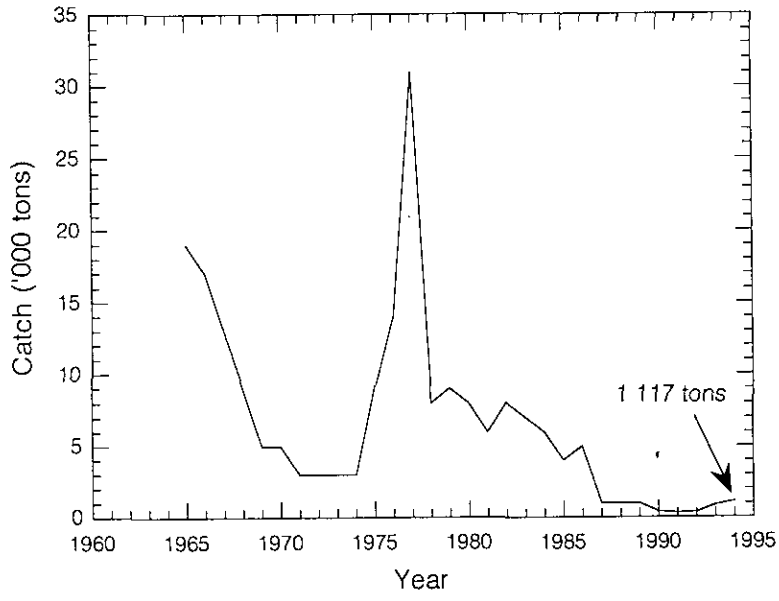


Fig. 11. Redfish in Subarea 1: catches

b) **Input Data**

i) **Commercial fishery data**

Length measurements of catches of golden redfish taken off West Greenland and landed at Cuxhaven or Bremerhaven were presented for the period 1962-78. They revealed significant reductions in mean fish size of about 4 cm, with the biggest reductions occurring in the late-1970s, when mean fish length remained under 40 cm.

ii) **Research survey data**

EU-Germany groundfish survey. Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys commencing in 1982. These surveys covered the areas from the 3-mile line to the 400 m isobath of Div. 1B to 1F and were primarily designed for cod as target species. Therefore, the high variation of the estimates for redfish could be caused as a result of the incomplete survey coverage in terms of depth range and pelagic occurrence. The survey results indicated that golden redfish (≥17 cm) decreased continuously in abundance and biomass by 99% (Fig. 12). Estimates for beaked redfish (≥17 cm) varied without a clear trend but were determined to be extremely low since 1992. Both stocks showed abrupt changes in their size structure from a regular modal length at 30 cm to significantly smaller individuals in 1992 and 1995, respectively. No mature redfish were caught during the survey in 1994. Since 1986, juvenile redfish (<17 cm) were found to be very abundant (Fig. 13).

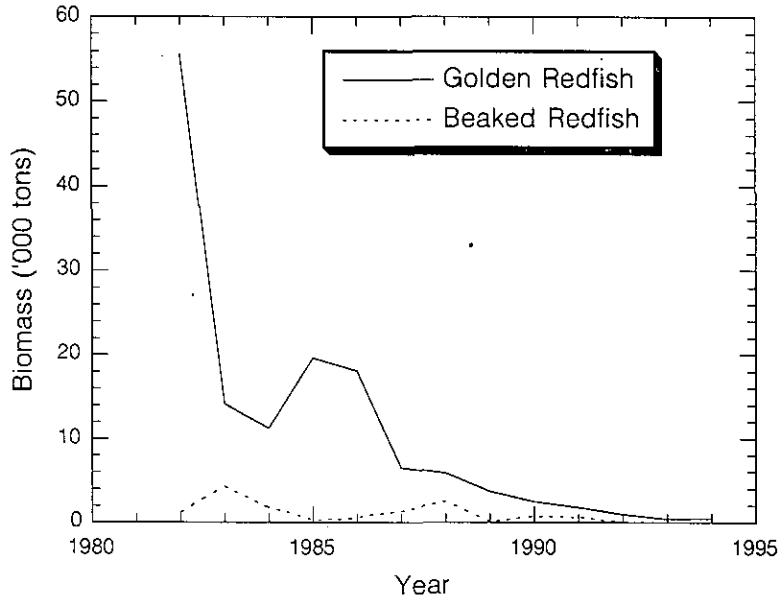


Fig. 12. Redfish in Subarea 1: biomass estimates of redfish ≥17 cm from surveys.

Species and stock identification of these juvenile redfish is still unclear, but reappearing peaks at 6, 10-12 and 15-16 cm might indicate annual growth increments and represent the age groups 0, 1 and 2 years.

Greenland-Japan groundfish survey. Since 1987, cooperative trawl surveys directed to Greenland halibut and roundnose grenadier have been conducted on the continental slope in Div. 1A-1D at depths between 400 m and 1 500 m. In August 1994, one stratified random bottom trawl survey was carried out. As usual, beaked redfish was mainly caught at depths less than 600 m. The biomass index in 1994 decreased to 400 tons, the record low of the time series and one third of the estimate in 1993 (1 200 tons). Length measurements revealed that the size structure of the stock is presently dominated by individuals <20 cm.

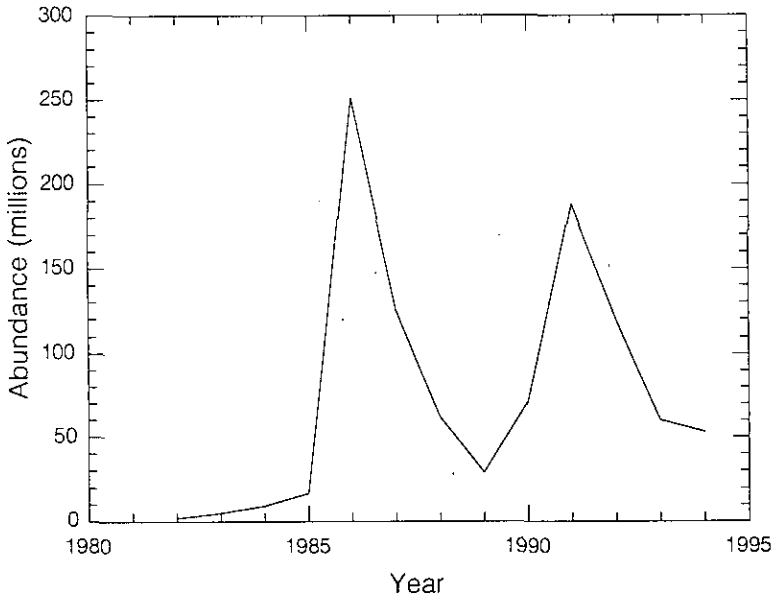


Fig. 13. Redfish in Subarea 1: abundance of juvenile redfish from surveys.

c) **Assessment Results**

In view of dramatic declines in survey abundance and biomass indices of golden and beaked redfish (≥17 cm) to an extremely low level along with significant reduction in fish sizes, STACFIS concluded that both stocks are severely depleted. The origin of the very abundant pre-recruits (<17 cm) as indicated by the surveys and their recruitment potential to the stocks under consideration is unclear.

5. **Redfish in Division 3M** (SCR Doc. 95/26, 48, 51, 71; SCS Doc. 95/4, 12, 13, 15)

a) **Introduction**

There are three species of redfish which are commercially fished on Flemish Cap: deep sea redfish (*Sebastes mentella*), golden redfish (*Sebastes marinus*) and Acadian redfish (*Sebastes fasciatus*). The term beaked redfish is used for *S. mentella* and *S. fasciatus* combined. Because of the difficulties with identification and separation, all three species are reported together under redfish in the commercial fishery.

i) **Description of the fishery**

Directed fishing on redfish in Div. 3M in 1994 was mainly conducted by non-Contracting Parties, Russia and EU-Portugal. This was a change in comparison to 1993 when other Contracting Parties were also engaged in this fishery. This change was reflected in the amount of the total estimated catch of about 11 000 tons in comparison to 29 000 tons in 1993. The reduction in catches was mainly caused by less effort of nearly all participating fleets. Non-Contracting Parties accounted for 60% of the catches.

The Portuguese trawler and gillnet fleets operated from January to October on Flemish Cap with about 40% less effort in the trawl fishery and 10% less effort in the gillnet fishery compared to 1993. Russian trawlers fished from the second half of July until the beginning of October . The Spanish pair-trawl fleet operated mainly in the first half of the year on Flemish Cap whereas the Cuban fleet in 1994 did not fish on Flemish Cap. The Japanese redfish fishery was conducted during winter 93/94 and spring 1994. Except for a few Portuguese gillnetters mostly bottom trawls were used.

The non-Contracting Party fishery was assumed to be directed at redfish.The Russian, Japanese and Baltic States fisheries were also directed at redfish. Because of good cod catches, the Spanish and Portuguese fleets aimed at cod (except a few Portuguese gillnetters) and the redfish catches were mainly taken as by-catch in the cod fishery.

ii) **Catches**

Catches were double the TAC in 1987 and were about three times higher in 1989 (Fig. 14). In the period from 1991 to 1993 catches were at the TAC level, and in 1994 were substantially less than the TAC. Due to uncertainty in the amount of unreported and misreported catches, a range of 9 000 tons to 17 000 tons for realistic catches was likely.

Recent catches ('000 tons) and TACs are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	20	20	20	20	20	50	50	43	30	26	26
Catch	20	29	44	23	58[1]	81[1]	48[1]	43[1,2]	29[1,2]	11[1,2]	

[1] Includes estimates of non-reported catches from various sources
[2] Provisional

There continued to be a substantial amount of non-reported catches accounted for by non-Contracting Parties. Since 1989 these catches have been estimated in the range of 3 000 tons to 10 000 tons.

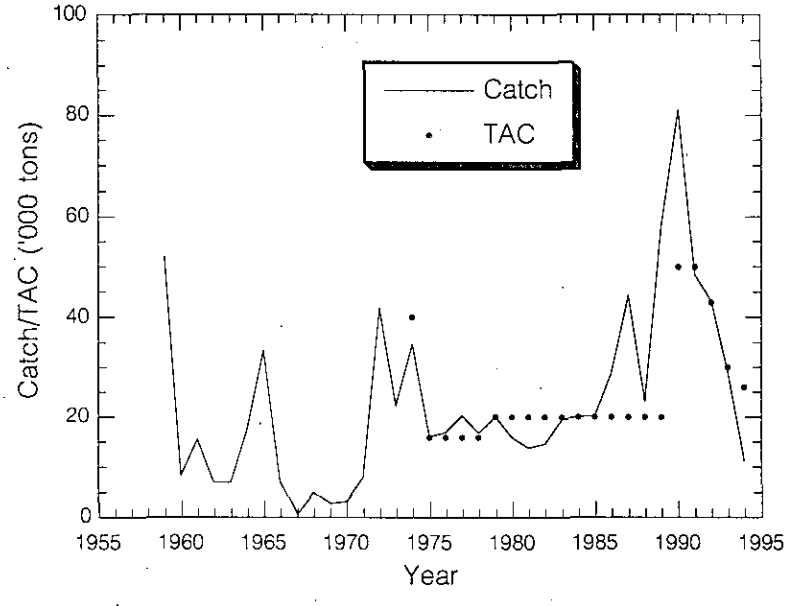


Fig. 14. Redfish in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Sampling data. The amount of catches covered by the samples in 1994 was estimated at about 4 000 tons out of the 11 315 tons estimated total catch.

For *S. mentella* the Portuguese trawl catches showed a mode for males at 26 cm and two modes for females at 22 cm and 27 cm. The respective age compositions implied ages 7 and 8 as dominant.

Gillnet catches of *S. mentella* were dominated, for both males and females, by a relatively large range of lengths between 31 cm and 45 cm, with a mode at 39 cm corresponding to ages older than 11 years for males and females. The information available also suggested that mean length and mean weight in the catch increased from 1993 to 1994 (*mean length by about 1.5 cm*).

Catches of *S. marinus* by the trawl fishery were dominated by fish with a large range of lengths, between 26-37 cm for males and 24-47 cm for females, corresponding to a large range of ages, with 12 year olds dominant for males and 15 year olds for females.

In the Spanish samples of the pair-trawl fishery, two modes at about 17 to 20 cm and at about 35 cm were observed. These were also represented in the Russian sampling data although the second mode was less pronounced. In both cases redfish species were not identified.

CPUE data. Data were examined from the Portuguese directed redfish fishery only. Unfortunately the data for 1994 were based only on a few samples, which was reflected in a large standard error and led to the conclusion that changes in CPUE from 1993 to 1994 may not be significant. However, the trends in the time series of the Portuguese CPUE and the EU bottom trawl survey generally agreed.

Concerns were expressed in using CPUE as an indicator of stock status, especially for redfish. There were only a few fleets operating on Flemish Cap which regularly targeted redfish. Most of the fleets fished redfish as an alternative when cod was less plentiful or cod quotas were restrictive. A greater proportion of redfish catch would be taken as by-catch when cod fishing became more profitable. Also the vertical distribution of redfish varies widely in space and time, and therefore the availability of this species to the bottom trawl and gillnets which are mostly used in the redfish fishery on Flemish Cap is also subject to high variability. Concern was expressed that CPUE data from redfish fisheries on Flemish Cap were not appropriate as an indicator of the state of redfish stocks on a year-to-year basis.

ii) **Research survey data**

There were two survey series which gave information on the state of the redfish stocks on Flemish Cap. A Russian bottom trawl survey was conducted in the period 1983 to 1993. Acoustic estimates were available from the same survey series since 1988. Unfortunately this survey was not continued in 1994. Since 1988 the EU conducted a bottom trawl survey providing estimates of all three redfish species which are combined in the following table ('000 tons):

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
						Russia						
Bottom	155	132	52	310	106	47	83	18	45	18	70	
Bottom+Pelagic						379	366	246	108	100	147	
						EU						
Bottom						158	137	104	64	104	63	126

The increase in total biomass from 1993 to 1994 was mainly due to an increase of *S. marinus* and juvenile redfish (SCR Doc. 95/26). For the first time since 1990 *S. marinus* biomass reached the same level in 1994 as *S. mentella* biomass. Fish of age 8 dominated the golden redfish stock and the beaked redfish biomass was dominated by age group 5.

The sudden increase of the golden redfish biomass, which was not due to juveniles, proved the perception of a highly variable biomass time series caused by variable availability of this species to the survey gear, mainly due to changes in the spatial distribution.

There was also length frequencies available from a Japanese deepwater survey in Div. 3L and 3M which took place for the first time in spring 1995. The observed length frequencies were similar to those of the commercial fishery.

c) **State of the Stocks**

The EU survey estimated the trawlable biomass of the redfish stocks on Flemish Cap at about 126 000 tons (Fig. 15). There was no information on the absolute biomass of the redfish stocks, however, the trawlable biomass estimates of the two survey series indicated an increase of the trawlable biomass since 1992 to a level seen in 1989 and 1990. The contribution of *S. marinus* biomass to the total biomass was higher in 1994 (26%) than in 1989 (17%) and 1990 (14%). There was little information on spawning stock biomass but indications were that good recruitment can be expected. Fishing mortality had probably been reduced, due to the reduction of effort from 1993 to 1994.

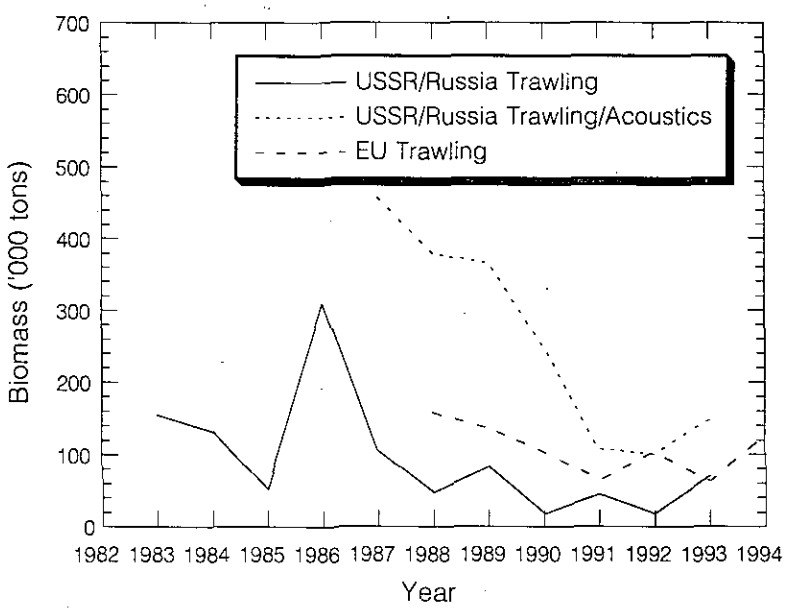


Fig. 15. Redfish in Div. 3M: biomass estimates from surveys.

Redfish as by-catch in the shrimp fisheries. The increased abundance of juvenile redfish on Flemish Cap will cause further by-catch problems in the shrimp fishery, likely with negative impact on future recruitment to the redfish fisheries. For the September 1994 Scientific Council Meeting, provisional data from Canadian observers were available indicating that small redfish accounted for up to 32% of total catch weight in the shrimp fishery in April 1994. However, there were no further data for 1994 available during this meeting. Furthermore, this information is necessary if STACFIS is to evaluate the effectiveness of separator grates currently in use in the shrimp fishery. STACFIS therefore strongly **recommended** that *relevant data on by-catch of small redfish in the shrimp fisheries on Flemish Cap in 1994 and 1995 should be made available prior to the Scientific Council meeting in June 1996.*

6. **Redfish in Divisions 3L and 3N** (SCR Doc. 95/13, 48, 51, 55; SCS Doc. 95/4, 13)

a) **Introduction**

The average reported catch from Div. 3LN from 1959 to 1985 was about 22 000 tons ranging between 10 000 tons and 45 000 tons (Fig. 16). Catches increased rapidly from about 21 000 tons in 1985 to a historical high of 79 000 tons in 1987 and subsequently declined to about 27 000 tons in 1992. The accepted estimates for 1993 and 1994 catches were about 23 000 tons and 7 000 tons, respectively. These amounts could not be estimated precisely because of discrepancies in the available sources of information, however, depending on how the information was combined, estimates ranged from 20 000 tons to 26 000 tons for 1993 and between 3 700 tons and 7 500 tons for 1994.

In the early-1980s the former USSR, Cuba and Canada were the primary fleets directing for redfish in what was essentially a trawler fishery. The expansion of the fishery in 1986 was due primarily to the entry of EU-Portugal, taking about 21 000 tons. In 1987 various countries who were not Contracting Parties of NAFO, most notably South Korea, Panama and Caymen Islands began to fish in the Regulatory Area accounting for a catch of about 24 000 tons. Since then these countries have taken between 1 000 tons and 13 000 tons annually.

During the 1980s most of the Div. 3LN catch was taken in the vicinity of the Div. 3N and Div. 3O border in addition to the slopes of the Grand Bank in Div. 3L. Since the 1990s a considerable amount of activity has occurred in the 'Beothuk Knoll' area which is southwest of the Flemish Cap at the Div. 3M, Div. 3L and Div. 3N border. However, in 1993 and 1994, fishing activity increased in the southwest portion of Div. 3N. In 1994 fleets from the Baltic countries returned home early in the year because of a relatively poor fishery in the area of the Beothuk Knoll.

From 1980 to 1990 the TAC each year for this stock had been 25 000 tons. The TAC was reduced to 14 000 tons for 1991 and has been at that level to 1995. Even at the higher catch estimate of 7 500 tons, 1994 was the first year since 1985 that the TAC was not exceeded. In some years from 1986 to 1993 catches have been double (1988, 53 000 tons) and even triple (1987, 79 000 tons) the agreed TAC.

Recent nominal catches and TACs ('000 tons) are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	25	25	25	25	25	25	14	14	14	14	14
Catch	21	43	79[1]	53[1]	34[1]	29[1]	26[1]	27[1,2]	23[1,2,3]	7[1,2,3]	

[1] Includes catch estimated by STACFIS.
[2] Provisional.
[3] STACFIS could not precisely estimate the catch (see text for explanation).

b) **Input Data**

i) **Commercial fishery data**

A catch-rate database with effort measured in hours fished and another with effort measured in days fished were standardized for each Division separately using a multiplicative model. In previous assessments the data available from NAFO Statistical Bulletins were supplemented with Portuguese observed data because of possible confounding with directed effort of other target species. The current analyses examined the NAFO data and the observed data separately.

As in the past indices using the NAFO data were not considered reflective of year to year changes in population abundance (see NAFO Sci. Coun. Rep, 1989, p. 70), although they may be indicative of trends over longer periods of time. There were indications of decline beginning from the early- to mid-1980s in all derived indices for Div. 3L and Div. 3N. The large increase in 1992 in both Div. 3L series was difficult to reconcile with other indices of abundance for Div. 3L.

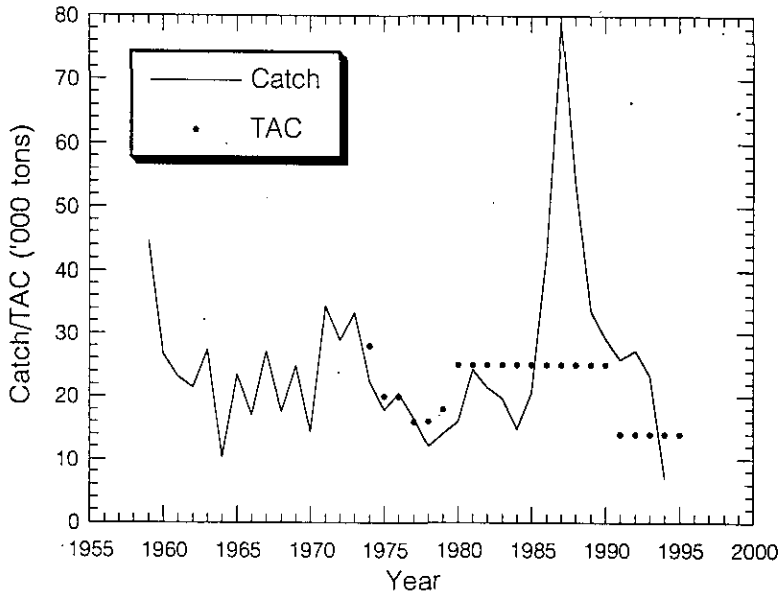


Fig. 16. Redfish in Div. 3LN: catches and TACs.

A standardized CPUE series based on Portuguese observed data (SCS Doc. 95/13) suggested stability in Div. 3L from 1988 to 1993 while directed effort to redfish gradually declined over the same period. There was no directed fishery in 1994. An analysis of Portuguese CPUE observed data for Div. 3NO combined indicated an increasing trend from 1991 to 1994. STACFIS was uncertain whether these indices were reflective of the trends in the population or simply reflect the experience of the Portuguese fleet. Nonetheless, the Committee considered it more appropriate if the Div. 3NO data could be disaggregated and, accordingly, **recommended** that *future analyses of Portuguese observed catch-rate data for redfish be presented separately by Division.*

Limited sampling from the 1994 Portuguese fishery in Div. 3L (SCS Doc. 95/13) suggested males 24 cm-30 cm and females 24 cm-38 cm dominated the catch based on samples obtained in May. The mean lengths of the samples were 30.0 cm for males and 31.4 cm for females. Sampling of the 1994 Div. 3N Portuguese fishery from March to June suggested males 22 cm-29 cm and females 22 cm-35 cm dominated the catch. The mean lengths of these samples were 27.0 cm for males and 29.7 cm for females.

Sampling from a 1994 exploratory Russian fishery in Div. 3L in June-July (SCS Doc. 95/4) suggested males 24 cm-29 cm and females 24 cm-31 cm comprised the bulk of the catch. The mean lengths of these samples were 26.1 cm for males and 26.8 cm for females.

ii) **Research survey data**

Results of bottom trawl surveys for redfish demonstrated a considerable amount of variability. This was realized both between consecutive seasons and years, and amongst tow by tow catches within a single survey. Although it was sometimes difficult to interpret year to year changes in the estimates, in general, the data from Canadian surveys in Div. 3L suggest that trawlable biomass since 1992 was at its lowest level (an average 5 000 tons) relative to the time period from 1978 to 1986 (an average 103 000 tons).

Canadian surveys have also been conducted in spring and autumn in Div 3N from 1991-1995. Mean number and weight per standard tow in Div. 3N were generally higher than in Div 3L, but it was also evident that there was greater fluctuation of, and larger variability around the mean densities than in Div. 3L. The source of this variability was unclear but was likely due to seasonal changes in catchability or distribution rather than real changes in population abundance. The interpretation of these data in terms of year to year trends

was difficult. Nevertheless, the average trawlable biomass over the 1991-94 period was about 16 000 tons. A preliminary estimate from the spring 1995 survey was about 1 300 tons.

The possibility of a relationship between redfish in Div. 3O and Div. 3LN was revisited. It was reported that Canadian spring and autumn surveys also covered Div. 3O but that the pattern of results may not account for the fluctuations observed in Div. 3N. STACFIS concluded that a further look into these and other survey data for redfish in Div. 3LN and 3O is warranted and accordingly **recommended** that *(1) data in Div. 3LN and 3O be analyzed further to determine if a relationship exists between Div. 3O and Div. 3LN that may help in the interpretation of the indices of abundance; and (2) data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O as management units for redfish.*

Russian stratified-random bottom trawl surveys in Div. 3L indicated that there has been a decline in relative abundance and biomass from 1984 to 1990. There was an increase in the 1991 estimates. The survey was not conducted in 1992. The 1993 and 1994 estimates were both at the level of the 1989-90 estimates which are the lowest in the time series. The trawlable biomass estimate for Div. 3L derived from the 1994 survey was about 4 000 tons.

In Div. 3N, although there were some rather dynamic changes that have occurred over the period 1984-93, Russian surveys also indicated a general decline from 1984 to 1991. This was evident in both the mean number and weight per standard tow. The 1993 survey suggested a rather large increase relative to 1991 but this was highly influenced by the catch in one stratum which accounted for 70% of the biomass but only represents about 9% of the area surveyed. There was no survey conducted in 1994 in Div. 3N.

Canada has conducted deepwater surveys in Div. 3L in the summer of 1991 and winters of 1994 and 1995 (SCR Doc. 95/51). Very few redfish were caught in depths greater than 750 m. Trawlable biomass estimates from the three surveys ranged from 600 tons in 1991 to 1 500 tons in 1995. There was partial coverage of Div. 3N for those strata greater than 550 m in close proximity to Div. 3L with highest trawlable biomass occurring in the 1994 survey at 205 tons.

A deepwater survey was conducted by Japan from March-April 1995 in Div. 3L in the depth range 732 m-1 280 m which utilized a trawl with an unlined 140 mm mesh codend (SCR Doc. 95/48). The trawlable biomass estimated was less than 150 tons which again indicates low occurrence of redfish beyond 750 m, however, it was noted that station selection was not random.

iii) **Recruitment**

Length and age distributions from Canadian surveys in Div. 3L indicated there has been relatively poor recruitment since the early-1980s. The 1994 spring and autumn survey catches were dominated by 25 cm-31 cm fish corresponding to the year-classes that were born in the early-1980s. Length frequencies and age distributions from the Div. 3N Canadian surveys from 1991-93 showed different distributions compared with Div. 3L for each corresponding seasonal survey, consistently being composed of size groups that were much smaller. There was a relatively good pulse of recruitment picked up in the 1991 autumn survey in the range of 12-14 cm (1986-87 year-classes) that could be tracked through to the 1994 survey at about 19 cm. Given the variability in the survey estimates the magnitude of this recruitment could not be determined. However, there was no sign of any year-classes subsequent to this from the surveys.

Length distributions in terms of percent at length from the 1994 Russian survey of Div. 3L (SCR Doc. 95/13) indicated the bulk of the research catch occurred from 24 cm-29 cm. There was a mode which occurred at 19 cm similar to that of the 1994 Canadian autumn survey but it was relatively less abundant compared to the Canadian survey in Div. 3L. The historical series of these length distributions from the Russian surveys extending back to 1989 suggest that fish greater than 32 cm were much less represented in the size distribution since 1991.

c) **Assessment Results**

It was not possible to provide an estimate of the absolute size of the stock in Div. 3LN. The results from Canadian spring and autumn surveys suggested trawlable biomass has been low in Div. 3L since 1991 relative to the late-1970s to mid-1980s. The situation in Div. 3N based on the Canadian surveys was unclear because of large seasonal fluctuations, however, trawlable biomass has averaged 16 000 tons since 1991 which was about three times the average trawlable biomass estimate based on Canadian Div. 3L surveys since 1992 (5 000 tons). Russian bottom trawl surveys also indicated that relative abundance in 1993 and 1994 was at historically low values in Div. 3L.

The catch rate indices derived for Div. 3L and Div. 3N showed much variability. Although some of the changes in mean catch rate between some years were too dramatic to be solely the result of changes in population abundance, there were indications of decline from the mid-1980s to 1990 in all the derived indices. This corresponded to a period when some of the largest catches historically were taken and probably generated high fishing mortalities.

In summary, the resource in Div. 3L appears to be very low with no sign of good recruitment. The Div. 3N portion contains a recruiting component of unknown abundance that may already be recruiting to some fleet sectors. Despite this there is no sign in the research surveys of any good year classes to follow.

d) **Future Studies**

The Committee was informed that within Canada there has been a working group formed to address questions related to stock structure and migration which will likely include Div. 3LNO. STACFIS welcomed this, noting that the information available at this meeting was inadequate to address a previous outstanding recommendation regarding the integrity of Div. 3LN as a separate management unit from Div. 3O (see NAFO Sci. Coun. Rep, 1994, p. 78). STACFIS considers this issue important and necessary to resolve (see **recommendation** in Section b.ii above).

7. **Silver Hake in Divisions 4V, 4W and 4X** (SCR Doc. 95/44, 53, 76, 80; SCS Doc. 95/4, 8)

a) **Introduction**

The fishery was conducted primarily by large Cuban and Russian Federation otter trawlers using small-meshed bottom trawls. Before 1977 the fishery was not restricted by season or area, however, since 1977 the fishery has been restricted to April 1 through November 15 and to the area seaward of the small mesh gear line (SMGL). Since 1990, allocations have been made to Canadian companies which have entered into developmental arrangements with Cuban and Russian fishing companies to harvest silver hake. Despite these realignments, the resultant composition of the fleet actively fishing silver hake has not changed. Nominal catches since 1970 ranged from a maximum of 300 000 tons in 1973 to a minimum of 8 000 tons in 1994. Catches generally increased from 1977 to 1989, with the exception of 1983, from 37 000 tons in 1977 to 91 000 tons in 1989. Since 1989, catches have shown a continual decline and are now the lowest in the time series. Since 1977 catches for this stock have been below the TAC through allocations being made to parties which did not participate in the fishery, and allocations which were made late in the season when commercially viable catch rates could not be achieved. These tendencies continued in 1994, and resulted in only 8 000 tons being harvested from a TAC of 30 000 tons.

Recent catches and TACs ('000 tons) are as follows (Fig. 17):

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	100	100	100	120	135	135	100	105	86[1]	30	60
Catch	75	83	62	74	91	69	68	32[2]	29[2]	8[2]	

[1] Projected catch at $F_{0.1}$ was 75 000 tons; 11 000 additional tons were allocated by Canada in the knowledge that not all allocations would be fully harvested.

[2] Provisional.

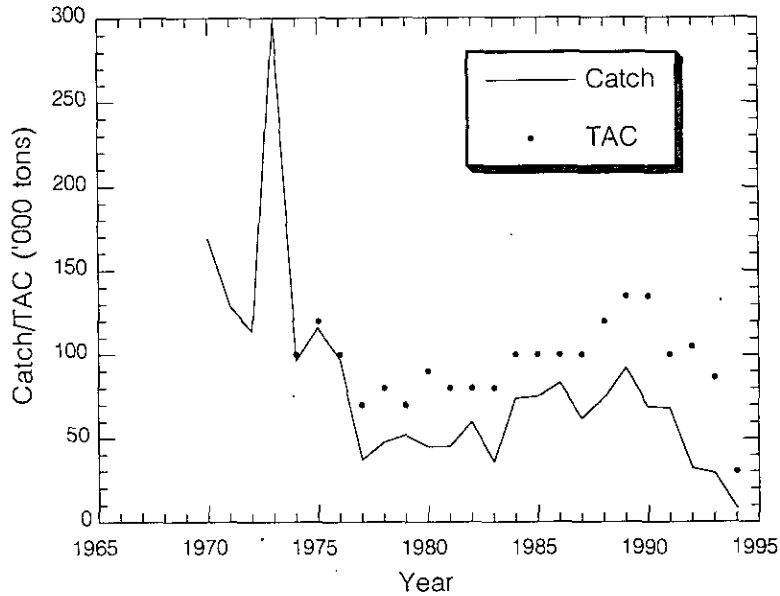


Fig. 17. Silver hake in Div. 4VWX: catches and TACs.

The 1994 fishery commenced in the last week of April, and finished in mid-July. In 1994 Canada implemented regulatory changes to minimize cod, haddock and pollock by-catches in this fishery - the position of the SMGL was moved to restrict fishing to water deeper than 190 m, and use of a separator grate in codends was made mandatory. These measures were effective in reducing by-catches while not affecting silver hake catch rates significantly. Observed catch rates were generally poor compared to levels seen between 1985-89, at approximately the same levels seen in 1992 and 1993.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. Catch and effort data from the commercial fishery were analyzed using a multiplicative model to derive a standardized catch rate series from 1977-94. As was the case in the past assessment, country, Division, month, and year were considered as factors. To quantify the effects of the modifications to the 1994 fishing regulations, position relative to the new line and presence/absence of a separator grate were added to the model. Country, Division, month, and year had a significant effect in the model, while fishing location and presence of a separator grate did not. STACFIS expressed concern that for silver hake in Div. 4VWX the interaction effects between month and year in the silver hake CPUE model may be influencing the results, and **recommended** that *these effects be investigated in future.* The standardized catch-rate for this stock has dropped in recent years (Fig. 18), from a peak of 5 tons/hr in 1989 to 1.7 tons/hr in 1992, 1993 and 1994. The most recent catch rates are similar to those experienced in the late-1970s and early-1980s.

Catch-at-age and weight-at-age data. The commercial removals-at-age for 1994 were calculated from Canadian length samples from the commercial fishery and an age-length key constructed from Canadian ageing data. For 1991 to 1993 a combined Canada/Russia age-length key was used in calculating removals-at-age, but it was not possible to continue this approach, as no commercial samples were collected by Russia from the 1994 silver hake fishery. Length/weight data from Canadian July research vessel surveys were used in the calculation of weights-at-age. Removals-at-age and weights-at-age for 1994 were calculated using monthly age length keys to reduce possible mis-assignment by age. The

estimates for 1992 and 1993 were re-calculated in the same fashion, while values for 1977-91 were taken from the previous assessment. Commercial mean weight-at-age has shown a sharp decline since 1992.

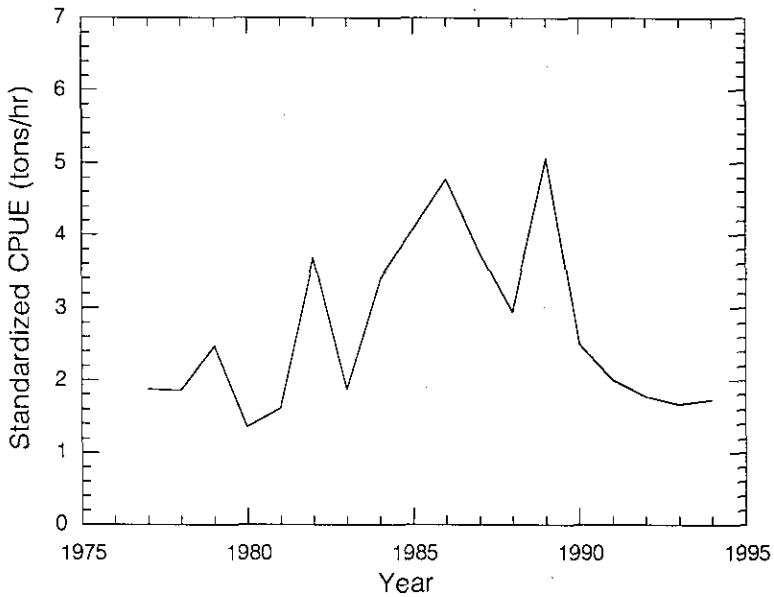


Fig. 18. Silver hake in Div. 4VWX: standardized catch rates.

ii) **Research survey data**

The survey results indicated a continual decline in total numbers and biomass over the period 1986-92 (Fig. 19). Both measures increased in 1993, but the 1994 survey indicated both numbers and biomass had declined slightly.

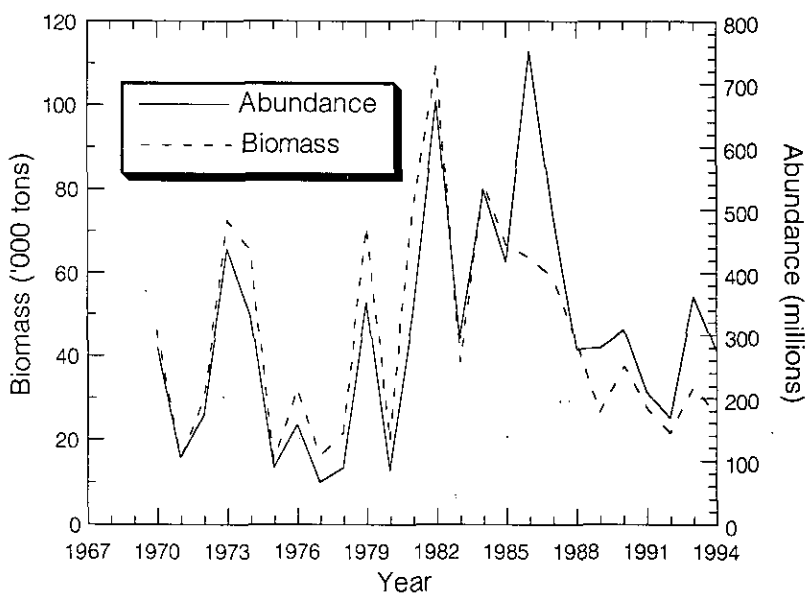


Fig. 19. Silver hake in Div. 4VWX: survey biomass and abundance.

The July survey in 1993 indicated the 1992 year-class at age 1 was above average. However, in 1994 this cohort appeared below average at age 2. The 1990 and 1991 year-classes were of average strength in size at age 3 and 4, respectively. The 1994 0-group survey showed the 1994 year-class to be below average.

iii) **Biological studies**

In the last review of stock status for silver hake in Div. 4VWX, it was noted that mean weight-at-age and length had shown a decreasing trend in recent years (SCR Doc. 94/32). Preliminary investigations of possible causes for decline concluded that the low length-weight parameters derived from the 1993 Canadian summer survey were the source. However, this was assessed to be an artifact and average mean weights for the 1989-93 commercial fishery were used for catch projection.

STACFIS reviewed an analysis which examined size-at-age and weight-at-length for the 1983-94 time period. Timing of the Canadian summer survey, progression of length and age modes, maturity composition and distribution of the population were evaluated. Recent changes in Canadian age determination responsibility and training have been fully documented (SCR Doc. 94/34) with only a small bias between readers. Nevertheless, age determination was considered to be a potential source of bias and was included in the analysis. The Canadian summer survey was used as the primary source of data. The population length frequency and derived age components for 1983-94 appeared to follow a logical progression with high abundance at length and age in one year reflected in the following year. There were not many indications of incorrect assignment to age as would be indicated by substantial overlap or discontinuity in distributions. The modal lengths have shown a substantial decrease in recent years and in particular those at age one in 1993 and 1994 are the smallest observed. Mean weight-at-length results indicated a relatively small variation in weight for most of the length range, although there was evidence of some strong year effects. Electronic balances were used for fish weights after 1989 and these balances provide a more precise measure of weight and also permit weighing of fish less than 50 gm. The mean date of the research surveys did not appear to have any trend in timing. The proportion by maturity stage was variable over the time series with some indication of an increasing trend in the proportion of post-spawning fishes since 1991. This would imply that more fish had completed spawning prior to the survey in the recent part of the time series and that the contribution of the gonad to total weight had therefore decreased. Information on the distribution of abundance within the Div. 4WX area showed some annual variation in the relative contribution of Div. 4W, 4X and the Bay of Fundy.

Results of the study confirmed that a decrease in both size-at-age and weight-at-age of silver hake in the Scotian Shelf area have occurred in recent years. Age determination was not the source of this decrease. The change in size-at-age was consistent with the shift to smaller modal lengths in the length frequency and age data matched the length modes with good correlation. The decrease in mean length appears to have been gradual without abrupt changes, as might be expected if an ageing bias or error had been introduced. Changes in the timing of spawning in relation to the summer research survey appeared to be a factor which could result in a reduction in total weight-at-length.

Results of silver hake age training and comparison for Canadian age readers were reviewed. Based on a sample size of about 350 otoliths, between reader agreement was 71% with a marginally significant bias. These results were similar to those reported in 1994. Age length keys derived from the two sets of age determinations were used to estimate catch-at-age for the June 1994 commercial catch length frequency. The two independent catch-at-age results were similar, although the bias noted above produced somewhat different estimates for ages 3 and 4.

c) **Estimation of Parameters**

Sequential population analysis

Previous assessments of this resource have exhibited strong retrospective patterns, where F was consistently underestimated by 40-60%. Several approaches were undertaken to investigate this

pattern. High negative residuals were noted for the 1977 and 1978 July research vessel and CPUE indices, so these years were removed from the analysis. Population analysis was then conducted using three techniques - an ADAPT framework version from 1988, a Laurec-Shepherd analysis, and a version of the ADAPT framework which calculates and adjusts for bias associated with the analysis. Commercial catch-at-age (ages 1-9, 1979-94), age disaggregated standardized CPUE (ages 1-9, 1979-94), Canadian July survey catch-at-age (ages 1-9, 1979-94) and a juvenile index (0-group, 1981-94 except 1992) were used for tuning in each analysis. A dome-shaped partial recruitment pattern was used in the analysis, and M was set at 0.4.

The analysis using the bias correcting ADAPT framework appeared to reduce the retrospective effect substantially, while the non-adjusted methods showed strong retrospective patterns. Based on this comparison, the bias-adjusted method was used for the SPA. In 1994 the estimated average F over ages 3-5 was low, at 0.1.

d) **Assessment Results**

The 1994 year-class will make a significant contribution to the catch in 1996 at age 2. Size of this year-class was calculated from a linear relationship between the 0-group survey and SPA numbers at age 1, where SPA=a + b(0-Grp); r^2=0.57. Based on this relationship, the 1994 year-class was estimated at 789 million fish. The size of the 1993 year-class at age 1 was poorly estimated in the SPA, as the estimate was based on a single occurrence in the catch matrix. While it was decided to accept the estimates of the 1992 and earlier year-classes as given by the SPA, the strengths of the 1993 year-class was inferred from July survey data. Year-class estimates from the research vessel survey were regressed against estimates from the SPA for the 1982-92 year-classes at age 1, using the model SPA = a + b(ln RV); r^2 = 0.69. Prediction from this relationship for the strength of the 1992 year-class was 790 million fish. For projection, an $F_{0.1}$ value of 0.70 was used, based on the yield-per-recruit analysis conducted during the previous assessment. STACFIS expressed concern over the marked decline in mean commercial weight-at-age since 1992. These declines appear to be a biological phenomenon rather than due to sampling or ageing biases. It is not clear whether the declining trend in mean weights-at-age will continue in 1995 and 1996. The year-classes which are presently observed to be small at age are expected to remain small at age throughout their lifespan. Therefore, mean weights-at-age for projection were taken as the average of only the three most recent years (1992-94). The partial recruitment pattern was taken as the average of the period 1990-94. Weights-at-age and partial recruitment were:

Age	Avg weight (kg)	PR
1	0.063	0.02
2	0.117	0.30
3	0.157	0.89
4	0.190	1.00
5	0.227	0.85
6	0.277	0.85
7	0.377	0.63
8	0.383	0.51
9	0.789	0.09

e) **Future Studies**

STACFIS continues to support cooperative studies on silver hake. These include continuation of the joint Canada-Russia juvenile survey, which is noted as a critical element in the prediction of incoming year-class size for this stock.

8. **American Plaice in Divisions 3L, 3N and 3O** (SCR Doc. 95/48, 51, 55, 58, 59, 62; SCS Doc. 95/13, 15)

a) **Introduction**

No directed fishery was allowed in 1994, although there was a TAC of 4 800 tons. The best estimate of catch in 1994 is 7 378 tons (Fig. 20), although some estimates were as low as 3 000 tons. This catch was mainly taken in the Regulatory Area. Canadian catch in 1994 was 71 tons.

Recent nominal catches and TACs ('000 tons) are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	49	55	48	40[1]	30.3	24.9	25.8	25.8	10.5	4.8[2]	0
Catch	54[3,4]	65[3,4]	55[3]	41[3,4]	44[3,4]	32[3,4]	34[4]	13[4,5]	17[5,6]	7[5]	

[1] Although the TAC was set at 40 000 tons, Canada reduced its domestic quota to 33 000 tons, therefore the effective TAC was 33 585 tons.
[2] No directed fisheries allowed.
[3] Includes a percentage of the "flounder non-specified" catch reported to NAFO by South Korea.
[4] Includes estimates of misreported catches.
[5] Provisional.
[6] Catch may be as high as 19 400 tons.

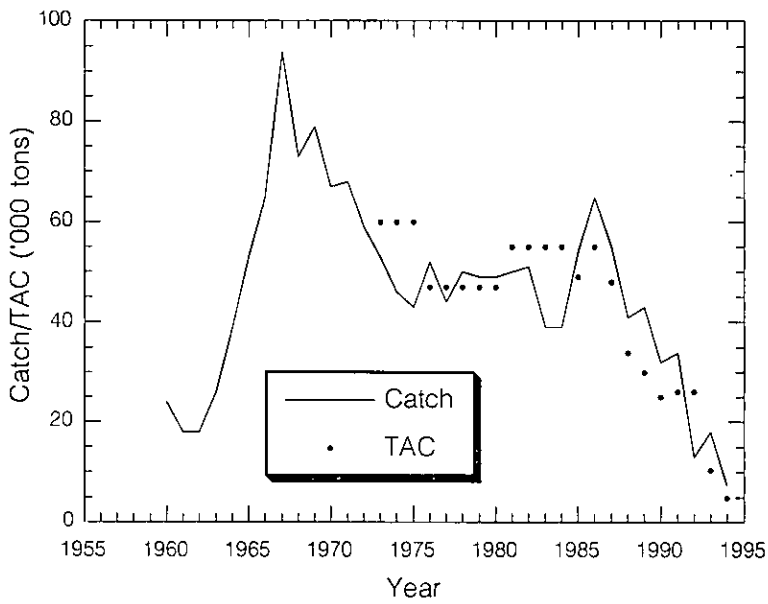


Fig. 20. American plaice in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Catch and effort. Limited data from the Portuguese otter trawl catches showed that CPUE in Div. 3NO was relatively stable from 1990 to 1994. Spanish catches were mainly taken as by-catch in the deep water fishery. There were no catch/effort data from the Canadian fishery in 1994.

Catch-at-age. Sampling was available from the Spanish and Portuguese fisheries in 1994. The main length range taken in the Spanish catch was 25 - 45 cm. This was similar to the Portuguese catch, where the peak in ages for both males and females in all Divisions was ages 8 and 9. The 1985 year-class (age 9) is the same cohort which dominated catches in the Regulatory Area from 1989 to 1993. There were no Canadian catch-at-age data for 1994.

ii) **Research survey data**

Canadian stratified-random groundfish surveys. Data from spring surveys in Div. 3L, 3N and 3O were available, with some exceptions, from 1971 to 1995, although only

preliminary estimates of biomass for Div. 3NO were available from the 1995 survey. Surveys prior to 1991 generally had a maximum depth of 366 m. From 1991 to 1995, the depth range has been extended to at least 731 m in each survey.

In Div. 3L, the trawlable biomass index was highest from 1978-82, declined to a lower but stable level from 1985 to 1988, then declined by 35% or more in each year from 1989 to 1994, and is currently at a level (5 100 tons) which is only about 3% of the 1985-88 mean value. In Div. 3N, the trawlable biomass index also showed a decline in recent years, with 1994 and 1995 (4 100 tons) being the lowest points by far in the series, about 55% lower than the 1993 value. In Div. 3O, the biomass index has shown a consistent decline since 1990, with the 1994 and 1995 (9 600 tons) values being the lowest in the series, down 30% from the previous low in 1993.

In all areas, the trawlable abundance was generally highest in the late-1970s and early-1980s (Fig. 21) as the strong year-classes of the early-1970s dominated survey catches. The total abundance index for 1994 was the lowest estimate in the series having declined by 80% from the value of 1990. In Div. 3L the decline was worse, with abundance in 1994 being only 3% of the peak abundance in the 1977-80 period. In the late-1970s, fish aged 9 years and older, which was an approximate measure of spawning stock numbers, made up 35 to 45% of the abundance index. By 1993, the last year for which ageing data were available, fish in these age groups made up only 20% of the index, and the estimates of abundance at these ages had declined by about 95% during the period.

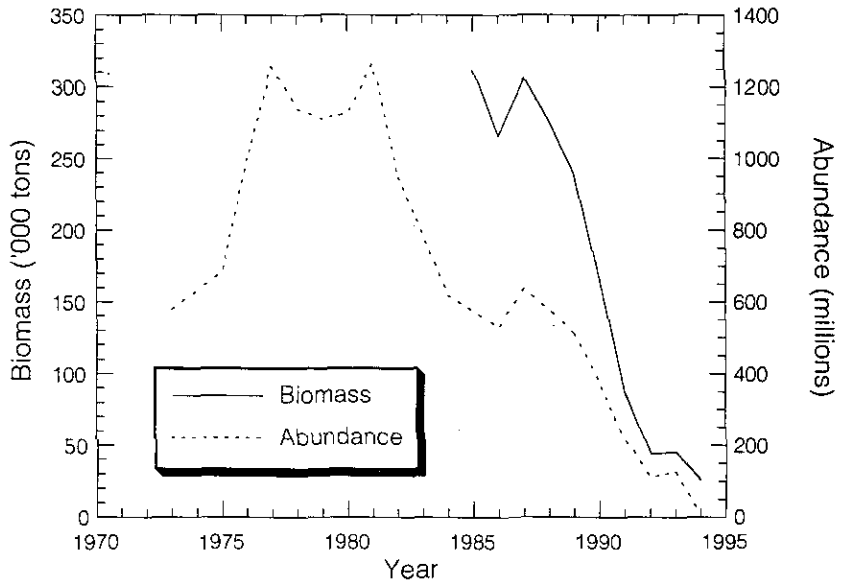


Fig. 21. American plaice in Div. 3LNO: biomass and abundance from spring surveys.

The distribution of fish in the spring survey had changed with 27% of the biomass in Div. 3L being found in strata from 366-731 m in 1994, as compared to 5% in 1991. Also, the proportion of the stock north of 45°N had decreased substantially in recent years. An index of concentration (area of distribution), presented to STACFIS for the first time, showed some indication of a decrease in the area of distribution of American plaice in Div. 3L and 3N but no clear pattern in Div. 3O. However, there was some question of how the index was calculated and further investigation was required.

From Canadian autumn surveys in Div. 3L, (maximum depth of 731 m since 1990) population estimates have shown a sharp downward trend since 1984 to a level in 1994 (6 500 tons) which is less than 3% of the estimates in the early-1980s. Similar to the spring

surveys, the 1993 abundance estimates at every age older than 4 years were the lowest in the series.

From 1990 to 1994, autumn surveys were also carried out in Div. 3NO (maximum depth of 731 m since 1993). The 1994 biomass estimates in both Divisions are the lowest in the time series (Div. 3N - 23 200 tons, Div. 3O - 16 600 tons). The estimates of total abundance from the autumn surveys in Div. 3L have declined by 30% or more in each of the last 4 years, while there has been no trend in either Div. 3N and 3O. For Div. 3LNO in total, the autumn surveys indicate a decline in abundance of 75% from 1990 to 1994 (Fig. 22), compared to a decrease of 80% during this period in the spring surveys (Fig. 21).

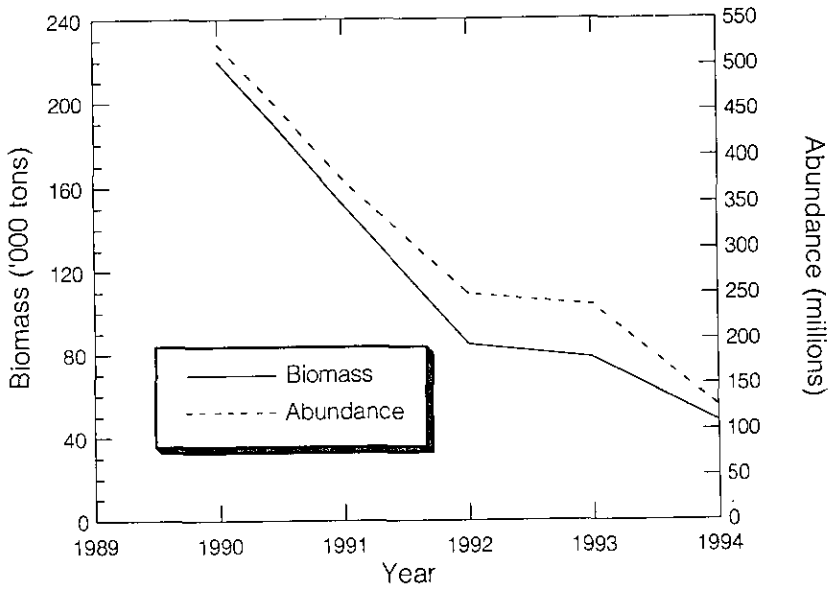


Fig. 22. American plaice in Div. 3LNO: biomass and abundance from autumn surveys.

Canadian juvenile groundfish surveys. Stratified-random surveys of Div. 3LNO were conducted inside the 91 m depth contour from 1985 to 1988, were extended to 183 m in the 1989 to 1991 surveys and further to 273 m in the 1992 to 1994 surveys. In 1994, large catches of juveniles were taken in the Regulatory Area in Div. 3NO, consistent with previous surveys. Two other sites were identified as areas of major aggregations of juveniles: the Whale Deep area in Div. 3O, and the north and northeast slope of Div. 3L. American plaice were generally found in deeper and colder water in Div. 3L than in Div. 3NO. In both Div. 3L and 3N, the total abundance and biomass increased slightly in 1994 compared to 1993, but were relatively stable over the last few years. In Div. 3O, total abundance declined somewhat in 1994, but both abundance and biomass in Div. 3O have been fairly stable since 1989. Age composition data were available for the time series to 1993, with no ageing being available from the 1994 survey. Overall, the abundance of older fish had declined over the time series with the decline being most severe in Div. 3L. The abundance of juveniles has been more stable over the time series. The 1988 and 1989 year-classes showed some promise in the 1993 survey, but the 1991 and 1992 year-classes were the lowest in the time series at their respective ages.

STACFIS noted that the abundance and biomass estimates from the juvenile surveys (Fig. 23) were much higher in all years than those in the comparable spring and autumn groundfish surveys. This was due mainly to the higher efficiency of the trawl used in the juvenile surveys, and most of the biomass and abundance estimated from the juvenile surveys was comprised of young fish.

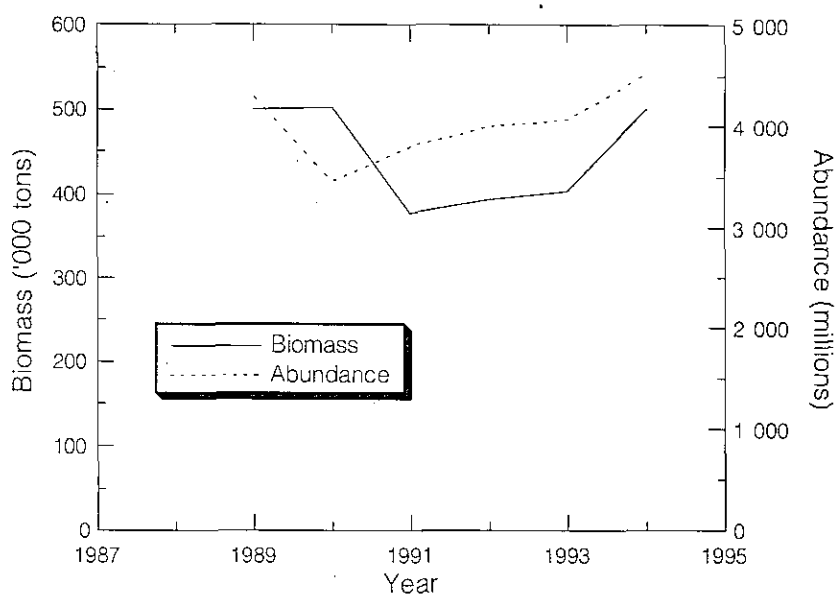


Fig. 23. American plaice in Div. 3LNO: biomass and abundance from juvenile surveys.

USSR/Russian surveys. Results from USSR/Russian surveys in Div. 3LNO were available for 1972-91, but no comparable survey was done in 1992 and the 1993, and 1994 results were not available at this meeting. STACFIS recognized the importance of the Russian spring survey data in providing an index of abundance for American plaice in Div. 3LNO and **recommended** that *the estimates from the 1993 and 1994 surveys be made available in June 1996 if possible.*

EU survey. Preliminary results from a survey conducted in 1995 by EU-Spain in the Regulatory Area in Div. 3NO to a maximum depth of 731 m were available. This survey produced a biomass estimate of 54 000 tons. Since the relationship between the catchability of the trawl used in this survey and those used in the Canadian surveys was unknown, this point estimate can not be put in the context of the Canadian series. In this survey, half the biomass was estimated to be in a known nursery area for American plaice. The peak catch was from 22 to 34 cm for both sexes and much of the biomass was composed of small fish.

Japanese survey. Results of a deep water survey conducted in 1995 by Japan were also available. This survey covered depths of 730 to 1 280 m in Div. 3L. Some American plaice were caught as deep as 1 200 m. The biomass estimate for the area covered was 900 tons.

Canadian deep water surveys. There have been deep water surveys conducted by Canada in summer 1991 (depth range 750 to 1 500 m), and winter 1994 (depth range 550 to 1 500 m) and 1995 (depth range 500 to 1 500 m). In 1991, no American plaice were found in the area surveyed. In 1994 and 1995 the biomass estimates in Div. 3L were 4 879 tons and 8 406 tons, respectively. A small portion of Div. 3N was surveyed in 1994 and 1995, giving biomass estimates of 1 575 and 1 714 tons. Fish collected on the western side of the Flemish Pass in Div. 3L appeared to originate from Div. 3L based on mean lengths-at-age, which were different from the mean lengths-at-age of American plaice caught on the eastern side of the Flemish Pass in Div. 3M.

iii) **Biological studies**

Age at 50% maturity (A_{50}) for females in Div. 3LNO was estimated for each year from 1960 to 1993. The A_{50} has declined substantially over this period from an average of around 11 years in the early-1960s to a current estimate of about 8.5 years. The annual estimates of A_{50} were significantly correlated with the estimated 6+ abundance from the VPAs done in 1985 and 1993.

An index of female spawning stock biomass was calculated from the Canadian spring groundfish surveys from 1975 to 1993. This index was relatively stable until the late-1980s when it began a precipitous decline (Fig. 24). The current estimate of 11 000 tons is 90% less than the estimates of the mid-1980s.

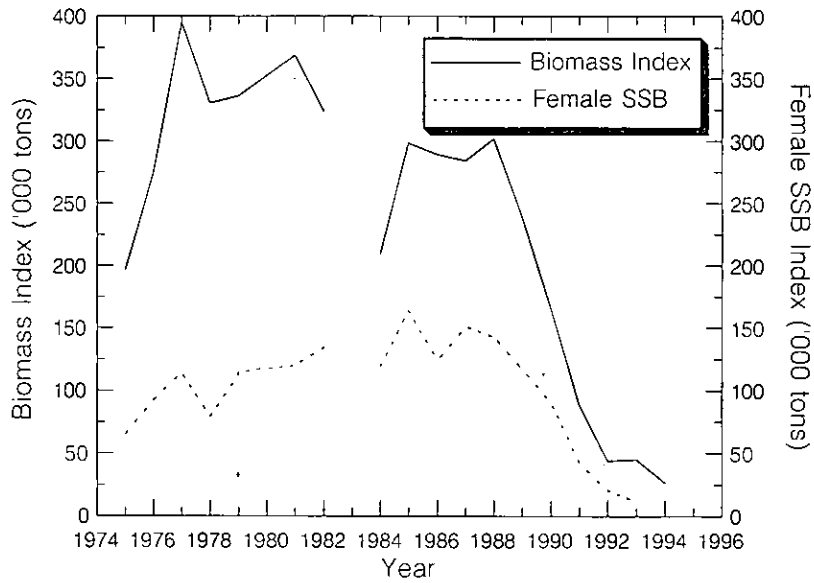


Fig. 24. American plaice in Div. 3LNO: estimates of biomass and SSB from Canadian spring surveys.

c) **Assessment Results**

STACFIS concluded that the stock has declined rapidly and substantially from the mid-1980s to the present, and it was clear that the stock is at a record low level. Total mortality has been high in recent years, although it was not clear if recent increases in all areas can be fully attributed to the fishery.

All Canadian survey series have shown a substantial decline in the abundance of older fish (7+) over the 1990 to 1993 period. Abundance estimates for these ages are only 30 to 50% of what they were in 1990. The juvenile surveys have shown consistency in the abundance of young fish over that time series but STACFIS noted that large estimates of cohort size at young ages in the juvenile surveys did not result in large estimates-at-age from those cohorts 4 to 5 years later in any of the surveys. It was not clear what causes this apparent large mortality, particularly in Div. 3L. It was noted that north of this area in the Subarea 2+Div. 3K stock of American plaice, there have been large declines in stock size in the absence of a directed fishery. The 1988 and 1989 year-classes show some promise but there have been no large year-classes since.

d) **Research Recommendations**

STACFIS noted that ageing data were not available for this meeting from any of the 4 Canadian surveys in 1994, which made it difficult to evaluate abundance-at-age or estimate the recruitment

potential of recent year-classes. It was **recommended** that *where ever possible, ageing for American plaice from all surveys in Div. 3LNO be made available for the June 1996 Meeting of the Scientific Council.*

STACFIS also noted the extension of distribution of American plaice to deeper water, more than in the past. Recognizing that the stratification scheme for the Div. 3LNO area includes depths to 1 500 m, STACFIS **recommended** that *survey coverage be extended to depths of recent distribution of American plaice.* STACFIS further **recommended** that *the year round occurrence of American plaice in these depths be investigated.*

9. **American Plaice in Division 3M** (SCR Doc. 95/26, 48, 51, 72; SCS Doc. 95/13, 15)

a) **Introduction**

Since 1974, when this stock started to be regulated, catches ranged from 600 tons in 1981 to the highest value of 5 600 tons in 1987. After that catches declined drastically to 275 tons by 1993. Nominal catches for 1994 were reported as 253 tons, but estimates suggested 669 tons as a more realistic value.

The observed reduction in the level of the catches in the last three years was partly due to the shift in the target species to Greenland halibut for the Spanish fleet.

From 1979 to 1993 a TAC of 2 000 tons was agreed for this stock. In 1994, a reduction to 1 000 tons was agreed (Fig. 25).

Recent TACs and catches ('000 tons) are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	2	2	2	2	2	2	2	2	2	1[1]	0
Catch	1.7	3.8	5.6	2.8	3.5	0.8	1.6	0.8[2]	0.3[2]	0.7[2]	

[1] No directed fishing.
[2] Provisional.

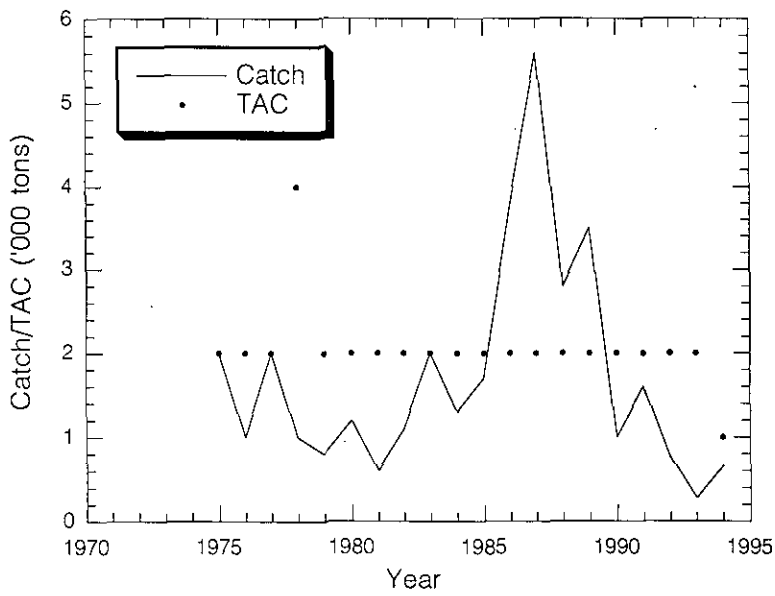


Fig. 25. American plaice in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Length compositions of the catch were derived from a limited sample (122 fish in April) obtained from the Spanish large-freezers catch, which took only 2 % of the total catch. Compared to the length composition derived from the July research survey, one can observe a predominance of smaller fish in the commercial catches. This can be attributed to the fact that the catch composition from this fleet reflects the length composition of the American plaice by-catch in the Greenland halibut fishery in this Division. For this reason it was only considered adequate to extrapolate this length composition for that 2% of the catch. For the remaining commercial catch the length composition of the research survey was used, as major differences between length distributions of the catch and survey were not found in 1993. The age-length key from the survey was used to derive the age composition of the catch.

Mean weights-at-age in the catch did not indicate any trend.

ii) **Research survey data**

Two deep-water surveys took place in Div. 3M in April 1995, one conducted by Canada and the other conducted by Japan. Both found American plaice in the strata below 730 m, which are not covered by the EU survey. It was not clear if American plaice occurred in those depths in earlier years. However, the presence of this species below 800 m appeared to be seasonal, being found only in winter and spring. The results of the EU survey should therefore not be affected. The series of research surveys conducted by the EU since 1988 was continued in July 1994. The Russian survey series that commenced in 1983 was interrupted in 1994. From the EU survey, the continued decrease observed in the biomass index since the start of the series, was reversed in 1994 (6 173 tons against 5 949 tons in 1993). This change in the decreasing trend had already been seen in the 1993 Russian survey (Table 2, Fig. 26). The EU abundance index did not follow the same trend as it continued to decrease from 1993 (9.3 million) to 1994 (8.5 million). The 1986 year-class (age 8 in 1994) remained the most abundant cohort of recent years. The 1990 year-class, the second in abundance at age 4, appeared about average, while the 1991 and 1992 year-classes appeared to be very weak.

Table 2. Div. 3M American plaice: indices of abundance ('000) and biomass (tons).

	EU		USSR/Russia	
Year	Number	Biomass	Number	Biomass
1983				8900
1984				7500
1985				7800
1986				20200
1987				9300
1988	21219	11868	10000	6500
1989	20500	10533	8300	5000
1990	16631	9101	2600	1200
1991	13932	7565	12700	14400
1992	10363	6492	1900	1000
1993	9268	5949	3600	2700
1994	8538	6173	-	-

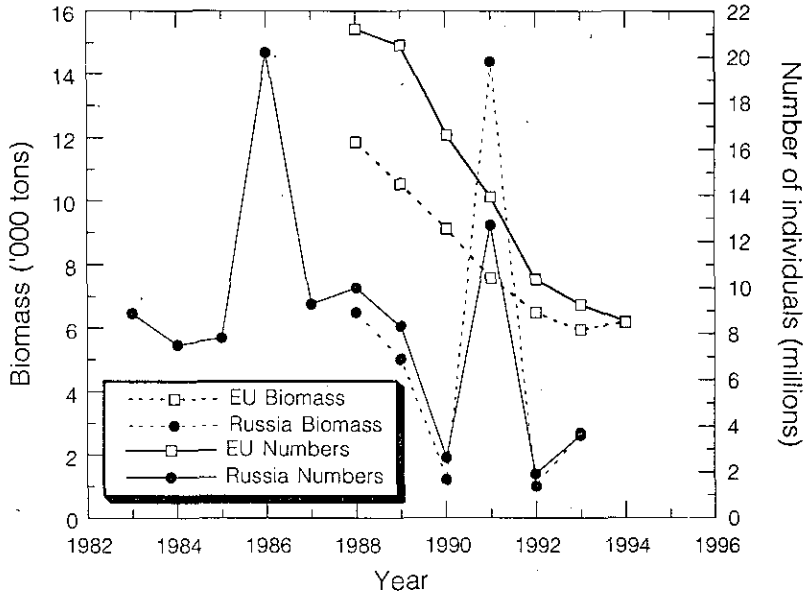


Fig. 26. American plaice in Div. 3M: estimates of biomass and abundance from surveys.

The spawning stock biomass (50% of age 5 and 100% of age 6+), as estimated from the EU surveys, increased in 1993 to a value close to the 1990-91 value, and remained stable at this level in 1994, due to the recruitment of the 1986 year-class (Table 3):

Table 3. American plaice in Div. 3M: index of the SSB in the EU surveys.

	1988	1989	1990	1991	1992	1993	1994
SSB	8.5	5.8	5.3	5.7	3.6*	5.0	5.0

* Estimated using mean weight-at-age in the catch.

c) **Estimation of Parameters**

Taking into account the deficiencies in the data base, only a crude approximation could be used for the estimation of annual F.

Using last year's method, which provided moderately-biased estimates when the catchability of the survey changed with age (SCR Doc. 94/61), a value of F = 0.22 was obtained for 1994 (Table 4).

Table 4. American plaice in Div. 3M: catchability (q) of the survey, estimated from ages 8-11 for the period 1988-90 and annual Fs for the period 1988-94.

	Biomass 8-11			
Year	survey	catch	C/B	F
1988	6066	1298	0.21	0.41
1989	2573	1470	0.57	1.10
1990	3262	497	0.15	0.29
1991	2481	768	0.31	0.60
1992	2141	435	0.20	0.39
1993	1075	111	0.10	0.20
1994	2666	309	0.12	0.22
1988-90	11 901	3 265	0.27	0.53

q = 0.518830

Fishing mortality in 1994 was estimated to be about the same level as in 1993, which was not far from the level of natural mortality for this species.

d) **Assessment Results**

Estimates of fishing mortality and survey biomass in 1994 were similar to the levels observed in 1993. The stock appears to be stable at a low level. There are concerns that the 1991 and 1992 year-classes appeared to be weak.

10. **Witch Flounder in Divisions 3N and 3O** (SCR Doc. 95/89, 51, 55, 58, 63; SCS Doc. 95/15)

a) **Introduction**

Reported catches in the period 1972-84 ranged from a low of about 2 400 tons in 1980 and 1981 to a high of about 9 200 tons in 1972 (Fig. 27). With increased effort, mainly by EU-Spain and EU-Portugal in 1985 and 1986, catches rose rapidly to 8 800 and 9 100 tons, respectively. This increased effort was concentrated mainly in the Regulatory Area of Div. 3N. Non-Contracting Parties such as South Korea (Contracting Party as of December 1993), Cayman Islands, Panama and USA also contributed to the increased catches.

Recent TACs and catches ('000 tons) are as follows:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	5	5	5	5	5	5	5	5	3[1]	0
Catch	9	8	7	4	4	5	5[2]	4[2]	1[2]	

[1] No directed catch.
[2] Provisional.

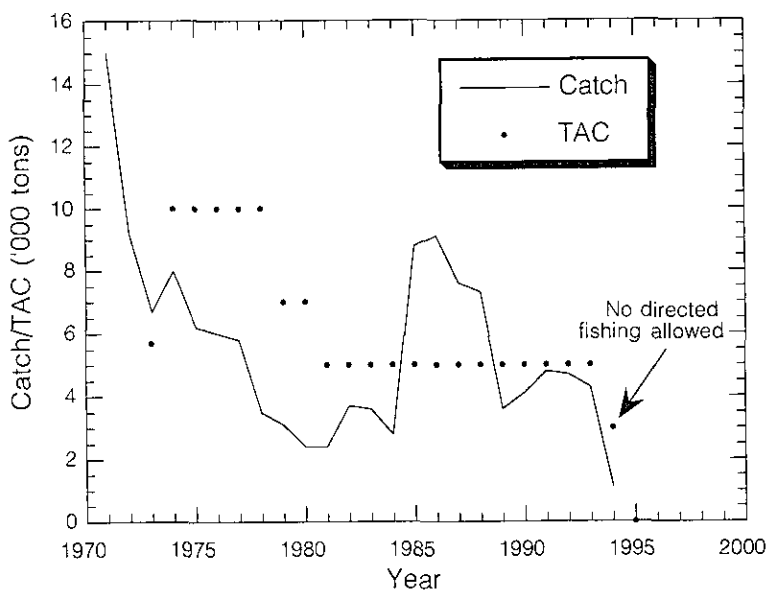


Fig. 27. Witch flounder in Div. 3NO: catches and TACs.

In 1987 and 1988, the total catch was about 7 500 tons, declining to between 3 700 and 4 900 tons in 1989 to 1992 with a catch of 4 400 tons estimated for 1993. The best estimate of catch for 1994 was 1 100 tons despite a moratorium on directed fishery. Other estimates ranged as low as 250 tons. Catches by Canada ranged from 1 200 tons to 4 900 tons in recent years (about 2 650 tons

in 1991 and 4 300 tons in 1992) and were mainly from Div. 3O. Only 2 tons was reported by Canada in 1994 (by-catch). Catches by USSR/Russian vessels declined from between 1 000 and 2 000 tons in 1982-88 to less than 100 tons in 1989-90, and to 0 since then.

STACFIS noted catch statistics were not adequate for this stock, given that there were catches by non-Contracting Parties which were not reported to NAFO (greater than 30% for 1991 and 1992) and have been only estimated from other sources. There were also catches in some instances which must be estimated from breakdowns of large catches of unspecified flounder.

b) **Input Data**

i) **Commercial fishery data**

Very little information was available due to a moratorium on directed fishing. Some length frequency data from the Spanish fishery in Div. 3N and 3O indicated catches in the range of 25-62 cm with modes at 37-40 cm in Div. 3N and 33-36 cm in Div. 3O.

ii) **Research survey data**

Biomass estimates. Estimated biomass from Canadian surveys in Div. 3N has been at very low levels during 1971-95 and in most years was less than 1 000 tons. For Div. 3O the estimates of biomass fluctuated annually, on average between 6 000 and 12 000 tons in the late-1980s. It was observed that despite the fact that survey coverage during 1991-93 has been the most complete in the time series, including much deeper water, there was a sharp declining trend since 1989 with the 1993 value (1 500 tons) being approximately the lowest observed in the time series. The estimate from the 1994 Canadian spring survey indicated a biomass of about 6 600 tons, followed by a decline in the autumn of 1994 to a level near the 1993 estimate (Fig. 28). The most recent estimate (spring 1995) was 1 800 tons, which was also near the very low 1993 value.

A survey conducted by EU-Spain in May 1995 estimated biomass in the Regulatory Area of Div. 3NO at about 3 500 tons comprised of fish mainly in a length range of 30-50 cm.

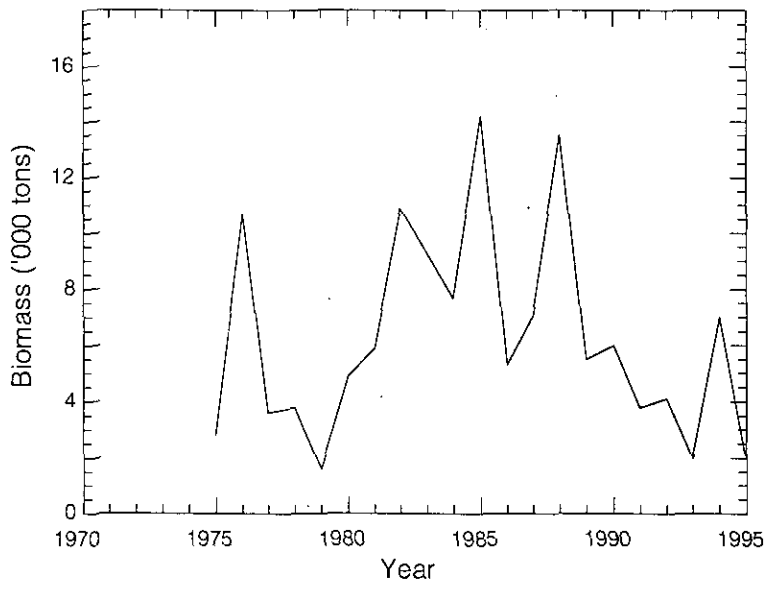


Fig. 28. Witch flounder in Div. 3NO: estimates of biomass from surveys.

c) **Assessment Results**

Based on the available data, the stock appeared to remain at a very low level with little sign of rebuilding.

d) **Recommendations**

STACFIS noted that it was not possible for ageing data for witch flounder in Div. 3NO to be available for this meeting from any of the Canadian surveys in 1994, which made it difficult to evaluate abundance-at-age or estimate the recruitment potential of recent year-classes. It was **recommended** that *where ever possible the most up to date catch-at-age data from the surveys for witch flounder in Div. 3NO witch flounder be made available for the June 1996 Meeting.*

11. **Yellowtail Flounder in Divisions 3L, 3N and 3O** (SCR Doc. 95/55, 58, 74, 79)

a) **Introduction**

Catches decreased in 1994 to about 2 100 tons from around 13 600 tons in 1993 (Fig. 29). The main reason for the decline was the drop in catches by Canada and non-Contracting Parties. Catches by EU vessels were at relatively low levels from 1992 to 1994. Catches exceeded the TACs in each year from 1985 to 1993. As noted in previous reports of Scientific Council, catch statistics for this stock are not adequate, with as much as 25-50% of the catch in some years coming from surveillance estimates and categorization of unspecified flounder catches. STACFIS noted that estimates of the total catch in 1994 ranged from 1 700 to 2 250 tons.

Recent TACs and catches ('000 tons) are as follows:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	15	15	15	5	5	7	7	7	7[1]	0[1]
Catch	30[2]	16	16[2]	10[2]	14[2]	16[2]	11[3]	14[2,3]	2[1,3]	

[1] No directed fisheries permitted.
[2] Includes estimates of misreported catches.
[3] Provisional.

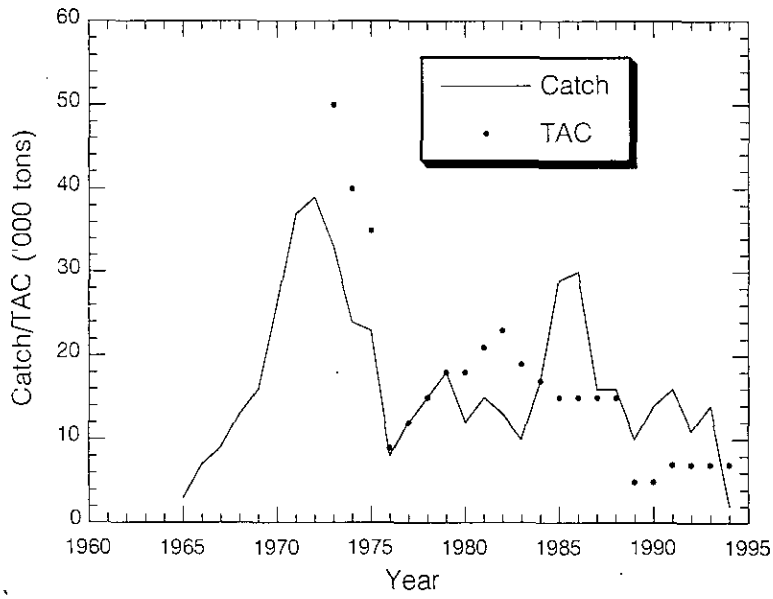


Fig. 29. Yellowtail flounder in Div. 3LNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

There were no catch rate or sampling data from the commercial fisheries in 1994. A multiplicative model used in 1994 to analyze the Canadian catch and effort data showed a slight increase from 1991 to 1993, but the values in these years were the lowest in the 29 year time series. Given the continuing uncertainties with catch and the lack of sampling data from some fleets and years, no catch-at-age or mean weights-at-age have been calculated for the total removals for many of the years since 1984.

ii) **Research survey data**

Canadian stratified-random spring surveys. Surveys have been carried out by Canadian research vessels in Div. 3LNO each year, with some exceptions, from 1971 to 1995. Yellowtail flounder are confined almost exclusively to depths less than 100 m on the Grand Bank. The surveys in all years have covered the depths where yellowtail flounder are found. Most of the trawlable biomass of this stock continued to be found in Div. 3N, where the index declined from about 60 000 tons in 1985-86 to between 29 000 and 43 000 tons from 1988-94 (Fig. 30). The preliminary estimate from the 1995 survey was 36 000 tons, somewhat higher than the 1994 estimate of 30 000 tons. In Div. 3L the index of trawlable biomass has declined steadily from about 15 000 tons in 1984-85 to practically zero in 1992-94. In Div. 3O, the biomass index was relatively stable around 15 000 tons from 1988 to 1991, however, the 1992 and 1994 values were around 6 000-7 000 tons, compared to 27 000 tons in 1993. The preliminary estimate from the 1995 survey was 8 000 tons. There was a high degree of variability associated with the 1993 abundance estimate in Div. 3O, and the 1994 and 1995 surveys suggest that this 1993 estimate may have been anomalously high.

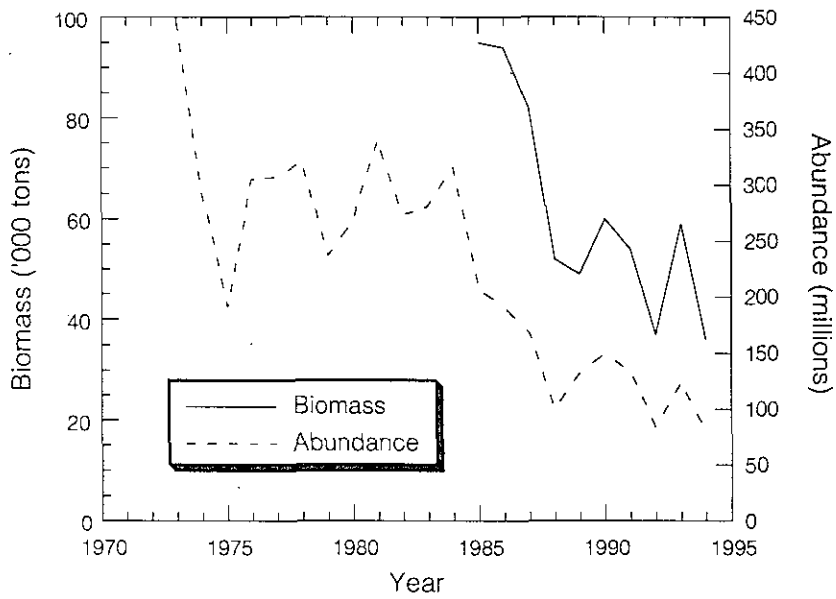


Fig. 30. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian spring surveys.

The Canadian groundfish survey catches have been usually dominated by yellowtail flounder aged 5-8 years, which was the case in 1994. STACFIS noted that the age-by-age information from the 1995 spring survey was not available at this meeting.

EU stratified-random survey in the NAFO Regulatory Area in Div. 3NO in May, 1995. This survey, which covered a depth range of 45 to 731 m, produced a trawlable biomass

estimate of 28 000 tons, of which 97% was found in strata 360 and 376, the traditional nursery area in Div. 3N. This point estimate can not be put in the context of the Canadian surveys because information on the catchability of the different bottom trawls used in the Canadian and Spanish surveys was not available. The length composition of the yellowtail flounder catches ranged in size between 8 cm and 56 cm, with a modal length group of 22 to 24 cm.

Canadian stratified-random autumn surveys (1990-94). These surveys covered depths to 731 m. The trawlable biomass index from these autumn surveys in Div. 3LNO from 1990 to 1992 ranged from 38 000 to 48 000 tons, although the 1992 estimate was biased downward by the omission of one stratum and part of another which historically had relatively high yellowtail flounder abundance. The 1993 and 1994 estimates of trawlable biomass were 67 000 tons in each year (Fig. 31).

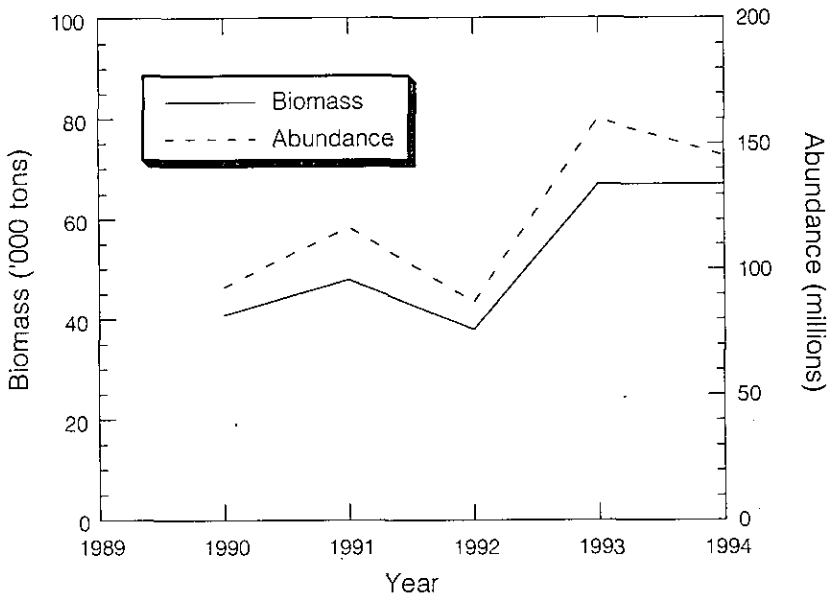


Fig. 31. Yellowtail founder in Div. 3LNO: estimates of biomass and abundance from Canadian autumn surveys.

Canadian stratified-random juvenile groundfish surveys. From 1985 to 1994, annual surveys have been conducted in Div. 3LNO, directed for juvenile American plaice and yellowtail flounder. These surveys covered the areas of juvenile and adult yellowtail distribution. In Div. 3L, the biomass had declined steadily since 1985 to the lowest level in the series in 1993-94 at 2 500 tons. The biomass estimates for Div. 3N which had generally shown an increase since 1988, increased in 1994 to the highest value (241 000 tons) in the series, about double the 1993 level. In Div. 3O, the 1994 biomass estimate of 57 000 tons remained at the same level as seen in 1992-93. The 1992-94 average was about 60% higher than the average level in 1989-91. Of note were the high variances associated with the 1993 estimate in Div. 3O, and both the Div. 3N and 3O estimates in 1994.

In 1994, the total abundance for the 3 Divisions combined showed a 55% increase over the 1993 estimate (Fig. 32). This was mainly due to an increase, in 1994, in the abundance of all age classes from 1 to 7 years, compared to the previous year. This change was assumed to reflect changes in availability of the fish to the survey gear. STACFIS expressed caution about these estimates and noted that this increase may be a 'year effect'.

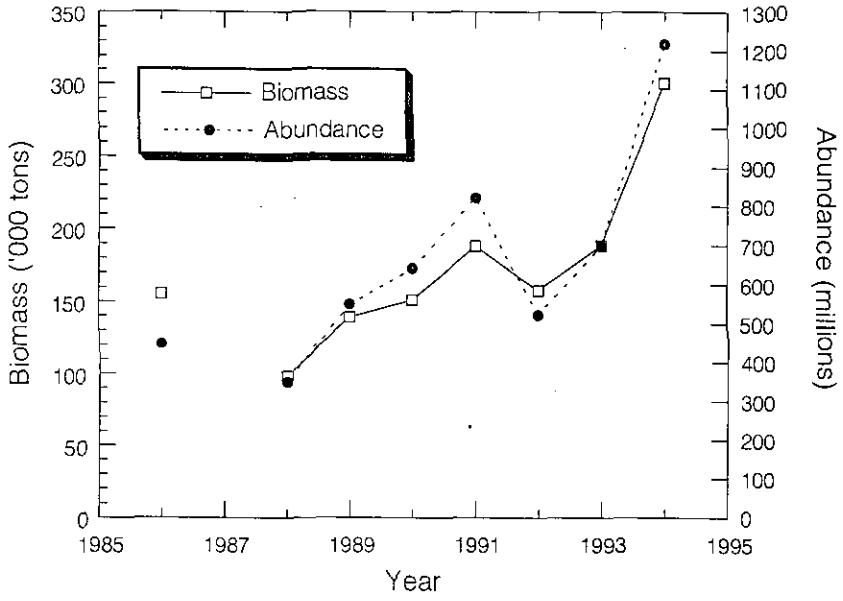


Fig. 32. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance form Canadian juvenile surveys.

Stock distribution. Changes in stock distribution on the Grand Bank, Div. 3LNO, were examined using the Canadian spring groundfish survey indices from 1976-94. A variety of techniques were used to examine distributional changes: biomass ratios, statistical ellipses and a concentration/area distribution index (Gini index). All three methods showed that there was a decline in the northern range since the late-1980s. STACFIS expressed some concerns about how the Gini index was constructed and thus there was some doubt about the interpretation of this index. Although this range contraction from the northern part of the bank (Div. 3L), to the area on and to the west of the Southeast Shoal, (Div. 3NO) coincided with a period of intense cooling of waters on the Newfoundland and Labrador Shelves, no significant correlation was found between survey bottom temperature and the decline in biomass in Div. 3L.

Contraction of stock distribution may simply reflect movement of parts of the population from marginal habitats as a function of low stock size.

c) **Assessment Results**

Since no CPUE data from the commercial fishery were available for this stock, evaluation of stock status continued to rely heavily on the interpretation of the available research survey indices of abundance. There were 3 indices used to evaluate this stock: the Canadian spring and autumn groundfish surveys, and the Canadian juvenile groundfish survey. The two groundfish surveys indicated the stock was still at a low level compared to historic values. The juvenile groundfish indices confirmed the continuous decline in stock size of yellowtail flounder in Div. 3L, as seen in the other surveys, however, the indices for Div. 3NO showed an increase in recent years. The high abundance of juvenile yellowtail flounder in the juvenile surveys contributed significantly to the biomass in the survey index. This was also seen in the 1995 Spanish bottom trawl survey in the Regulatory Area, which was dominated by juvenile fish. STACFIS noted that the difference in catchability of the two Canadian survey gears, with one targeting on the adult population and the other on both juveniles and adults, made it difficult to directly compare the survey indices, particularly in Div. 3NO where the stock was concentrated in a small geographical area. Estimates of exploitation rate, expressed as a catch/survey biomass ratio, were derived using the spring research vessel index. The ratio remained high during the late-1980s and early-1990s as biomass declined. A similar index based on the juvenile surveys showed that, during the same period, catch/biomass ratio remained stable as biomass increased up to 1993. A decline in the 1994 ratio

was difficult to interpret due to the uncertainty about the high 1994 biomass estimate.

STACFIS expressed caution about inclusion of juvenile age classes in the calculation of the catch/biomass ratios to reflect what is really happening in this stock, since the size composition of the commercial catch has changed several times over the history of the fishery.

The decline in stock size in the mid- to late-1980s was caused by poor recruitment from the year-classes of the early-1980s and a rapid increase in catches to about 30 000 tons in 1985-86 from 10 000-15 000 tons in 1980-83. The year-classes of 1984-86 were stronger than their immediate predecessors and supported increased catches from 1989 to 1991. Available data suggests that there has likely been increased fishing mortality at ages 5 and younger in the late-1980s and early-1990s than in earlier years. Given the continuing inadequacies with the catch and sampling data, and still unresolved questions about the natural mortality-at-age for this stock, it remains impossible to estimate the level of fishing mortality in recent years.

STACFIS noted that the stock area had contracted in recent years and this change could strongly influence catch rates in the research surveys and may have contributed to the high variance seen in recent surveys. As well, this contraction of the stock to a smaller geographical area makes it very vulnerable to over exploitation.

12. **Greenland halibut in Subarea 0 and Divisions 1B-1F** (SCR Doc. 95/19, 23, 50, 68; SCS Doc. 95/4, 6, 8, 12, 14)

a) **Introduction**

The annual catches in Subarea 0 + Div. 1B-1F were, in the period 1984-88, below 2 600 tons. From 1989 to 1990 catches increased from 2 200 tons to 15 500 tons. In 1991 catches dropped to 10 000 tons and then increased to 17 800 tons in 1992. Since then catches have gradually decreased through 12 900 tons in 1993 to 10 598 tons in 1994. In SA 0 catches peaked in 1990 with 14 513 tons, but have declined from 12 358 tons in 1992 through 7 441 tons in 1993 to 4 722 tons in 1994. Catches in Div. 1B-1F have fluctuated between 900 and 1 600 tons during the period 1987-91. After then catches increased to about 5 550 tons where they have remained since (Fig. 33 and 34).

Recent TACs and catches ('000 tons) are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992[1]	1993[1]	1994[1]	1995
Recommended TAC[2]	25	25	25	25	25	25	25	25	25	25	11
SA 0	1	+	+	1	1	15	8	12	7	5	
Div. 1BCDEF	+	+	1	2	1	1	2	5	5	6[3]	
Total	1	+	1	3	2	16	10	18	13	11[3]	

[1] Provisional catches.
[2] In the period 1985-94 the TAC included Div. 1A.
[3] Including 780 tons non-reported.

The fishery in Subarea 0. Prior to 1984, USSR and GDR conducted a trawl fishery in the offshore part of Div. 0B. Also Faroese longliners have regularly taken catches in this area. In 1990 and in 1991 the Faroese longline catches were about 2 500 tons, but they dropped to a low level in 1992 and 1993. No catches were recorded from Faroe Islands in 1994. Since 1990 the trawl fisheries in Div. 0B have increased significantly. Catches in Div. 0B jumped from 907 tons in 1989 to about 14 500 tons in 1990 but have gradually decreased to 4 722 tons in 1994. A catch limit at 4 500 tons and 1 000 tons for offshore and inshore areas, respectively, was imposed mid-year 1994. Most of the catches in recent years have been taken by Russian trawlers. The fishery in Div. 0B is restricted by the ice coverage and in 1994 the fishery took place during July-October.

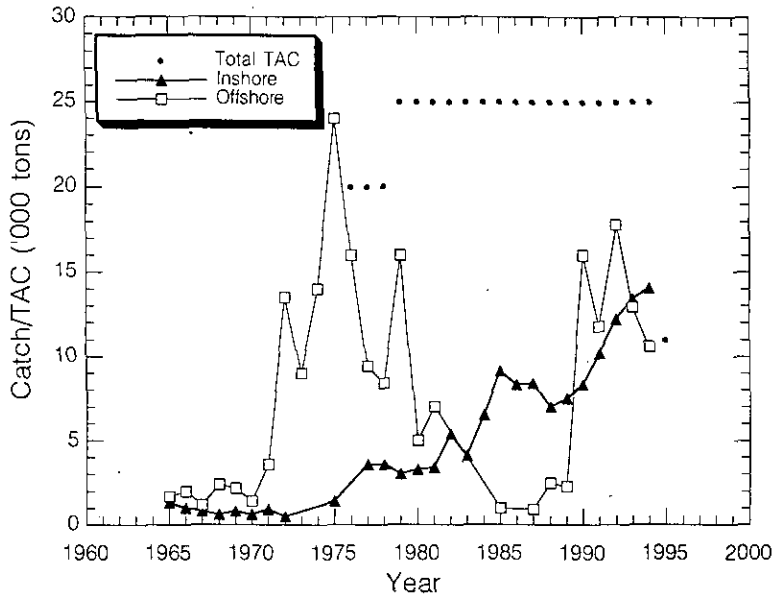


Fig. 33. Greenland halibut in Subarea 0 + Div. 1B-1F: catches and TACs (TAC for 1995 excludes Div. 1A inshore).

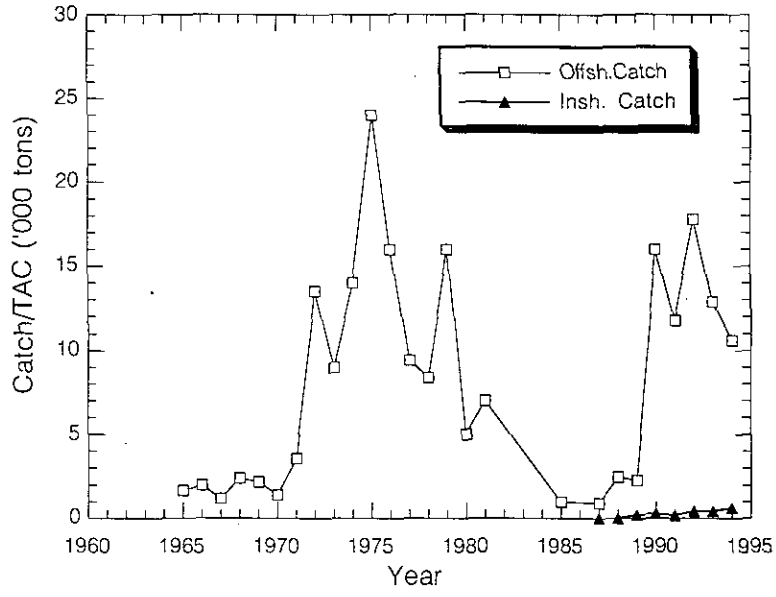


Fig. 34. Greenland halibut in Subarea 0 + Div. 1B-1F: inshore and offshore catches.

In 1987 a longline fishery started inshore in Cumberland Sound. The catches gradually increased to 400 tons in 1992 where it has remained since. Within the fishing area, depth can vary from 750 to 950 m. The fishery takes place during the winter, typically from February until the end of May.

No catches were reported from Div. 0A.

The fisheries in Div. 1B-1F. The offshore fishery in Div. 1B-1F increased from about 900 tons in 1987 to about 1 500 tons in 1988 and catches remained at that level until 1992 when they increased to 5 550 tons. Catches have remained at that level until 1994. Japanese trawl catches amounted to 819 tons in 1994. The Norwegian trawl fishery caught 3 194 tons, 217 tons were taken by a German trawler, and 663 tons were taken by a Greenlandic longliner. Almost all the fishery took place in Div. 1CD. The offshore fishery took place in the second half of the year. In 1994, 203 tons were taken inshore, mainly in Div. 1D.

b) **Input Data**

i) **Commercial fishery data**

For 1994 catch-at-age and weight-at-age data in Subarea 1 were available from the offshore fishery in Subarea 1 and from the inshore fishery in Div. 0B and Div. 1D. The shift towards younger age groups seen in the offshore fishery in 1993 had become more evident in 1994.

Maturity data were available only from the inshore areas in Div. 0B where 97% of the fish sampled were females. All fish were either immature or not in spawning condition. No ripe or spent specimens were observed.

Standardized catch-rate series were calculated from available logbook data from the offshore trawl fishery in Div. 1CD during 1988-94. From 1988 to 1992 the standardized catch rates were fairly constant, but they have declined since then. Catch rates for a Japanese trawler for the period 1987-92 showed a drop in 1991, but in 1992 the value was similar to the average of the years 1987-90. In 1994 the catch rate decreased about 37% compared to 1992. Average catch rates from the Norwegian trawl fishery in Div. 1CD showed a decrease by about half from 1991 to 1993, but had stabilized between 1993 and 1994.

Inshore in Div. 0B, the CPUE decreased in terms of number of fish, gradually from 1989 to 1991. In 1992 the CPUE, increased to slightly above the 1987 level, where it has remained since. The age compositions in the catches have remained the same throughout the years, with ages 10, 11 and 12 being the most abundant, comprising 65% of the catches. The mean weight-at-age has decreased significantly during the last three years.

ii) **Research survey data**

Since 1987 bottom-trawl surveys have been conducted in Subarea 1 jointly by Japan and Greenland. In 1994 a survey was conducted in August and covered Div. 1B to 1D at depths between 400 and 1 500 m. The trawlable biomass was estimated to be 31 400 tons, which was lower than in 1993 (37 700 tons) and significantly lower than the estimates from 1992 and 1991 (62 000 and 77 000 tons, respectively). Abundance estimates for Div. 1CD for the period 1988-92 fluctuated in the range 35-53 million but declined to 30 million in 1993 and further to 25 million in 1994.

In the period 1990 to 1992 the total biomass declined (Table 5). In the same period offshore catches were in the range 10 000-18 000 tons, compared to catches about 3 000 tons or less in the period 1984-89.

Biomass estimates ('000 tons) from Greenland/Japanese surveys and German/USSR (GDR until 1989, EU-Federal Republic of Germany since 1990-91 and USSR until 1991, Russia since 1992) surveys for the years 1987-94 in Subareas 0+1 are as follows (Fig. 35):

Table 5. Greenland halibut in Subarea 0 + Div. 1B-1F: biomass estimates from GDR(FRG)/USSR (Russian) (OB) and Greenland/Japan (Div. 1BD surveys).

Year	GDR(FRG)/USSR(RUS) Surveys 0B	1BCD	Greenland/Japan Surveys 1BCD	1ABCD[1]	Total 0B+1ABCD[2]
1987	37	56	54[3]	58[3]	95
1988	55	47	53	57	112
1989	79	-	63[4]	-	-
1990	72	88	53[5]	56[5]	128
1991	46	-	77	79	125
1992	38	-	62	64	102
1993	-	-	38	-	-
1994	-	-	31	-	-

[1] Div. 1A south of 70°N.
[2] GDR(FRG)/USSR(RUS) Survey Div. 0B + Greenland/Japan Survey Div. 1ABCD.
[3] In 1987 the survey did not cover the depth stratum 1 000-1 500 m.
[4] Estimate only for Div. 1CD.
[5] Average values of two surveys.
- no survey.

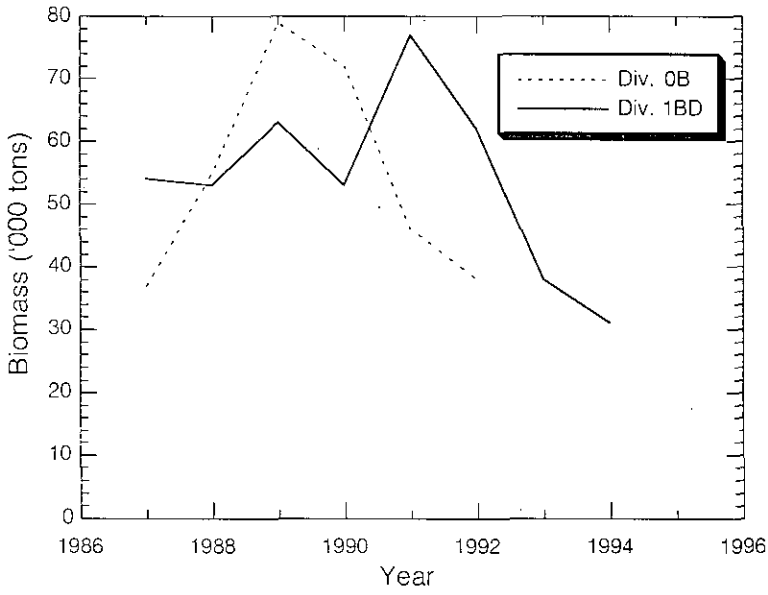


Fig. 35. Greenland halibut in Subarea 0 + Div. 1B-1F: biomass estimates from GDR(FRG)/USSR (Russian) (0B) and Greenland/Japan (Div. 1BD surveys).

Since 1988 annual trawl surveys were conducted with a shrimp trawler off West Greenland between 59°N and 72°30'N from the 3-mile line to the 600 m depth contour line. Estimated trawlable biomass increased from 3 000 tons in 1991 to about 9 000 tons in 1992 and 1993 and further to 12 200 tons in 1994. In 1994 17% of the biomass was located in Div. 1A. The catches were almost exclusively composed of one and two year old fish. The abundance was estimated to 253 million which is at the same level as in 1992 (276 million) and 1993 (239 million), and somewhat higher than 70-80 million recorded in 1990 and 1991.

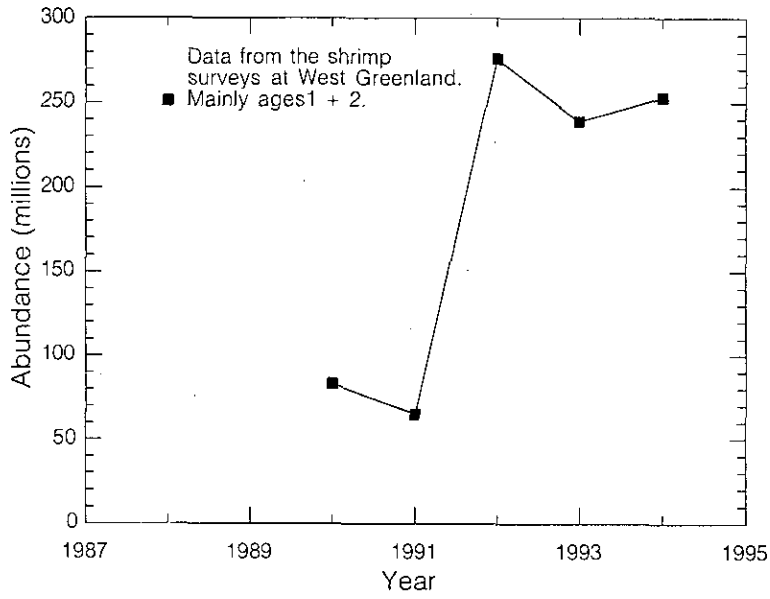


Fig. 36. Greenland halibut in Subarea 0 + Div. 1B-1F: abundance estimates from shrimp trawl surveys.

In the summer of 1994, an exploratory trawl was fished in the outer part of Cumberland Sound outside the winter fishing ground. The trawlable biomass ranged from 0 kg km^{-2} at <275 m depth to 2 678 kg km^{-2} at 900 m depth. Exploratory longline and gill net sets during the summer in the traditional winter fishery area yielded low catches.

iii) **Biological studies**

It is uncertain whether adult Greenland halibut in Cumberland Sound contribute to the spawning population in Davis Strait. The shallow sill (about 300 m) between Cumberland Sound and Davis Strait may act as a barrier between the areas and prevent Greenland halibut from passing freely between the two areas. Water temperatures on top of the sill during the summer are colder than -0.5°C, while temperatures near the bottom of the Sound are slightly above 0°C. It may be that cold water above 300 m depth acts as a barrier to adult migration. A stock identification program based on genetic and morphological indicators, now in progress, may contribute to the solution of the problem concerning the status of the inshore stock component.

c) **Estimation of Parameters**

An Extended Survivors Analysis and a Pope's Cohort Analysis were attempted on the Greenland halibut stock component in Subarea 0 + Div. 1B-1F, but they were unsuccessful due to difficulties in the data set. Further, a yield-per-recruit analysis was attempted, but it was unsuccessful due to uncertainty in the estimation of weight-at-age and the relevant partial recruitment pattern.

d) **Assessment Results**

Survey trawlable biomass in Div. 1B-1D decreased by about 50% for 1991-92 to 1993-94 (Table 5). Both the commercial and survey catch-at-age estimates showed a shift towards younger fish in the catches. Standardized CPUE series from Div. 0B offshore showed a decline of about 30% from 1991 to 1993 (no data from 1994) and standardized catch rates from Div. 1CD also showed a decline of about 30% during the period 1992-94. Based on the shrimp trawl surveys covering depths down to 600 m in Subarea 1 the recruitment seems to be at a stable level.

e) **Research Recommendations**

No catch numbers-at-age, weights-at-age data or CPUE data were available for offshore Greenland halibut in Div. 0B for 1994, and STACFIS **recommended** that *these data should be presented at the June meeting in 1996, in order to continue the time series already established.*

The joint Greenland/Japan survey covers Subarea 1 only and STACFIS **recommended** that *surveys should be conducted in Subarea 0 as well, in order to obtain a more detailed assessment of the stock status in the area.*

The question of whether the Cumberland Sound Greenland halibut stock contributes to the SA 0+1 stock needs to be resolved. STACFIS **recommended** that *a tagging program be initiated in Cumberland Sound to ascertain whether adult fish move into Davis Strait. The degree of spawning activity should be examined at the same time.*

13. **Greenland Halibut in Division 1A** (SCR Doc. 95/18, 19, 67; SCS Doc. 95/14)

a) **Introduction**

The main fishing grounds for Greenland halibut in Div. 1A were located inshore. The annual inshore landings in Div. 1A were around 7 000 tons in the period 1984 to 1989, but have been steadily increasing to 14 049 tons in 1994 (Fig. 37). In recent years the inshore landings were rather evenly distributed throughout the year.

Recent landings ('000 tons) in Div. 1A are as follows:

	1987	1988	1989	1990	1991	1992[1]	1993[1]	1994[1]
Ilulissat	2.3	2.7	2.8	3.8	5.4	6.6	5.4	5.2
Uummannaq	2.8	2.9	2.9	2.8	3.0	3.1	3.9	4.0
Upernavik	0.5	0.8	1.1	0.9	1.5	1.8	2.6	4.8
Collector vessel	1.2	-	0.1	0.4	-	0.4	1.2	1.0[2]
Offshore	-	-	-	-	-	-	+	+
Unknown[3]	0.4	0.6	0.6	0.6	+	-	-	-
Total	7.2	7.0	7.5	8.5	9.9	11.9	13.1	14.0
Officially reported	8.4	7.0	7.5	7.5	9.2	-	-	-

[1] Provisional.
[2] Already included in the Upernavik landings.
[3] Landings from unknown areas within Div. 1A.

The offshore fisheries in Div. 1A. There was practically no offshore fishing for Greenland halibut in Div. 1A. In 1993, 34 tons were taken by a Japanese trawler, and in 1994, 18 tons by a Greenlandic longliner.

The inshore fisheries in Div. 1A. The fishery was traditionally performed with longlines from small boats below 20 GRT, or by means of dog sledges, typically in the inner parts of the ice fjords at depths between 500 to 800 m. In the middle of the 1980s gillnets were introduced to the inshore fishery, and were used more commonly in the following years. In 1989 gillnets and longlines accounted equally for the Greenland halibut catches, but since then the annual proportion of catches from each gear has varied considerably. Authorities have in recent years tried to discourage the use of gillnets, because of their high efficiency and perceived problems of 'ghost-fishing' with lost gear. Longline catches comprised 76% of the total catches in 1993 and 73% in 1994 .

The inshore fishery in Div. 1A was located in three areas: Ilulissat (69°N), Uummannaq (71°N) and Upernavik (74°N).

Ilulissat. The Greenland halibut fishery was conducted in, and in front of an ice fjord in the immediate vicinity of Ilulissat town, and in an ice fjord, Torssukattâk, north of Ilulissat. Use of gillnets is prohibited in the inner parts of the ice fjords.

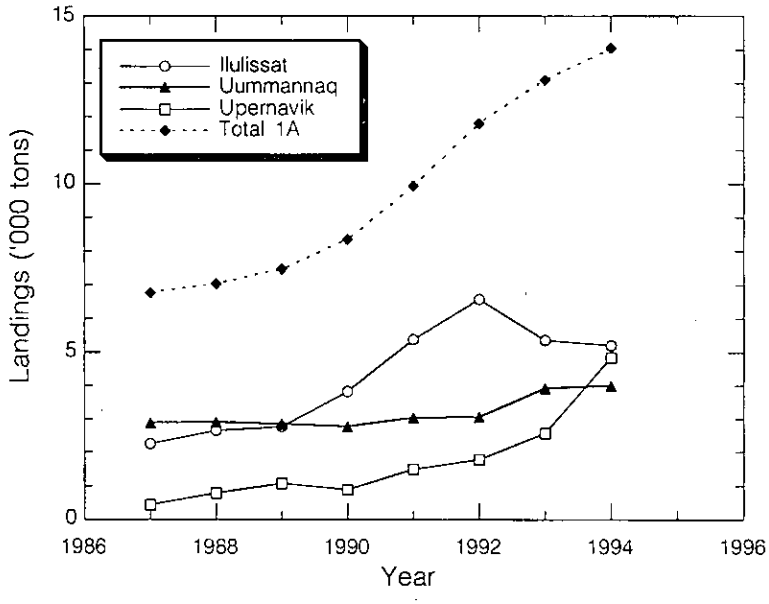


Fig. 37. Greenland halibut in Div. 1A: catches by area.

The catches at Ilulissat increased from about 2 000 tons in 1987 to 6 600 tons in 1992. In 1993 the catches decreased to 5 400 tons and further to 5 200 tons in 1994 (Fig. 37). Longline catches comprised 84% in 1992 and decreased to 67% of the total catches in 1994.

Uummannaq. Uummannaq comprises a large system of ice fjords, where the fishery for Greenland halibut was conducted. The main fishing ground was the southernmost fjord Qarajaq Ice fjord. Use of gillnets is prohibited in the inner parts of the fjords.

The catches at Uummannaq were stable about 3 000 tons in the period 1987 to 1992. In 1993 the catches increased to 4 000 tons where it remained in 1994 (Fig. 37). In 1992 longline catches comprised 77% of the landings at Uummannaq, but decreased to 57% in 1994.

Upernavik. The northernmost area consists of a large number of ice fjords. The main fishing grounds were Upernavik Ice fjord, Tussaq and Gieseckes Ice fjord, all north of Upernavik town. Use of gillnets is prohibited in the entire area.

The catches in Upernavik area have increased steadily from 450 tons in 1987 to 4 800 tons in 1994 (Fig. 37). The substantial increase from 1993 to 1994 was due to a relocation of effort from southern areas in 1994.

b) **Input Data**

i) **Commercial fishery data**

Catch-at-age data for the three inshore areas separately were available, based on sampling from the commercial fishery covering area, gear and, in most cases, season. Age-length keys from 1993 were applied to 1991 and 1992 data. Due to lack of length frequency samples, no catch-at-age data were available for Uummannaq in 1991-92, and at Upernavik in 1992. Catch-at-age data for Upernavik 1991 and 1993 were obtained by using an age-length key from Uummannaq, 1993. In 1994 age-length keys were obtained for all three areas.

ii) **Research survey data**

Since 1962 various longline trial fisheries were conducted with research vessels from Greenland Institute of Natural Resources. Due to differences in survey design and gear, these surveys were not quite comparable. In 1993 a longline survey program for Greenland halibut was initiated for the inshore areas, Ilulissat, Uummannaq and Upernavik. The surveys were conducted annually covering two of three areas alternately, in order to obtain a CPUE index series for Greenland halibut in the inshore areas. In July-August 1994 the research longline vessel 'Adolf Jensen' covered the fjord areas of Upernavik and Ilulissat. A total of 73 longline settings with 58 000 hooks were made. CPUE and mean-length values from the 1993 and 1994 longline surveys at Ilulissat were at the same level, but below values from surveys in the 1980s. At Uummannaq the CPUE values and mean-length have decreased (Table 6). The stock at Upernavik was considered virgin until 1994, when large scale fishing started. CPUE and mean length values from 1994 are larger than observed in Ilulissat.

Table 6. Greenland halibut in Div. 1A: CPUE values (kg/100 hooks) from longline surveys conducted in Div. 1A inshore areas.

Area	1962	1985	1986	1987	1993	1994
Ilulissat	-	-	8.3	16.5	3.1	3.1
Uummannaq	4.6	13.7	-	8.6	2.8	-
Upernavik	-	-	-	-	-	5.2

Mean length (cm) from catches taken in Div. 1A inshore longline surveys.

Area	1962	1985	1986	1987	1993	1994
Ilulissat	-	62.4	53.5	62.2	55.9	56.5
Uummannaq	67.8	70.5	-	61.8	57.5	-
Upernavik	-	-	-	-	-	64.6

Ages 1 and 2 fish at the nursery areas south-southwest of Disko Island and Disko Bay were considered as recruits to the inshore areas in Div. 1A, although the proportion of recruitment to the inshore areas was unknown. Since 1988 annual trawl surveys were conducted with a shrimp trawler off West Greenland between 59°N and 72°30'N from 3-mile offshore line to the 600 m depth contour line. Since 1991 the area inshore of the 3-mile line in Disko Bay was also included in the surveyed area. Biomass indices from the nursery area south-southwest of Disko Island have increased since 1989 and were estimated to be 8 224 tons in 1994. The abundance indices from the nursery area have increased from 60 million in 1990 to 242 million in 1992. The abundance has been at a stable level around 200 million, in 1993 and 1994 (Fig. 38). In Disko Bay which is a nursery area for the inshore stock at Ilulissat, the biomass increased from 2 000 tons in 1991 to 4 000 tons in 1992 and has been stable around 2 000-3 000 tons in 1993 and 1994. The abundance increased from 26 million in 1991 to 69 million in 1992, and has been stable between 30 and 40 million in 1993 and 1994. Data from the nursery areas suggested that the recruitment level was stable, and that the 1991 year-class was above average.

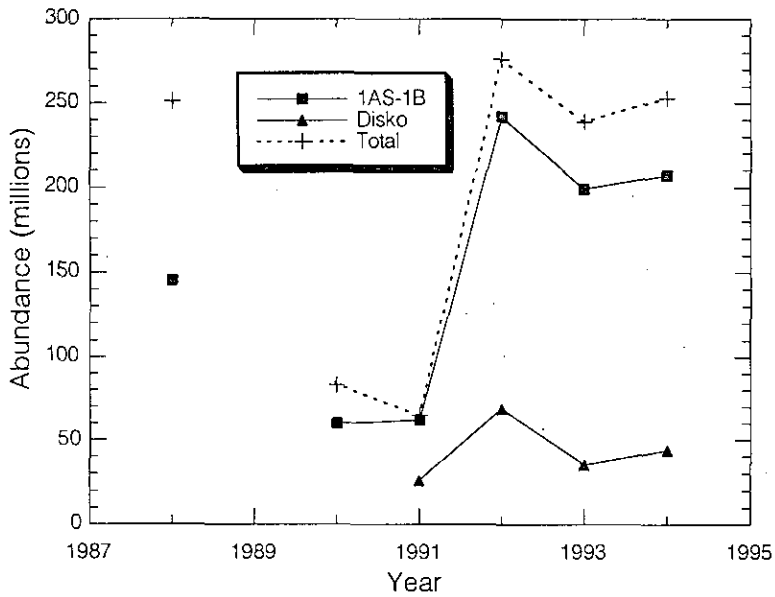


Fig. 38. Greenland halibut in Div. 1A: estimates of abundance from shrimp trawl surveys.

iii) **Biological studies**

Three different age readers have been engaged in otolith readings in the periods 1988-90, 1993 and 1994. Results of otolith exchanges showed that age readings within the entire period were not quite comparable, influencing the assessment. In particular, the 1994 age composition appeared inconsistent with the rest of the time series.

A preliminary study of inshore female Greenland halibut maturity stages was presented, suggesting differences in visual and histological evaluations of maturity. M_{50} was estimated to 65.4 cm by visual evaluation, and to be 58.1 cm by histological evaluation. There was no explanation of this difference, and no further information on maturity was available.

c) **Assessment Results**

The recent level of fishing mortality was estimated by means of catch-curves using data from the commercial longline fishery. Yield-per-recruit analyses were performed for each area, and the results suggested that the stock in the three areas were growth overfished. Due to discrepancies in the age determinations and insufficient sampling, catch-at-age data were not considered sufficient to allow reliable analyses.

d) **Research Recommendations**

The basic problem for the assessment of Greenland halibut in Div. 1A was the age determinations, similar to the assessment for the offshore stock in SA 0+1, and STACFIS therefore **recommended** that *a special effort should be directed to resolve these problems.*

14. **Greenland Halibut in Subarea 2 and Divisions 3KLMNO** (SCR Doc. 95/26, 28, 29, 48, 54, 55, 56, 57, 58, 64, 65, 78; SCS Doc. 95/13, 15)

a) **Introduction**

Catches increased from low levels in the early-1960s to over 36 000 tons in 1969, and ranged from 24 000 tons to 39 000 tons over the next 15 years. From 1986 to 1989, catches exceeded 20 000 tons only in 1987 (Fig. 39). In 1990, an extensive fishery developed in the deep water (down to at least 1 500 m) in the Regulatory Area, around the boundary of Div. 3L and 3M and by 1991

extended into Div. 3N where it has continued. The total catch estimated by STACFIS for 1990-93 was 47 000 tons in 1990, 55 000-75 000 tons in 1991 and about 63 000 tons in 1992 and 42 000-62 000 tons in 1993. STACFIS accepted an estimated catch of 48 000 for 1994 although estimates reviewed ranged as high as 53 000 tons. The major participants in the fishery in the Regulatory Area are EU-Spain and EU-Portugal.

Canadian catches peaked in 1980 at just over 31 000 tons, while the largest non-Canadian catches before 1990 occurred in 1969-70. USSR/Russia, Denmark (Faroe Islands), Poland and EU-Germany (GDR before 1989) have taken catches from this stock in most years, but catches by the latter two countries were negligible since 1991. USSR/Russia catches increased from about 1 100 tons in 1988-90 to 8 200 tons in 1991, the largest catch by this fleet since 1975. EU-Portugal and Japan have taken catches from this stock each year since 1984. Canadian catches have ranged from 8 200 to 13 500 tons from 1985-91. The Canadian catch declined in 1992 to 6 900 tons and further declined to 4 700 tons in 1993 and 2 900 tons in 1994.

In most years, the majority of the Canadian catch has come from Div. 3K and 3L, with catches from Div. 2G and 2H usually being relatively low. Canadian gillnet catches declined from a high of 28 000 tons in 1980 to about 3 000 tons annually in 1992-94, which was the lowest in the time series. Catches prior to 1992 were mainly from inshore areas, while catches since then have been taken mainly in offshore areas at the edge of the Continental Shelf.

Canadian otter-trawl catches peaked at about 8 000 tons in 1982, declined to less than 1 000 tons in 1988 and increased to about 7 400 tons in 1990, which was the highest level since 1982. In 1992, the catch declined again to a level of 2 800 tons followed by a further decline to 1 500 tons in 1993. In 1994, the Canadian otter-trawl catch was less than 600 tons.

Recent TACs and catches ('000 tons) are as follows.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC[1]	55	75	100	100	100	50	50	50	50	25	27
Catch[2]	19	16	31	19	19	47	55-75	63[3]	42-62[3]	48[3]	

[1] Set autonomously by Canada 1985-94 and by NAFO Fisheries Commission in 1995.
[2] Includes estimated unreported catches in 1990-94.
[3] Provisional.

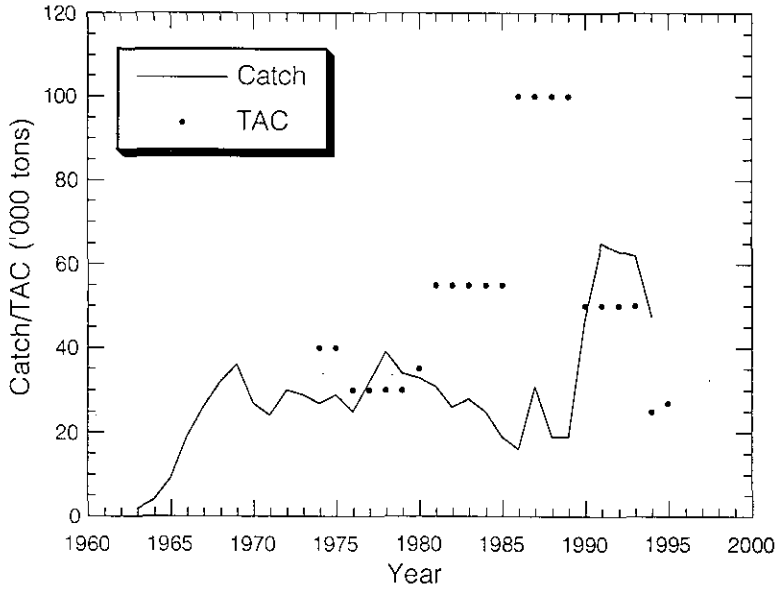


Fig. 39. Greenland halibut in Subarea 2 + Div. 3KLMNO: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Catch and effort. A detailed analysis of Canadian gillnet catch and effort data since the mid-1980s was reviewed. The general trends observed indicated steep declines over time since 1986/87 for the near shore areas of Div. 3K and 3L (<500 m fishing depth) and by the early-1990s this fishery had essentially collapsed. Some of this effort moved from near shore areas to the deep waters of the Continental Slope (about 1 000 m fishing depth) particularly in Div. 3K and 3L. As catch rates declined in these areas, effort moved northward along the slope area to as far north as Div. 2G, where catch rates in these areas also declined quickly over a very short time period during the 1990s.

An analysis of otter trawl catch rates, largely by Canadian vessels, indicated a declining trend since about the mid-1980s to reach its lowest level by 1992 with little change since then. Data from the most recent years, however, were very limited as a result of low effort due to poor catch rates.

A catch-rate index from the EU-Spain fishery in the NAFO Regulatory Area based on data collected by observers on board commercial vessels also declined from 1990 to 1994. Information from the Portuguese fishery in the NAFO Regulatory Area from 1988-94 was also presented. The data indicated in Div. 3L a decline from a higher level between 1988 and 1990 to a lower level for the period 1991-94. However, no trend in catch rates could be detected in Div. 3N.

Size and age data were not available from the 1994 Canadian fishery in time for this meeting. However, the geographical development of fishing effort in 1994 was similar to that of 1993. The 1993 catches were dominated by 7-8 year old fish although there were more older fish in the catches than in earlier years. This was due to the increase in the use of large mesh (200 mm) gillnets in deep water in recent years, accompanied by a reduction in trawler effort which usually catches smaller (younger) fish.

Age compositions were provided for the 1994 EU-Spain fishery which represents most of the commercial catch. The catch by number was dominated by ages 6 and 7 with about 80% of the catch comprised of ages 9 and younger. Nearly 30% of the catch in 1994 was made up of ages 4 and 5.

The commercial catch-at-age for 1994 from EU-Portugal indicated few fish older than age 7 in the trawler catches, which comprise most of the Portuguese fishery, with the peak of the catches at ages 4 and 5.

Some length frequency data from an exploratory fishery by Russia in Div. 3L and 3N during the summer of 1994 were provided. Virtually no fish larger than 50 cm were observed with the mode of the length frequency at 30 cm in the Div. 3L data. In Div. 3N, fish from 18 to 68 cm were caught with modes at 28, 40 and 54 cm

ii) **Research survey data**

STACFIS noted that all research vessel surveys providing information on the abundance of Greenland halibut were deficient in various ways and to varying degrees. The surveys were often initiated to obtain abundance indices for other species and this remains a major objective for most surveys. The geographical and depth range of the surveys have been progressively adapted in accordance with changes in the fishery for Greenland halibut and possible changes in the geographical distribution of this species and others. This creates problems in the comparability of results from different years. Furthermore, it remained the case that no survey covered the entire geographical range of the Greenland halibut stock and therefore the abundance of the total stock remained unestimated.

Canadian stratified-random groundfish surveys in autumn. Biomass indices of Greenland halibut have been declining in Div. 2J (to depths of 1 000 m) since 1982 from a level of over 100 000 tons to less than 9 000 tons by 1992. There was a slight increase

in 1993 to near that of 1991 and the biomass remained at that level in 1994. The biomass index in Div. 3K (to depths of 1 000 m) peaked at 112 000 tons in 1984 but by 1987 biomass in this Division also declined similar to Div. 2J and reached a low of just over 20 000 tons in 1992. In 1993 there was a similar proportional increase in biomass in Div. 3K as with Div. 2J to a level slightly higher than that of 1991. The 1994 survey, however, estimated the Div. 3K biomass to be at a level similar to 1992 which is the lowest in the time series. Estimates for Div. 3L to a depth of 366 m were relatively stable from 1981 to 1990 at about 15 000 tons. Between 1990 and 1991, the biomass index fell from nearly 17 000 tons to 7 300 tons and further to 6 700 tons in 1992 although survey coverage in 1991-94 was extended to depths of 732 m. Unlike Div. 2J and Div. 3K, the biomass index for Div. 3L in 1993 continued to decline to a level of about half of the 1991-92 estimates and remained at about that level in 1994. The cumulative biomass index for all three Divisions has declined rather steadily from a high of about 225 000 tons in 1984 to 37 000 tons in 1992 which is the lowest in the time series (Fig. 40). The cumulative estimate for 1993 increased to 49 000 tons, but in 1994 returned to near the low 1992 level.

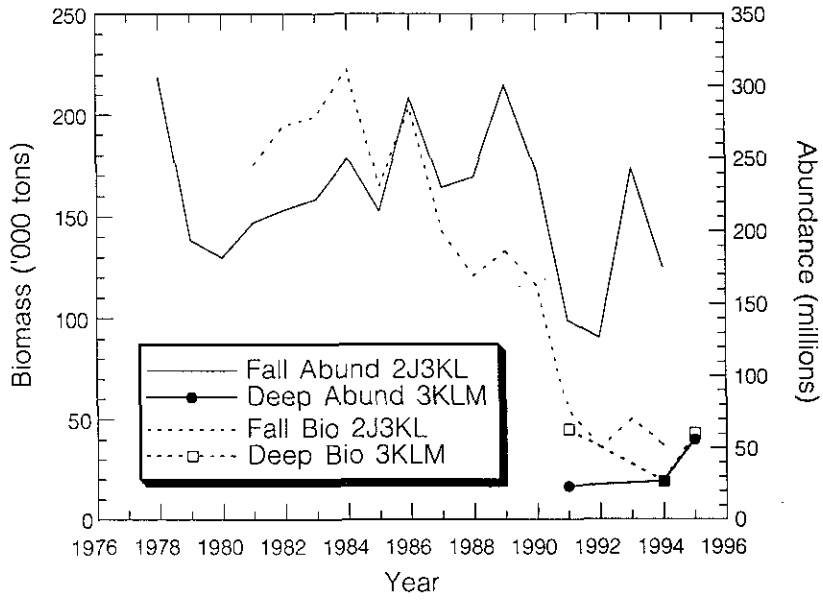


Fig. 40: Greenland halibut in Subarea 2+ Div. 3KLMNO: estimates of biomass and abundance from Canadian surveys.

Since declines in biomass were not consistent across all age-classes, decreases in age specific abundance were less apparent than in total biomass. An examination of the age structure indicated that the ages 6+ abundance had been declining since the mid-1980s and by 1993 the age 6+ abundance was far below anything previously observed, at a level of about one third of that estimated in 1992, and was even lower in 1994. Age 10+ has been declining since the early-1980s and by 1993-94 appeared only incidently in the survey catches. On the other hand, the numbers of ages 3-5 were slowly increasing from the early-1980s to about 1989. From 1989 to 1992, however, these age groups also declined very sharply to a level less than half the 1988 estimate. A sudden increase in abundance was observed in 1993 and was due to a significant increase in the estimated abundance of ages 2 and 3 (1991 and 1990 year-classes, respectively) in the 1993 survey. The 1991 year-class in the 1994 survey also appeared above average but much less than was indicated at age 2 in the 1993 survey. The 1990 year-class did not stand out in the 1994 survey to the extent that it did in the 1993 survey.

Canadian deepwater surveys (SCR Doc. 95/52). The results of deepwater surveys conducted in the summer of 1991 and the winters of 1994 and 1995 in Div. 3K, 3L and 3M and Div. 3N (1994 and 1995) were reviewed. All surveys were conducted using 30 min. hauls with the same bottom trawls in a range of depths mainly between 750-1 500 m,

although in 1995 some area between 500-750 m was also surveyed. Biomass indices for commonly surveyed strata among years varied considerably and were difficult to reconcile. In Div. 3K, the estimates ranged from 17 000 tons in 1991 to 7 000 tons in 1994 and 19 000 tons in 1995. For Div. 3L, the estimates were 13 000 tons in 1991, 6 000 tons in 1994 and 15 000 tons in 1995. In Div. 3M, the estimates varied from 16 000 tons in 1991 to 5 000 tons in 1994 and 8 000 tons in 1995.

STACFIS noted the results of these 3 surveys should be viewed with some caution because there was variation in timing of surveys, by different ships, with different sampling designs, although this was mainly a concern with the timing and design of the 1991 survey. It was observed nevertheless, that fish were distributed generally in a similar pattern in Div. 3KLM, in all years. The abundance and biomass at age 7+ was greater in 1991, than in either 1994 or 1995, however, there was a considerably higher abundance of ages 3 to 6 in both the 1994 and 1995 surveys than in the 1991 survey. There were very few fish older than age 9 observed in 1994 and 1995. Biomass of age 9+ showed a considerable reduction between 1991 and 1994-95.

EU stratified-random surveys in Div. 3M (SCR Doc. 95/26). These surveys indicated that Greenland halibut biomass on Flemish Cap in depths to 730 m ranged from 4 300 tons in 1989 to 8 500 tons in 1992. The survey estimate in 1992 was similar to the value estimated in 1991 at 8 000 tons. The estimated biomass from this survey series in 1993 declined to 7 200 tons, but increased again to about 7 900 tons in 1994. While the estimates from these surveys were not indicative of the total biomass in Div. 3M and were outside the commercial fishery area they were stable during 1991-94 at about 8 000 tons within the survey area. The results could only be interpreted as an index of the population in depths to 730 m. The age composition data indicated that the abundance in 1992 was dominated by the ages 5-7 or the 1985-87 year-classes and that the 1993 survey was also dominated by the same year-classes in 1993 at ages 6-8. The 1994 survey was largely dominated by ages 6-7 and few fish older than age 9 were encountered in any of these surveys.

Japanese stratified exploratory survey (SCR Doc. 95/48). During the winter of 1995, an exploratory survey was conducted around the northern half of the Flemish Cap. Sets were chosen arbitrarily and the gear used had a 140 mm mesh size in the codend with no liner. Given these constraints, STACFIS had great difficulty in putting the results in the context of other survey observations. Nevertheless, biomass estimates for the areas surveyed were in the order of 11 000 tons for Div. 3L (at a depth range of 732-1 280 m) and 15 000 tons for Div. 3M (at a depth range of 551-1 463 m). Most fish were in a length range of 35-50 cm.

EU stratified-random survey in Div. 3NO Regulatory Area (SCR Doc.95/55). During the spring of 1995, a stratified-random bottom trawl survey was conducted by EU-Spain in the Regulatory Area of Div. 3NO at depths less than 732 m. The estimated biomass was about 2 800 tons. The size composition was bimodal with modes at 20 cm and 32 cm which probably represent mainly ages 2 and 3, respectively.

iii) **Biological studies**

Maturity in Greenland halibut (SCR Doc. 95/28, 29, 54). A number of detailed analyses of Greenland halibut sexual maturity data were reviewed. A histological assessment of oogenesis from samples collected in the Regulatory Area of Div. 3LM indicated that the Greenland halibut population may have a protracted spawning season with several peaks during the year (SCR Doc. 95/28), however, this was not consistent among years. A review of temporal and spatial variation in length-at-maturity in the Regulatory Area of Div. 3LM and 3NO was also considered (SCR Doc. 95/29). Estimates of L_{50} (length at 50% maturity) were stable at about 65-68 cm indicating that the age at maturity is at least 10 years.

A probit analysis of Canadian autumn survey data in Div. 2J and 3K and deepwater surveys in Div. 3K, 3L and 3M was also presented (SCR Doc. 95/54). This study reported very high spatial and temporal variability in the size and age at M_{50} (50% maturity level). The average age at M_{50} for female Greenland halibut based upon combining the 1991, 1994 and 1995 Canadian deepwater survey data in Div. 3K, 3L and 3M is 10.8 years.

Area of distribution index (SCR Doc. 95/58). An index of concentration (area of distribution) was developed for Greenland halibut using distribution data from Canadian autumn surveys in Div. 2J and 3K beginning in 1977 and 1978, respectively. The analysis was conducted using a standard econometric technique known as the Gini index. The results based on this analysis indicated that Greenland halibut were more widely distributed in the surveyed areas during the late-1970s and early-1980s compared to the late-1980s and early-1990s. However, there was some question as to how the index was calculated and further investigation is required.

Biological limits of over exploitation for Greenland halibut. An investigation was presented on the biological limits of exploitation of Greenland halibut based upon limitations imposed by the reproductive biology of the species. The analysis confirmed the well-recognized view that exploiting individuals of a fish stock many years before they have reached sexual maturity puts the stock at risk of biological collapse, even at relatively low levels of fishing mortality. Higher rates of exploitation could be sustained if the time span between the age of recruitment to the fishery and that of sexual maturity is reduced. On the basis of recent and historical data, the analysis assumed that Greenland halibut in the Northwest Atlantic recruit to the fishery at age 5 and that most females reach sexual maturity at about age 14. Given this scenario, it was suggested that this stock, with its low reproductive capacity, was highly sensitive even to low fishing mortality rates and that fishing immature fish should be avoided wherever possible.

STACFIS welcomed the development of methods by which limits to the rate of exploitation may be defined. However, it was felt that further development and testing of the method was required.

c) **Assessment Results**

According to most indices of biomass that were evaluated, the stock had declined significantly in recent years. The decline was particularly in evidence in shallower parts of Div. 2J, 3K and 3L where, traditionally, the Canadian fishery took place. Recent CPUE data for deeper water in Div. 2G, 2J and 3KL also suggested rapid declines in abundance in such depths. The magnitude of the decline appeared less severe in the Regulatory area. This may be associated with migration of fish from more northerly areas as concluded by STACFIS in previous years' assessments.

The abundance of older fish in the stock (age 10+) remained low. The catch of commercial fishing vessels still exhibited a wide range of age groups but most of the catch was comprised of young, immature fish most of which were several years younger than the age of sexual maturity.

Several sources of data from both 1993-94 and 1994-95 indicated that the 1990 and 1991 year-classes were of above average abundance, but the relative magnitude was difficult to determine. The 1990 year-class was believed to be of above average abundance also in the 1994 assessment. The more recent data were less clear as to the strength of this year-class but suggested, nevertheless, that it was at least average and may be above average as previously indicated.

In its 1994 assessment, STACFIS concluded that the fishery has been, in recent years, exploiting this stock well above levels which may be considered sustainable. In the 1994 assessment, all available stock indicators (survey results and catch rates in commercial fisheries) suggested a significant decline in stock size since the late-1980s up to 1994 particularly among the older age groups (10+). Most data from the current assessment confirmed this view although there was some indication of improved recruitment.

d) **Recommendations**

STACFIS noted that length and age frequency data from the 1994 Canadian commercial fishery of Greenland halibut in Subarea 2 + Div. 3KLMNO was not available, which made it difficult to fully evaluate the 1994 fishery, and STACFIS therefore **recommended** that *the most up-to-date data be made available for the June 1996 Meeting.*

15. **Roundnose Grenadier in Subareas 0 and 1** (SCR Doc. 95/23; SCS Doc. 95/4, 6, 12, 14)

a) **Introduction**

A total catch of 33 tons, have been reported for 1994 compared to 198 tons for 1993 (Fig. 41).

Recent catches and TACs ('000 tons) are as follows:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Catch	0.1	0.4	0.5	0.08	0.29	0.19	0.12[1]	0.20[1]	0.03[1]	

[1] Provisional

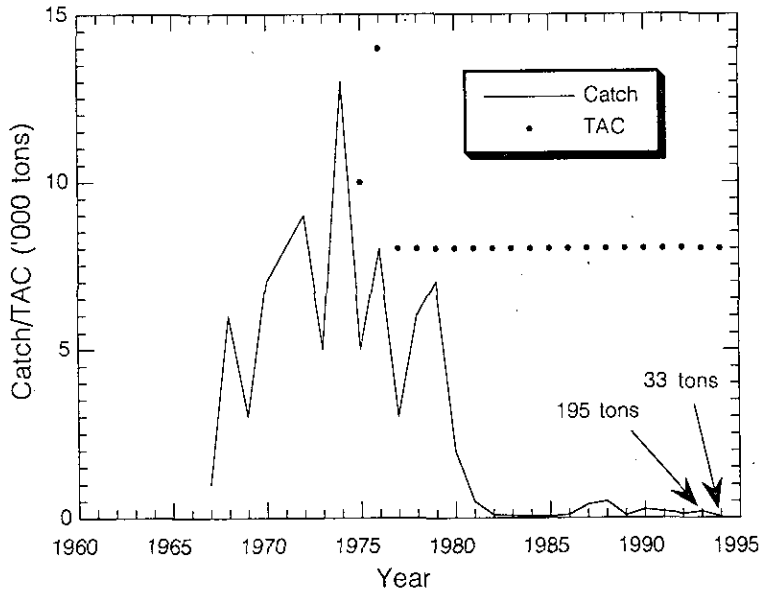


Fig. 41. Roundnose grenadier in Subareas 0+1: catches and TACs.

b) **Input Data**

i) ***Commercial fishery data***

There has been no directed fishery for roundnose grenadier in Subareas 0+1 since 1978. No update of the catch/effort analysis which was presented previously (NAFO Sci. Coun. Rep., 1985, p. 72) was possible. The by-catch in the Greenland halibut fishery, which was mainly roundnose grenadier, was reported to constitute 5-10% of the Greenland halibut catches. There was, however, a discrepancy between this information and the reported catches. This might be due to discarding without reporting, at least in Subarea 1.

ii) **Research survey data**

Since 1987 Japan in cooperation with Greenland has conducted bottom trawl research surveys in Subarea 1. The trawlable biomasses ('000 tons) in Div. 1CD for the depth range 400-1 500 m were estimated as follows:

Year	1987	1988	1989	1990	1991	1992	1993	1994
Biomass	45.8[1]	44.0[2]	5.9[3]	20.3[4]	41.7[4]	40.2[4]	8.2[4]	3.0[4]

[1] June/July depth 400-1 000 m,
[2] September/October.
[3] April/May,
[4] August/September.

In 1994 a survey was conducted in August. The survey gave an estimated biomass of 3 000 tons, which was the lowest level recorded in comparable surveys and a significant drop from 40 200 tons in 1992 through 8 200 tons in 1993 (Fig. 42). Only a few roundnose grenadier were taken at depths less than 600 m and 80% of the biomass was found in Div. 1D >1 000 m.

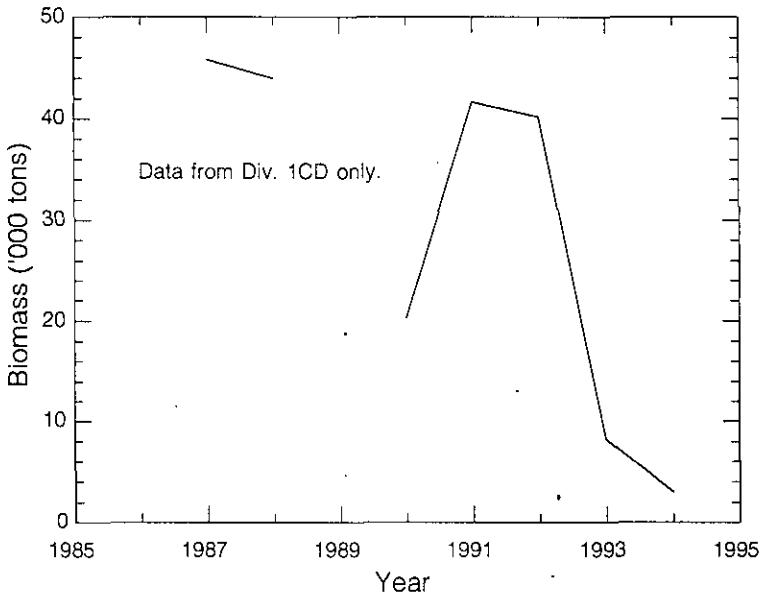


Fig. 42. Roundnose grenadier in Subareas 0+1: biomass estimates from surveys in Div. 1CD.

The joint Japan/Greenland surveys did not cover the entire stock area as roundnose grenadier also occur deeper than 1 500 m and Subarea 0 was not included in the estimate. A Canadian survey in 1986 gave a biomass estimate for Subareas 0+1 of 110 000 tons, of which 90% was found in Subarea 1. USSR and GDR have conducted surveys covering both Subareas 0+1 in 1987, 1988 and 1990, and STACFIS **recommended** that *the biomass estimates of roundnose grenadier from these surveys should be presented at the June 1996 Meeting.*

c) **Assessment Results**

Although the trawlable biomass for Subarea 1 was an underestimate of the total, the data showed a drastic decrease in estimated biomass during the last three years. The decrease in biomass can not be explained by fisheries, but may be due to changes in distribution and/or environmental factors.

16. **Roundnose Grenadier in Subareas 2 and 3** (SCR Doc. 95/48, 51, 61; SCS Doc. 94/4, 13, 15) (with some comments on roughhead grenadiers)

a) **Introduction**

Catches of roundnose grenadier averaged about 26 000 tons prior to 1979, but since then have only averaged slightly less than 4 000 tons (Fig. 43). Catches in the Regulatory Area by EU-Spain and EU-Portugal taken as by-catch in the Greenland halibut fishery represent a mix of both roundnose and roughhead grenadiers. From 1987 to 1994 the catches of roughhead grenadier exceeded those of roundnose in the Regulatory Area.

Nominal catches, revised catches, and TACs ('000 tons) for roundnose grenadier in the recent period are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992[1]	1993[1]	1994[1]	1995
TAC	11	11	11	11	11	11	11	11	11	3[2]	3[2]
Catch[3]	5	7	7	5	5	1	1-10[4]	3	4		
Catch[5]	5	7	8	6	5	4	9-14[4]	8	11	3	

[1] Provisional data.
[2] Inside Canadian zone only.
[3] Includes adjustments reported in SCS Doc. 94/13, and SCR Doc. 94/29.
[4] Includes estimates of misreported catches which could not be determined precisely.
[5] Original as reported to NAFO.

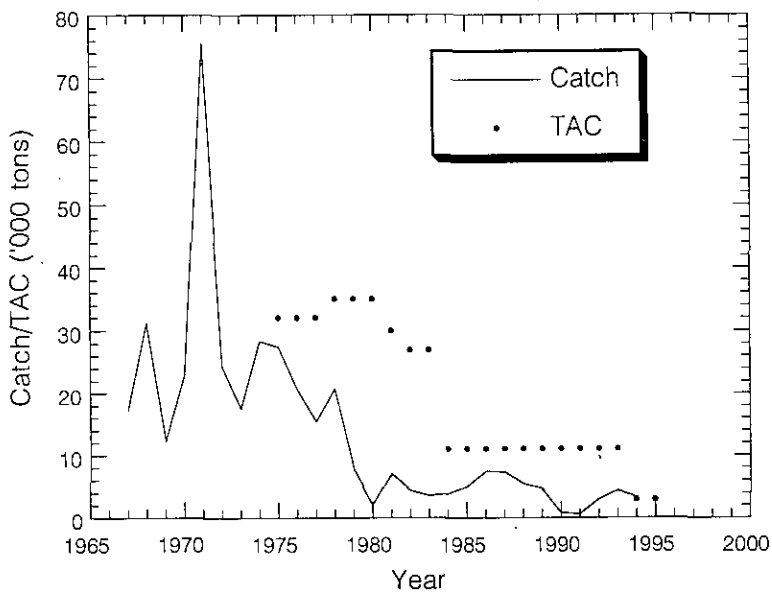


Fig. 43. Roundnose grenadier in Subareas 2+3: catches and TACs.

The estimated 1994 catch was 3 369 tons, down from about 4 408 tons in 1993. There had been no fishing effort by the EU-Germany or USSR/Russian Federation since 1990. Whereas their fisheries traditionally took place in the Canadian zone, primarily in Div. 3K, catches beginning in 1992 have been totally from the Regulatory Area. In 1993 and 1994 there were no allocations to non-Canadian vessels inside the Canadian zone.

Catches of roughhead grenadiers in the Regulatory Area ('000 tons) have been estimated to be:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Catch	0	+	1	1	0.3	3	4	5	6	5

b) **Input Data**

i) **Commercial fishery data**

Because there was no fishery in the 'traditional' area inside the Canadian zone in 1994, there were no new commercial catch or effort data available for examination. Length frequency data for the by-catch fisheries in the Regulatory Area were available for roughhead grenadier only.

ii) **Research survey data**

Results from deepwater (750-1 500 m) surveys conducted by Canada in 1991, 1994 and 1995 all showed the largest concentrations of roundnose grenadier to be at about 51°N in Div. 3K, but also indicated that catches were taken throughout the survey area. Concentrations were not as great in the Sackville Spur area of Div. 3L, across the north of Flemish Cap, and in Flemish Pass. Estimates of trawlable biomass from these surveys indicated no change in Div. 3K between 1991 and 1994, but a decline of about 70% in 1995. Declines in both 3L and 3M were noted from 1991 to 1994, and again in 1995. There were overall declines of about 80% and 60%, respectively, in these two Divisions from 1991 to 1995. The biomass was lowest in Div. 3N of all surveyed Divisions in 1994 and 1995, but no decline between years was observed.

Estimates of biomass for roughhead grenadier were lower than for roundnose in Div. 3K in 1991 and 1994, but about the same in 1995. The biomass of roughhead grenadier in Div. 3LMN combined was about 8 times greater than that of roundnose grenadier in 1995. The biomass of roughhead grenadier in the survey area has increased steadily from 1991 to 1995.

17. **Capelin in Divisions 3N and 3O** (SCR Doc. 95/10)

a) **Introduction**

Nominal catches of capelin increased from about 750 tons in 1971 to 132 000 tons in 1975, but then declined again to only 5 000 tons in 1978. During this period, most of the catch was taken by USSR trawlers and Norwegian purse seiners. The fishery was closed from 1979 to 1986, but reopened during 1987-92 under quota regulation. During this period, the TAC was never reached; the largest catch of 25 000 tons was taken in 1990. The fishery was again closed in 1992, and the closure has continued through 1995.

Nominal catches and TACs ('000 tons) for the recent period are as follows (Fig. 44):

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Advised TAC	0	10	10	28	30	30	30	0	0	0
TAC	0	10	15	28	30	30	30	0	0	0
Catch	0	1	7	9	25	+	+[1]	+[1]	0[1]	

[1] Provisional.

b) **Input Data**

i) **Research survey data**

The mean estimate of biomass of capelin during 1975-77 based on acoustic surveys carried out by the USSR was 900 000 tons (Fig. 45). During 1981-88, the mean estimate was only 300 000 tons. The estimate from the 1994 survey was only 83 000 tons. This represented an approximate 50% reduction from the 1993 estimate. Virtually all of this biomass was located in Div. 3O.

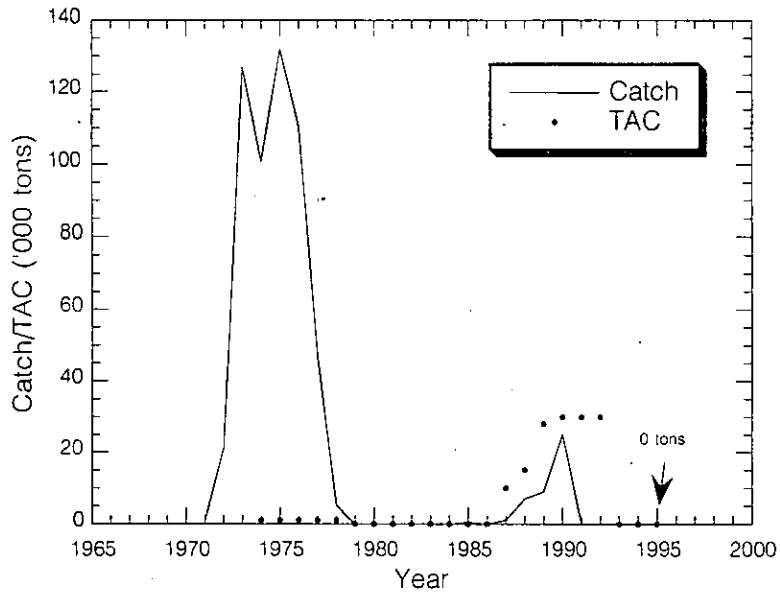


Fig. 44. Capelin in Div. 3NO: catches and TACs.

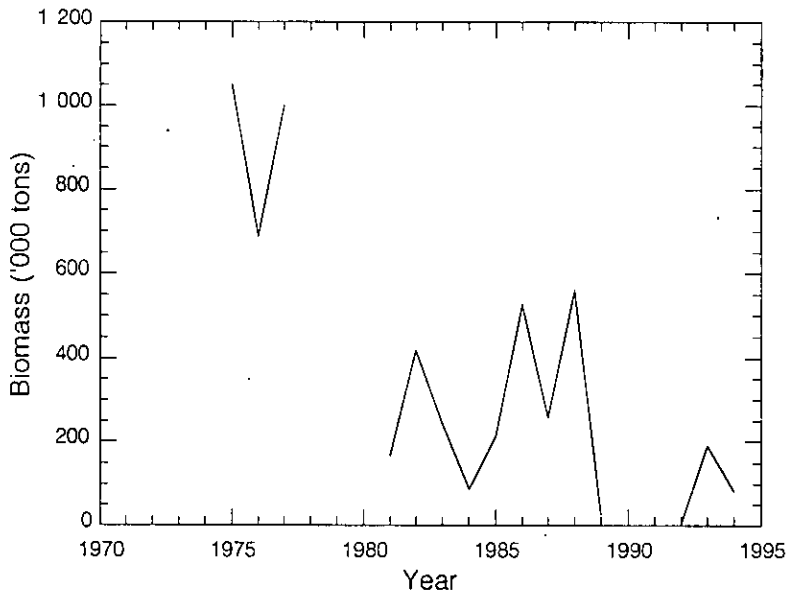


Fig. 45. Capelin in Div. 3NO: estimates of biomass from acoustic surveys.

In the past, STACFIS has been unable to determine the proportion of the biomass found in Div. 3O which would spawn in Div. 3L and in Div. 3NO. This was again the situation with the 1994 survey. Only low numbers of capelin were encountered in Div. 3L in 1994.

STACFIS also noted that the USSR/Russian acoustic biomass estimates have been presented for capelin in Div. 3LNO combined rather than separated by Division, and it was **recommended** that *in future, estimates of capelin biomass be provided separated by Division.*

STACFIS noted that Russia would not be conducting a survey for capelin in the Div. 3NO area in 1995.

18. **Squid in Subareas 3 and 4** (SCS Doc. 95/8, 12)

a) **Introduction**

Recent catches of *Illex* squid began increasing in Subareas 3 and 4 in 1989 and peaked at 11 000 tons in 1990, but declined again to only 2 000 tons in 1992. Since then, catches increased three-fold to 6 000 tons in 1994. Most of the 1994 catch was taken as by-catch in the silver hake fishery of Cuba. Recent catches (since 1989) have also increased in Subareas 5 and 6. No information on the 1994 catch from these areas was available.

Nominal catches and TACs ('000 tons) in the recent period are as follows (Fig. 46):

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC[1]	150	150	150	150	150	150	150	150	150	150
Catch (SA 3+4)	1	+	1	7	11	4	2[2]	3[2]	6[2]	
Catch (SA 5+6)				7	12	12	18[2]	18[2]		

[1] For Subareas 3 and 4 only.
[2] Provisional.

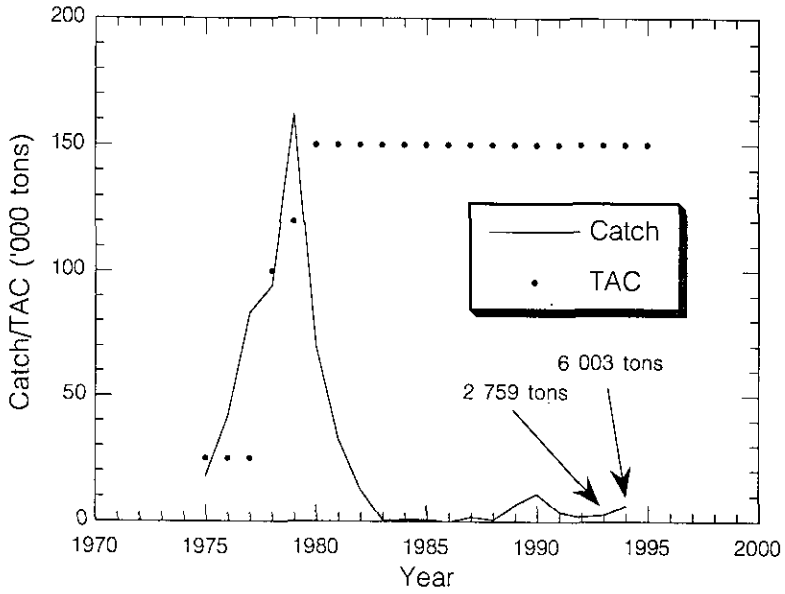


Fig. 46. Squid in Subareas 3+4: catches and TACs.

b) **Input Data**

There were no data available for review.

19. **Other Finfishes in Subarea 1** (SCR Doc. 95/4, 5, 23; SCS Doc. 95/6, 12, 14)

a) **Introduction**

Catches of Greenland cod, American plaice, Atlantic and spotted wolffishes, starry skate, lumpsucker, Atlantic halibut and sharks have been taken by offshore trawl fisheries directed to shrimp, cod, redfish and Greenland halibut, by longliners operating both inshore and offshore and by pound net and gillnet fisheries in inshore areas only. The statistics of these by-catches seem to be poorly reported in general. In 1994, reported catches of these species amounted to 3 373 tons representing an increase of 26%, as compared to the 1993 catch (2 500 tons) and 12% of the total finfish catch. Landings of Greenland cod (1 833 tons) and 'not specified' catches (629 tons) dominated the reported catch of other finfishes by 54% and 19%, respectively.

b) **Input Data**

i) **Research survey data**

EU groundfish survey. Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys commencing in 1982 by EU-Germany. These surveys covered the areas from the 3-mile line to the 400 m isobath of Div. 1B to 1F, and were primarily designed for cod as target species. During 1982-94, survey results indicated fundamental shifts in species composition of the demersal fish assemblage inhabiting the shelf and continental slope off West Greenland in Divisions 1B-1F down to 400 m depth. These observations happened in coherence with dramatic changes in stock abundance, biomass and size structure for ecologically and economically important species. Recent decreases of biomass estimates for demersal stocks of cod, American plaice, Atlantic and spotted wolffish and starry skates vary between 73% and almost 100% (Fig. 47), losses in abundance being less pronounced. Length distributions revealed that these stocks were mainly composed of small and juvenile fish at present.

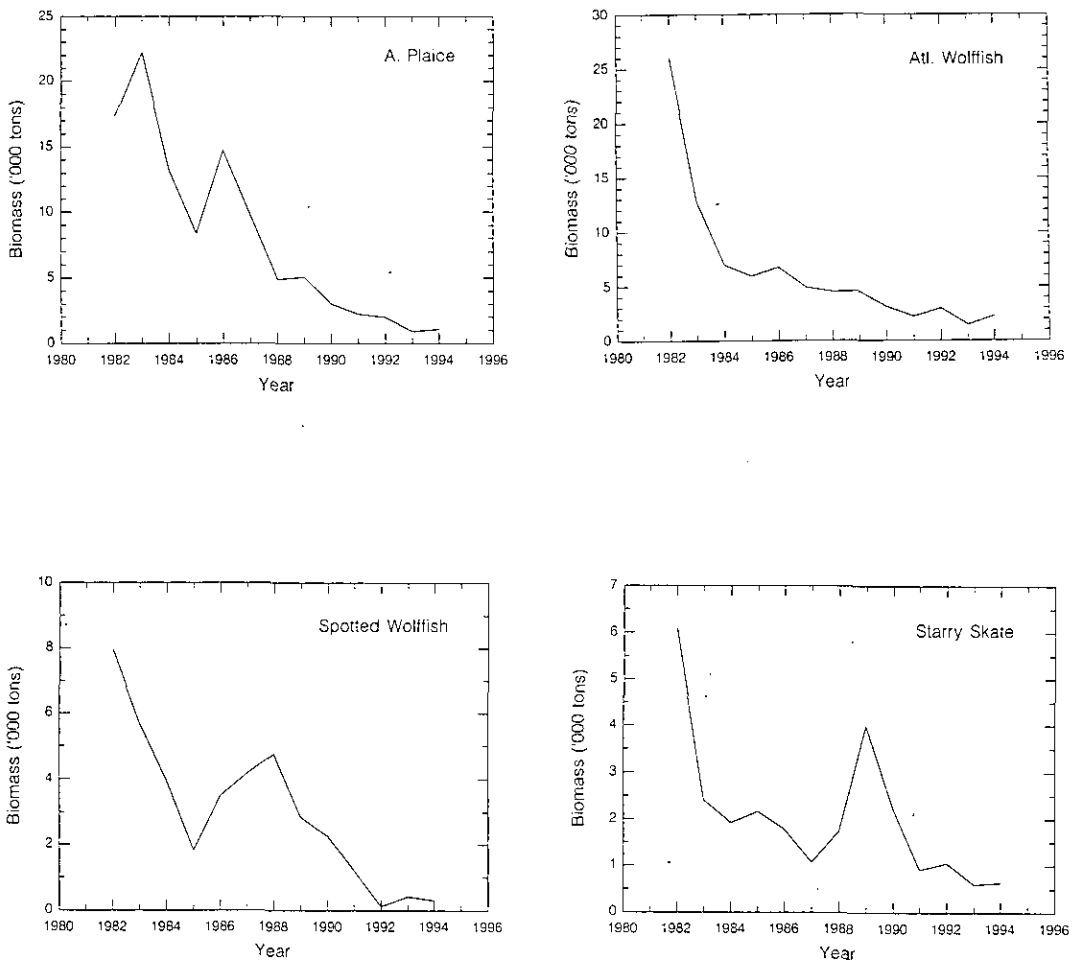


Fig. 47. Finfish in Subarea 1: estimates of biomass, from surveys, of various finfish species.

Greenland-Japan groundfish survey. Since 1987, cooperative trawl surveys directed to Greenland halibut and roundnose grenadier have been conducted on the continental slope in Div. 1A-1D at depths between 400 m and 1 500 m. In August 1994, one stratified random bottom trawl survey was carried out. The estimated biomass of most species classified as other finfishes contributed 5% to the total finfish catch and continued to decline since 1992 to lowest values of the time series (Fig. 47).

c) **Assessment Results**

In view of dramatic declines in survey abundance and biomass indices to an extremely low level along with significant reduction in fish sizes, STACFIS concluded that the demersal stocks of cod, American plaice, Atlantic and spotted wolffish and starry skates are severely depleted. The status of the demersal fish assemblage stagnated at that low level since 1990 lacking any signs of recovery.

V. AGEING TECHNIQUES AND VALIDATION STUDIES

1. Silver Hake Ageing Methodology Report

Canadian scientists reported that, in accordance with the recommendations of 1994, work on the silver hake ageing manual was progressing but the report could not be completed in time for the present meeting.

2. Report on the Otolith Exchanges of American Plaice and Greenland Halibut

STACFIS noted that an exchange of American plaice otoliths from various areas in the Northwest Atlantic had been completed some time ago by age readers of several countries. As well, an exchange of otoliths and scales from Greenland halibut had taken place. Scale reading of Greenland halibut was difficult and sometimes impossible for many of the participants, due to the condition of the scales and lack of proper equipment. Thus, full comparison of readings between scales and otoliths was not possible.

STACFIS noted that preliminary results of all exchanges had been examined, and all results will be sent to the exchange participants in the next few weeks. Further work on Greenland halibut scale/otolith comparisons was unlikely for the present, due to the transfer of the coordinator of this work to a different job. Additional work on standardizing the ageing of Greenland halibut and American plaice otoliths was continuing among institutes of various countries.

3. Other Ageing and Validation Studies

a) **Information on an ICES Redfish Ageing Workshop**

STACFIS noted that an ICES redfish ageing workshop had been scheduled to be held in Bremerhaven, Germany, in late-1995 and would be interested in having a summary of this workshop presented during the June 1996 Meeting.

VI. GEAR AND SELECTIVITY STUDIES

1. Reports on Redfish Selectivity Studies

Russian investigations (SCR Doc. 95/25, 80). A Russian selectivity study on redfish in Div. 3N was conducted in 1994 with mid-water trawls using mesh-sizes ranging from 88 mm to 132 mm, based on the covered codend technique. Even with 88 mm mesh, some fish as large as 34 cm escaped from the trawl. Redfish above 34 cm in length were a minor component of the catch, comprising only 0.9-2.2% of the catch. A trawl with 88 mm mesh allowed escapement of 31% of fish, that with 118 mm mesh - 65%, and that with 132 mm mesh - 90% of fish (by weight).

Investigations conducted in the Barents Sea showed that from 18 to 30% of the total escapement occurred during trawl retrieval and these fish were assumed to die due to the hydrostatic change and other injuries. Computation of the long-term advantage due to increasing mesh sizes in trawls, and hence increased escapement of small fish, indicated that during a transition (intermediate) period of 10 years these long-term

advantages will not compensate for losses due to escapement mortality related to increasing mesh size up to 120 mm and 130 mm.

A total positive effect for the fishery during a 15-year intermediate period will be possible only at fishing mortality of 0.25-0.30. A change from 88 mm mesh to 118 mm or 132 mm mesh will result in decrease of fishing efficiency by 1.9 and 3.8 times, respectively, based on the present size distribution in this stock. To catch the TAC a larger fishing effort will be required which will result in the multiple escape of small-size redfish through the mesh and, consequently, in higher levels of injury and probable death of fish.

Canadian investigations. Redfish mesh selectivity experiments were carried out by Canada in Subdiv. 3Ps to derive selectivity parameters for nominal mesh sizes of 90 mm, 105 mm and 115 mm in bottom trawls using the trouser trawl method. Selectivity parameters for each mesh size were calculated based on data from codends rigged with and without lastridge ropes (88% hanging ratio). Lastridge roped codends allowed more small fish (<23 cm) to escape while retaining more commercial sized redfish. Lastridge ropes allow the meshes to remain slack and open, with the strain of the catch taken by the ropes and not the meshes. Thus, escapement is increased and survival is assumed to be higher than for fish escaping during haulback. With respect to 23 cm redfish, currently accepted as the commercial minimum fish size by the Newfoundland fleet, optimal selectivity was obtained using the 90 mm nominal mesh size with lastridge ropes.

STACFIS considered that the redfish fishery in Div. 3LN with trawls with mesh over 90 mm may not result in significant long-term gains in yield if assumptions of high escapement mortality during haulback for this species are correct. The catch composition would include substantial numbers of fish, which for females, would be several years younger than the age of maturity. This generates the concern that exploiting individuals of a fish stock many years before they have reached sexual maturity puts a stock at risk of biological collapse even at relatively low levels of fishing mortality. This suggests that a fishery for redfish, using 90 mm mesh, needs to be controlled carefully.

2. **Greenland Halibut Selectivity Experiments**

Two papers were presented at the meeting. A summary of a third paper was reviewed (SCR Doc. 81/IX/89) to check for comparable results.

Norwegian investigations (SCR Doc. 95/22). Selectivity parameters were derived for the 135 mm mesh codend using alternate haul technique. An L_{50} of 36 cm was derived based on 3 pairs of alternate hauls using a control mesh size of 100 mm. The authors expressed concerns that the selectivity data had too few points in the lower end of the size range. Further selectivity work is planned.

EU investigations (SCR Doc. 95/47). Selectivity parameters were derived for a 130 mm mesh codend using the covered codend technique. Selectivity parameters calculated for different haul durations showed that length of haul influence the estimates of selection parameters. Hauls of one hour produced an L_{50} of 38.7 cm while hauls of four hours produced an L_{50} of 37.7 cm. This influence of haul duration was more pronounced in the L_{25} parameters resulting in an L_{25} of 34.5 for 1 hour hauls and an L_{25} of 30.5 cm for 4 hour hauls.

Earlier Russian investigations (SCR Doc. 81/IX/89). This paper was the very first one presenting data on selectivity of bottom trawls for Greenland halibut with 117, 124, 127, and 133 mm meshes in Subarea 0,and Div. 2HJ, 3K.

The selectivity was estimated using a covered codend technique with only the top panel covered. The experiments showed that 127 mm mesh permits escapement of Greenland halibut up to 55 cm long and that some fish up to 67 cm long fish escaped from 133 mm mesh. Mean length of Greenland halibut retained by the codend with 117 mm mesh in Div. 2J was 41.6 cm, with a 127 mm mesh was 44 cm. Fish retention by the codend was 92.3 and 89.9%, respectively (by weight).

Derivation of selection parameters from the analysis of the data and the selectivity curves in the paper point to an obvious masking effect of the codend cover, thus parameter estimates of L_{50} for 127 mm (38.5 cm) and L_{50} for 133 mm (42.5 cm) should be treated with caution. The authors also noted that differences in size composition in the various areas seriously affected selectivity. Greenland halibut fishery should not exceed 35 cm, whereas minimal mesh size should not be over 120 mm.

VII. OTHER MATTERS

1. Review of Arrangements for Conducting Stock Assessments and Documentation of Assessments

A number of issues were raised in the discussion of this agenda item. There was general agreement that there was some merit in separating the processes of determining stock status (STACFIS) and formulation of advice for the stocks (Scientific Council), as has been done this year. However, it was thought that Designated Experts would probably benefit from some guidance in preparing drafts of prognoses for review in Scientific Council.

There were continuing problems with getting correct data to the Designated Experts prior to the meeting which, as was the case in recent years, delayed completion of many assessments until the latter part of the meeting. This also impacted negatively on the peer review process, as many of the Designated Experts were unable to participate fully in the assessments of all stocks until their own work had been completed. There were no obvious solutions to this problem, but the situation may improve once the reporting of catches improves.

2. Other Business

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

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

Chairman: C. A. Bishop Rapporteur: E. F. Murphy

The Committee met at Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada on the 10 and 15 of June 1995, to discuss various matters pertaining to statistics and fisheries research referred to it by the Scientific Council. Representatives from Canada, Cuba, Denmark (in respect of Faroe Islands and Greenland), European Union, Japan and Russian Federation and an observer from the United States of America were present.

1. Opening

The Chairman opened the meeting welcoming participants. E. F. Murphy (Canada) was appointed rapporteur.

The status of recommendations from the 1994 meetings of STACREC were reviewed. It was agreed that most of the recommendations would be addressed in the agenda of this meeting, and no further consideration would be needed.

2. Fisheries Statistics

a) Progress Report on Secretariat Activities in 1994/95

i) Acquisition of STATLANT 21A and 21B reports for recent years

STACREC remained concerned about ongoing delays in receipt of national statistics reports although some improvements were observed since the June 1994 Meeting.

The 1994 STATLANT 21A reports have not been received for many nations and this meant that the update of fisheries trends could not be produced for the June Meeting. While most submissions had been received, the USA data were reported to be delayed as a result of a change in the reporting system commenced in 1994.

STACREC noted that data outstanding from EU-France since 1988 had been received. While some clarifications were needed, it was agreed that the next publication of the Statistical Bulletin would contain these data.

ii) Acquisition of statistical information from other NAFO Standing Committees

STACREC noted that some information in Reports and Working Papers of other Standing Committees was being used by Designated Experts in the stock assessment process . It was felt the use of this information could be better facilitated if Designated Experts were kept informed of the available Working Papers and Reports. It was agreed that the Secretariat should forward lists of such documents to the Designated Experts.

iii) Publication of statistical information

NAFO Statistical Bulletin, Volume 41 containing 1991 data was published in February 1995. This Bulletin did not contain data from France - St. Pierre and Miquelon as the 1991 data had not been received.

STACREC noted that outstanding data from EU-France and France - St. Pierre and Miquelon has since been received for the period 1988 to 1994. Data were presently being finalized for publication of NAFO Statistical Bulletin, Volume 42, with 1992 data, in July 1995. STACREC noted the Bulletin will report the French data.

The deadline for submission of STATLANT 21B reports for 1993 data was 30 June 1994. As of May 1995, data were still outstanding from several components and these data were delaying the publication of NAFO Statistical Bulletin, Volume 43.

STACREC welcomed the publication in April 1995 of the supplementary issue of the NAFO Statistical Bulletin listing catches of selected species by stock area and country, for the 1960-90 time series. Recognizing the importance of these data, STACREC again reviewed the format of decadal summary of catches (SCS Doc. 95/5). It was indicated that this document gets considerable use and any improvements to the format should be included. Some changes suggested were to not include listings for countries which continually report zero catch in the Convention Area and to use a dash (-) to differentiate them from non-reported in a particular year. STACREC also noted the addition of a table listing Non Specified Flounder for Subareas 3, 4 and 5 would be useful.

STACREC proposed that all users should review the document in its current state and submit any recommended changes to the Secretariat in writing. These suggested changes could then be reviewed by STACREC to avoid any confusions and yearly *ad hoc* changes in format.

STACREC was informed that recent statistical information on seals published in the Statistical Bulletin did not correspond with catch numbers reviewed by the ICES/NAFO Working Group on Harp and Hooded Seas. Working Group representatives agreed to clarify these catches for revisions.

iv) **Consideration on non-availability of data**

STACREC noted that the absence of some STATLANT 21A data had in recent years delayed the compilation of provisional catches in time for the assessment of stock during the June Meetings of the Scientific Council. The SCS Doc. 94/24 containing provisional catches for 1993 was not distributed until November 1994, well after the June Meeting requirements. The SCS Document containing the 1994 data could not be prepared for this meeting as submissions had not been made by a number of major fishing nations.

v) **Documentation of catches used in the assessment process**

STACREC expressed concern that there has been a persistent divergence in recent years, between the 'official' nominal catches reported in STATLANT forms by national offices, and are included in the Statistical Bulletins, and those that are available from other sources and used in assessments.

STACREC agreed these deficiencies should be indicated to the users. Several options were considered. These included: i) a statement at the beginning of the Statistical Bulletins directing researchers to the relevant assessment documents which would report the actual catches used; ii) to add a line indicating the agreed total for each stock and year, to the decadal summaries of catches of selected species by stock area and country as reported in the SCS Document series. There was discussion as to which total the Secretariat should use, as these catch totals tended to vary from year to year. It was suggested that some clarifications could be made if the Designated Experts provided the Secretariat with the accepted totals each year. However, it was also felt this problem may be less of an issue if 100% observer coverage was agreed to by the Contracting Parties. This discussion was not conclusive and it was agreed that it would have to be addressed in the future. It was agreed, however, that the process of how accepted catches were derived during this meeting would be documented in a section of the STACFIS report titled Review of Catches, and a table with the agreed catches would be included.

b) **Report of the CWP 16th Session and Review of STATLANT 21 Forms**

i) **Report of CWP 16th Session**

The Report of the 16th Session was tabled (SCS Doc. 95/9) and some key points were reviewed. STACREC noted the role of CWP was changing in that there were more organizations participating and the focus was becoming more global as had been agreed to by NAFO and other international bodies that formed the CWP. The new CWP Statutes as approved by General Council and Scientific Council in 1994, which included the

removal of the word 'Atlantic' from the title and Terms of Reference, were adopted by CWP. STACREC was informed on 14 June 1995, by the CWP Secretariat that FAO had approved the new statutes on 12 June. Since NAFO and ICES (the other founding members) had already adopted them in 1994, the new Statutes now come into force for the CWP.

STACREC observed that the long history of NAFO (and ICNAF) offers an extensive knowledge-base to the CWP and its young and new member organizations. It was pointed out that NAFO is a well respected member of CWP and many of the issues addressed by NAFO are also valuable contributions to the CWP and many of it's members. Problems with misreporting of catches and errors in databases, are global and CWP looks to NAFO for input on how to resolve or minimizes these problems.

ii) **STATLANT data and discrepancies in databases**

STACREC noted that most of the discrepancies between the NAFO and FAO databases have been resolved but the review process was ongoing. Many discrepancies were created because FAO was using STATLANT 21A, whereas the finalized data at NAFO were the STATLANT 21B data.

Some discrepancies still remaining were mainly the result of Contracting Parties changing status. The breakup of the former Soviet Union and the reunification of Germany are two examples. The data discrepancies are being continually worked on and are becoming fewer.

iii) **Proposals for CWP *Ad Hoc* Consultation**

In preparation for the 17th Session of CWP, *Ad Hoc* Consultation is planned for July 1996 in Rome. It has been a practice of the Scientific Council to send representation to these meetings and STACREC **recommended** that *the Assistant Executive Secretary attend the Ad hoc Consultation in July 1996.* It was noted that with CWP moving towards a global approach there would probably be some meetings that NAFO would not be able to attend. It was felt that consultation meetings should offer the opportunity to meet on a regional basis so that the concerns unique to the Atlantic could be addressed. In accordance with the views expressed by the General Council, STACREC **recommended** that *the Scientific Council request the CWP to ensure that meetings of regional interests should be held as needed by regional member organizations.*

STACREC agreed that the *ad hoc* Consultation would be valuable meeting to forward NAFO's interests to the CWP and further consideration be given to issues that the Scientific Council wishes to bring forward to the agenda of the 17th Session.

iv) **Consideration of CWP 17th Session**

At the CWP Meeting, tentative plans were made for the 17th Session of CWP. CCAMLR indicated it was prepared to host the 17th Session of CWP at Hobart, Australia. The CWP members were requested to confirm if this venue was suitable by October 1995. An alternative venue suggested was the EUROSTAT office in Luxembourg. STACREC discussed the invitation and **recommended** that *as in the past the Chairman of STACREC and the Assistant Executive Secretary should attend as NAFO representatives and the Scientific Council may at a later date propose a national representative as well.* The issue of cost of travel was discussed. STACREC observed that with advance planning and use of discounted airfares, the cost of participating at either site would be quite similar.

v) **World Fisheries Congress Second Meeting**

The 2nd World Fisheries Congress will be held 28 July-2 August, 1996, in Brisbane, Australia. STACREC saw the significant value of presenting the long and relatively unique experiences of NAFO (and ICNAF) to that meeting. It was felt that the NAFO experiences would be valued globally, particularly, in the management of high seas fisheries, and also enhance NAFO's image. STACREC accordingly, **recommended** that *Scientific Council*

bring the 2nd World Fisheries Congress to the attention of the General Council and Fisheries Commission and propose that there be attendance as well as a presentation describing NAFO's experiences.

3. **Biological Sampling**

a) **Report on Activities in 1994/95**

The Provisional List of Biological sampling for 1992 was tabled (SCS Doc. 95/11).

b) **Report by National Representatives**

National representatives reported on their sampling programs of commercial fisheries for 1994/95 as follows:

Cuba. No sampling, no fishing.

Canada. Canadian commercial fisheries in 1994 were reduced because of a moratorium and reduced TACs. Data relative to length and age were collected for most commercial catches as required from Subareas 2 to 5. Sampling at sea was accomplished by observers and extensive sampling was conducted on the Div. 2J+3KL and Subdiv. 3Ps cod food and subsistence fisheries.

Denmark-Greenland. Biological samples were obtained in 1994 from the commercial fishery in Subarea 1.

EU-Denmark. No sampling.

EU-France. No sampling, no fishing.

EU-Germany. No sampling, no fishing.

EU-Portugal. During 1994, biological sampling was obtained from one stern trawler fishing in all Divisions from January and another fishing Div. 3M in December. One gillnetter was also sampled from May to July in Div. 3M and 3O, and throughout the last quarter in Div. 3M. In all vessels, biological sampling was conducted on the most abundant species in each haul.

During the first half of the year cod, American plaice, Greenland halibut and redfish were sampled in trawl catches on the Nose and Tail of the Grand Banks. By the end of June cod and redfish trawl catches were the only ones sampled on the Flemish Cap. In Div. 3M, cod catches were sampled in March, June and December. However for gillnets, cod and redfish catches were sampled from September to December. Information on age composition was also collected.

A catch and effort data series for Portuguese trawl and gillnetters fisheries in the Regulatory Area has been reconstructed through revisions of skipper logbooks supplied from 8 trawlers and 5 gillnetters.

EU-Spain. During 1994 sampling of catches by Spanish fleet was obtained by observers on board. Length and age samples were obtained for Greenland halibut and cod, and length measurements were obtained for redfish, American plaice, witch flounder and roughhead grenadier.

Coverage included 9 pair trawler units (with one observer), 11 small freezer trawlers, with four observers and 27 large freezer trawlers (with approximately 1/3 of this fleet's catch covered).

Japan. No sampling.

Russian Federation. Data were obtained relative to length and age for redfish in Div. 3L and relative to length for Greenland halibut in Div. 3M and 3L, and for redfish in Div. 3M.

c) **Data Necessary for Stock Assessments** (Table 1)

The available data from commercial fisheries by stock, relative to the assessments are given in Table 1.

Table 1. Available Data From the Commercial Fisheries Related to Stock Assessment (1994).

			Biological Sampling					
Stock	Country[1]	Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
2J3KL Cod	CAN	+		X	X	X		
	E/ESP	+						
3M Cod	E/PRT	+	X		X	X		
	E/ESP	+	X		X	X		
	OTHER	+						
3NO Cod	CAN	+						
	E/ESP	+						
	E/PRT	+		X	X	X		
	OTHER	+						
SA 1 Redfish	GRL	+						
	E/DEU	+						
3M Redfish	EST	+						
	E/ESP	+		X				
	E/PRT	+	X	X	X	X	X	
	FAR	+						
	LTA	+						
	LVA	+						
	JPN	+						
	RUS	+		X	X			
	OTHER	+						
4VWX Silver hake	CAN	+	X	X	X		X	X
	CUB	+	X	X	X	X	X	X
3M American plaice	E/ESP	+		X				
	E/PRT	+						
	OTHER	+						
3LNO American plaice	CAN	+						
	E/ESP	+			X	X		
	E/PRT	+	X	X	X	X	X	
	JPN	+						
	NCP(E)	+						
	NCP(K)	+						
	USA	+						
3NO Witch flounder	CAN	+						
	E/ESP	+		X	X			
3LNO Yellow-tail	E/ESP	+						
	USA	+						
SA 0 + 1B-F Greenland halibut	E/DEU	+						
	GRL	+		X	X	X	X	
	JPN	+	X	X	X			
	NOR	+	X					
SA 1A Green-land halibut	GRL	+		X	X	X	X	

Table 1. Continued.

Stock	Country[1]	Biological Sampling						
		Catch	CPUE	Sex	Length	Age	Individual Wt.	Maturity
SA 2+3 Greenland halibut	CAN	+	X					
	E/ESP	+	X	X	X	X		
	E/PRT	+	X	X	X	X		
	RUS	+		X	X			
SA 0+1 Roundnose grenadier	E/DEU	+						
	GRL	+						
SA 2+3 Roundnose grenadier	E/ESP	+						
3NO Capelin	CAN	-						
SA 3+4 Squid	CAN	+		X	X		X	X
SA 1 Other finfish	GRL	+						

[1] Country abbreviations as found in Statistical Bulletin; 'OTHER' and 'NCP' refer to estimates of non-Contracting Parties who did not report catches to NAFO.

4. Biological Surveys

a) Report on Activities in 1994

An inventory of biological surveys conducted in 1994, as submitted by National Representatives and Designated Experts was prepared by the Secretariat (Table 2). Designated Experts also provided a more detailed account of the survey data available for 1994 relative to their stocks.

Table 2. Inventory of biological surveys conducted in the NAFO Area during 1994.

Subarea	Division	Country	Month	Type of survey	No. of sets
				Stratified-random Surveys	
1 (0)	A-F	GRL	7-9	Shrimp (included small area in 0B)	179
	B-D	GRL/JPN	8	Greenland halibut	80
	B-F	E/DEU	10-11	Groundfish, Oceanography	78
	D	GRL	11	Abundance of Iceland scallops	87
2+3	JK	CAN-N	11-12	Groundfish trawl	
3	L	RUS	6-7	Groundfish, temperature, salinity	97
	LNO		9-10	Juvenile flatfish	
			10-12	Groundfish trawl	
	LNOP		4-6	Groundfish trawl	
	M	E/ESP	7	Bottom trawl	116
	P	CAN-N	4	Groundfish trawl	
3+4	PV	CAN-N	8	Redfish trawl	

Table 2. Continued.

Subarea	Division	Country	Month	Type of survey	No. of sets
				Other Surveys	
1	A	GRL	7-8	Greenland halibut, inshore, longline	73 lines/58291 hooks
	B-F	GRL	6-7	Juvenile cod, inshore, gillnets	66
2+3	All Div.	CAN-N	6-10	Hydrography	
	JKL		6	Juvenile and adult cod acoustic	
			8-9	Abundance/distribution 0-group cod and capelin	
			9-10	Capelin acoustic	
			12	Demersal juvenile cod	
3	K	CAN-N	9	Snow crab	
			11-12	Herring acoustic	
	KL		6	Physical and biological oceanography	
	L		5,8,9-10	Snow crab	
			5-6	Current meter deployments	
			6,10	Inshore cod stock structure	
			7	Impact of trawling on benthos	
			7-8	Biophysical study of ichthyoplankton	
			8-9	Current moorings and CTDs	
			11	Biophysical study of plankton	
	LN		7	Gear tests	
			7	Assessment Iceland scallops, Grand Banks	
	LNO		8-9	Abundance/distribution 0-group cod and capelin	
		RUS	6	Capelin, temperature, salinity	12
	LNOP	CAN-N	5,7	Oceanography	
	LP		5-6,10-11	Hydroacoustic calibration and development	
	Ps		5	Pre-recruit survey sea scallops	

b) **Surveys Planned for 1995 and Early-1996**

An inventory of biological surveys planned for 1995 and early-1996, as submitted by National Representatives and Designated Experts, was prepared by the Secretariat (Table 3).

Table 3. Biological surveys planned for the NAFO Area in 1995 and early-1996.

Area	Country	Type of Survey	Dates
		Stratified-random Surveys - 1995	
2J+3K	CAN-N	Groundfish trawl/juvenile cod	Nov 7-Dec 21
3K		Greenland halibut	Apr 8-21
3LMN		Greenland halibut	Mar
3LNO		Groundfish trawl	May 2-Jun 16
		Groundfish trawl/juvenile cod	Oct 10-Dec 20
3M		Groundfish trawl	Sep 25-Oct 6
3P		Groundfish trawl	Apr 3-29
3P+4V		Redfish/deepwater trawl	Jul 24-Aug 11
1B-F	E/DEU	Groundfish, oceanography	Sep 11-Nov 1
3M	E/ESP	Bottom trawl	Jun 25-Jul 29
1A-F (small area of 0B)	GRL	Mainly directed at shrimp (180 sets)	Jul-Sep

Table 3. Continued.

Area	Country	Type of Survey	Dates
1A-D	GRL/JPN	Greenland halibut (10 sets)	Aug
1BCD	JPN	Trawl (500 - 1500 m)	Aug/Sep
		Other Surveys - 1995	
2J+3KL	CAN-N	Demersal juvenile cod	Jan
		Acoustic research juvenile and adult cod	Jun 19-Jul 8
		Oceanography	Jul 13-31
		Capelin acoustics	Sep 25-Oct 27
2J+3KLNO		Harp and hooded seal	Feb
		Abundance/distribution 0-group cod and capelin	Sep 5-22
3K		Herring acoustic	Oct 30-Nov 24
3KL		Juvenile cod habitat study	Oct 10-27
3L		Inshore cod acoustics	Jan
		Herring acoustic	Jan
		American plaice and cod behavioral studies	Feb-Mar
		Inshore cod stock structure	Apr 18-29, Nov 27-Dec 8
		Snow crab	May 8-19,Aug 7-18, Sep 25-Oct 6
		Experimental trawling	Jun 27-Jul 4
		Ichthyoplankton population dynamics	Jul 15-Aug 4
		Snow crab index of abundance	Sep 5-22
3LMNOP		Comparative fishing trials; TELEOST and A GADUS	Jan-Mar
		Scientific sea trials	May 15-19, Jul 11-22
3LN		Research and assessment Iceland scallops	Jun 6-17
3LNO		Comparative fishing TEMPLEMAN and NEEDLER	Jul 11-Aug 4
3LOP		Hydroacoustic calibration and development	May 29-Jun 6
4R		Research and assessment Iceland scallops	Aug 21-Sep 1
1A	GRL	Longline in inshore areas, Greenland halibut (80 lines)	Jul -Aug
1B-F		Gillnet in inshore areas, young cod (70 sets)	Jul-Aug
3LM	JPN	Trawl, exploratory, deepwater	Mar 5- Apr 30
		Surveys Planned for Early-1996	
3L	CAN-N	Fish behaviour/acoustic tagging/ catchability of cod by otter trawl	Feb 5-Mar 8
3LOP		Hydroacoustic calibration and development	Jan 8-19
3Ps		Herring acoustics	Jan 8-Feb 2

c) **Review of Stratification Schemes**

STACREC noted that the revised stratification scheme presented by Canada in June 1994 was being used by Contracting Parties conducting surveys in the Regulatory Area. It was agreed that further copies of the charts as needed would be supplied to the Secretariat.

It was noted that an error had been detected in the scheme affecting NAFO Subdiv. 3P. The error affected the size of strata in the Laurentian Channel and STACREC was informed that the error has been corrected. This correction is being documented and affected survey indices will be updated.

d) **Coordination of Surveys**

The issue of coordinating research surveys was raised and discussion focused on the need for a synoptic survey for Greenland halibut. It was pointed out such a survey would need input from many Contracting Parties and require one to two years lead time to plan and secure vessel time. In the current environment there is a tendency to get funding at the last minute and this hampers coordination and narrows the scope of survey objectives. STACREC **recommended** that *parties interested in a synoptic survey for Greenland halibut meet and formulate such a plan.* It was suggested a group be formed from these parties, and that the group should set dates and specify vessel and scientific staff requirements. This plan could then be put forward as Scientific Council requirements for answering Commission questions on this stock.

5. **Non-traditional Fishery Resources in the NAFO Area**

a) **Statistics and Sampling**

STACREC reiterated the importance of maintaining adequate statistical records and sampling, where possible, for non-traditional species such as skate and wolffish.

b) **Distribution Data from Surveys**

It was recommended at the September 1994 Meeting of STACREC that efforts be made to analyse data on distribution and abundance of non-traditional species for presentation at the June 1995 Meeting. The only reported analysis being conducted was that by Canadian scientists, but documentation was not available at present. STACREC again **recommended** that *analyses of distribution and abundance of non-traditional species be conducted for the extensive survey databases and the results presented at the June 1996 Scientific Meeting.*

6. **Review of SCR and SCS Documents Not Related to Assessments**

Four Research Documents were tabled for review by STACREC, and the reviews are presented below:

a) **The Impact of Mobile Fishing Gear on Low Topography Benthic Habitats in the Gulf of Maine (Northwest Atlantic): A Preliminary Assessment** (SCR Doc. 95/21)

Three areas in the Gulf of Maine (Div. 5Y) were examined for effects of mobile fishery gear on microhabitat availability through a range of sedimentary habitat types from mud and sand to gravel bottoms. Results indicated that mobile fishing gear impacted the physical structure of benthic habitats and reduced habitat complexity. Both sedimentary structures and emergent epifauna were impacted by mobile fishing gear.

b) **Retrieval of Lost Gillnets at Illulissat Kangia** (SCR Doc. 95/6)

A lost gillnet retrieval program was conducted at one of the main inshore fishing grounds for Greenland halibut in Greenland, Div 1A. Retrieval was performed by dredging from 30-foot vessels, and a total of 101 hauls were made. Twelve (12) gillnets were recovered. None of the recovered nets had retained their total fishing affectivity, and only two gillnets, recently lost, had noteworthy catches. The results suggested that lost gillnets in this particular environment probably will continue fishing for a short period of time, then collapse and stay inactive. Lost gillnets are a main source of longline loss.

c) **Zonation and Associations of Dominant Fish Fauna in Flemish Cap** (SCR Doc. 95/45)

The vertical distribution of 25 fish species in Flemish Cap were analyzed from the data of 682 hauls made in the EU surveys during the period 1988-94. Three main zones were identified: a shallower one (from 126 to 300 m), an intermedian one (from 300 to 600 m) and a deeper one (more than 600 m).

d) **On Population Structure of Beaked Redfish (*Sebastes mentella* Travin) in the Irminger Sea as Related to the Hypothesis of the Latter Larvae Drift into the North-Western Atlantic** (SCR Doc. 95/1)

The biological features of adult beaked redfish of the Irminger Sea distributed within pelagic depths (outside 200-mile zone) and on the slopes off Iceland and Eastern Greenland Shelves were considered, as well as data on the latter larvae and 0-group distribution. The results of the comparison suggested there was a lack of close relation between adult redfish of the above areas.

Concerning the early stages the redfish larvae, a drifting towards Western Greenland seemed to originate from the spawning area located at the shelf edge southwest of Iceland, while the larvae which hatch in the central sea area developed within the closed eddy generated by surface currents. Young redfish originating from the spawning area within pelagic depths also did not seem to recruit to the stock of the Iceland and Eastern Greenland shelf slopes. In general all information available suggested the existence of two beaked redfish populations in the Irminger Sea. The first one inhabiting the slopes off Iceland and Eastern Greenland shelves, and the second one distributed within the pelagic depths and its life cycle mainly restricted by the above-mentioned eddy.

7. Other Matters

a) List of Fishing Vessels for 1992

Data for the triennial *List of Fishing Vessels* for 1992 were requested in January 1993. As was the case in June 1994, 11 reports had been received and 11 were outstanding, therefore the list could not be provided. STACREC requested all National Representatives to ensure their reports were forwarded to the Secretariat.

b) List of Tagging Activities

The Secretariat compiled a list of tagging activities in 1995 (SCS Doc. 95/7). Representatives were requested to check the list and report errors and omissions.

c) Update of Information on Conversions Factors

In the past STACREC was asked by the Fisheries Commission to provide conversion factors for product weight to whole weight. A search for sources of conversion factors revealed that FAO had compiled a list in the past and had mailed out a questionnaire in 1993 to update them. FAO contracted an independent evaluation of existing conversion factors and the appropriate conversion factors were reported in FAO Circular Letter 847. STACREC noted that these factors were appropriate for conversions of product weight to equivalent whole fresh weight.

If new products were developed, then special studies would be required. STACREC also noted that these conversion factors may not be appropriate for answering questions on minimum fish length.

d) Pilot Observer Program

At the 1994 STACREC meeting questions were raised as to the availability of data from the Pilot Observer Program. It was noted that there was a proposal tabled at the Fisheries Commission to enter into agreements requiring 100% coverage by observers. STACREC raised concerns as to the effect this would have on data collections. It was felt by some Contracting Parties that even with 100% observer coverage, the present national sampling programs had to be maintained. It was also felt that these national observers have had enforcement training but lacked the expertise required to maintain biological sampling. Others noted that it would be impossible to maintain both observers and samplers in their fleets and since the observers were a requirement they would have to depend on them to provide any biological sampling. The question as to the ownership of data collected was raised and it was pointed out that this issue was on the agenda of the Fisheries Commission Meeting held in Toronto 7-9 June 1995.

e) **Other Business**

The problem of some flounder catches being reported as 'flounder not specified' was raised. STACREC noted that Canada (Scotia-Fundy Region) and Korea had reported some flounder catches as flounder not specified. STACREC requested the Secretariat determine from Canada and Korea if information was available to break these catches into species items.

f) **Acknowledgements**

The Chairman thanked the Secretariat for assistance in compiling all pertinent information for the meeting. STACREC noted that this would be the final meeting to be Chaired by C. A. Bishop (Canada) as he is due to retire in the near future, and members congratulated the Chairman for his efficient work and extended best wishes to him. The Assistant Executive Secretary on behalf of the Secretariat also thanked the Chairman and wished him well in his retirement. As there was no further business, the meeting was adjourned.

APPENDIX IV. REPORT OF STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chairman: W. R. Bowering Rapporteur: K.H. Nygaard

The Committee met at Keddy's Dartmouth Inn, Dartmouth, Nova Scotia, Canada on 12, 16 and 17 June, 1995. In attendance were W. R. Bowering (Canada, Chairman), M. J. Morgan (Canada), V. A. Rikhter (Russian Federation), M. Stein (EU-Germany), A. Vazquez (EU-Spain), K. H. Nygaard (Greenland) and the Assistant Executive Secretary (T. Amaratunga).

1. **Review of STACPUB Membership**

No changes had been made since June 1994.

2. **Review of Scientific Publications Since June 1994**

a) **Journal of Northwest Atlantic Fishery Science**

STACPUB noted Volume 16, containing 7 miscellaneous papers and 3 notices (99 pages) was published with the publication date of July 1994.

Volume 17 containing an Introduction, 5 papers presented at the November 1990 Canada-USSR Meeting on Capelin and 2 notices (77 pages) was published with a publication date of October 1994.

There was presently 1 paper in hand at the Secretariat which was in the process of being prepared for publication.

b) **NAFO Scientific Council Studies**

Studies Number 20, containing 7 miscellaneous papers and 3 notices (113 pages) was published with a publication date of February 1994.

Studies Number 21, containing 10 papers on Northern Cod and 3 notices (165 pages) was published with the publication date of December 1994.

Studies Number 22, containing 6 miscellaneous papers, 1 notice and 1 obituary (95 pages) was published with a publication date of May 1995.

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

There was presently 1 paper in hand at the Secretariat, which was in the process of being edited.

c) **NAFO Statistical Bulletin**

NAFO Statistical Bulletin, Vol. 41 for 1991 was published without France (St. Pierre and Miquelon) data, in February 1995 (318 pages).

NAFO Statistical Bulletin, Vol. 42 for 1992 was in the final stages of preparation and will be published within the next two months.

Deadline for submission of STATLANT 21B reports for 1993 was 30 June 1994. As of May 1995, data were still outstanding from many nations, and STACPUB noted that the delay in the acquisition of final data continues to delay the publication of the Bulletin.

d) **NAFO Scientific Council Reports**

The volume (234 pages) containing reports of the 1994 meetings of the Scientific Council in June, September and November was published and distributed in January 1995. STACPUB agreed that the January publication date was more suitable than the end of each year.

e) **List of Fishing Vessels**

Data for this triennial publication is being compiled for 1992. This publication was due to be published last year, and data are still outstanding from a number of countries. STACPUB expressed concern regarding this delay.

f) **Inventory of Sampling Data**

Inventory of Sampling Data, 1985-89 was published in March 1993. The next issue for 1990-94 was targeted for 1996.

g) **Index of Journal and Studies**

The Index of Journal of Northwest Atlantic Fishery Science and NAFO Scientific Council Studies, 1980-93 (62 pages) was completed and published in February 1994, and STACPUB noted the considerable interest in this document.

h) **Index of Lists and Titles**

The provisional index of titles of 97 Research Documents (SCR Doc.) and 25 Summary Documents (SCS Doc.) which were presented at the Scientific Council meetings during 1994 were compiled and presented in SCS Doc. 95/2 for the June 1995 Meeting.

3. **Production Costs and Revenues for Scientific Council Publications**

a) **Publication Costs and Revenues**

The production costs and the revenues for the various publications related to the activities of the Scientific Council were reviewed by STACPUB. No significant departures from those of previous years were observed, however, the new billing procedure had resulted in a decrease in copies sent out.

STACPUB noted that much has been accomplished in regard to avoiding double printing of documents, as no second print was now made from the majority of SCR and SCS Documents. As participants at the meetings no longer receive a second copy by mail, there has been a further decrease in the costs of publications.

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

a) **Invitational Papers**

As a result of the established Russian/German Data Evaluation Project on historic ICNAF/NAFO oceanographic data, STACPUB looks forward to an invitational paper on this bilateral project. This paper will be available after the completion of the project, expected to be in 1998.

As indicated at the Scientific Council Meeting in September 1994 a first review (SCR Doc. 95/34) on Flemish Cap oceanography had been prepared by the STACFEN chairman (M. Stein, EU-Germany) collating abstracts from a number of papers. During the course of the June Meeting, the STACFEN Chairman undertook to prepare a detailed review document on Flemish Cap oceanography. STACPUB agreed to publish this review in addition to the annual review papers on climatic conditions during 1994 under single cover of Scientific Council Studies, prior to the September 1995 Meeting.

A progress report by the Designated Expert (D. Parsons, Canada) on the possible compilation of papers on Flemish Cap shrimp in an invitational paper was expected for the Scientific Council Meeting in September 1995.

5. **Editorial Matters Regarding Scientific Publications**

a) **Review of Editorial Board**

STACPUB was informed that Associate Editor Sv. Aa. Horsted (Denmark-Greenland) had requested to withdraw from the Editorial Board because of retirement. STACPUB expressed the Committee's sincere appreciation of the dedicated, analytical and comprehensive work done by Sv. Aa. Horsted and extended best wishes.

In considering the structure of the Editorial Board concern was raised regarding a slow editing process in some instances of Journal papers. STACPUB agreed careful consideration was needed, to improve both the review process of papers and the turn around time of the publication of Journal issues. STACPUB members undertook to consider suggestions for more firm guidelines for the editing process and coordination between editors and associate editors.

b) ***Progress Report of Publication on Western Atlantic Cod***

The collection of papers on western Atlantic cod was published on schedule in Studies Number 21 by December 1994. This publication represented of valuable collection of papers prepared in the Canadian Northern Cod science program.

c) **Progress Report of Publication on West Greenland Cod**

Papers for the publication on West Greenland cod was being compiled by the coordinator, Hans Lassen. Two papers submitted and edited early have already been published as miscellaneous papers, as decided by STACPUB in 1994. Some progress had been made on possibly 8-10 other papers. However, the coordinator expressed concern on the progress by some authors. Hence, the plan to have all papers in one single issue may be changed somewhat with some papers being published as single miscellaneous papers in other issues.

d) **Progress Review of Journal Issue of 1993 Special Session**

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". Of the 25 papers presented, 12 papers have been received and are in advanced stages of the review process: the editorial reviews have been completed for 6 of the papers, and the editors have placed a deadline of 17 July 1995 (for the balance) with the authors. STACPUB hoped that the editorial work, which was seriously delayed, has been brought up to date and this issue be completed in late-1995.

e) **Considerations for Publishing Symposium Proceedings**

Collection of papers from a Symposium in a single publication was found useful, and STACPUB agreed that publication of Symposium proceedings be issued as supplementary issues of either the Journal or Studies.

STACPUB stressed that conveners of a Symposium would have to decide whether contributions to the Symposium are intended for the Journal or Studies before posters are send out announcing the Symposium. If discussions at the Symposium are to be included in the proceedings conveners should aim for Studies, and it should be clearly stated that publication in the proceedings should not hamper a possible future publication of the same or an upgraded paper in primary literature.

f) **Progress Review of Publication of 1995 Special Session**

Given the decision taken under item 5.e and recognizing the likelihood of many primary literature standard papers being submitted to this Symposium, the conveners of the 1995 Special Session

will be requested to take the proper action to inform potential contributors in advance of the Symposium, and to publish papers in a proceedings volume.

6. **Papers for Possible Publication**

a) **Procedures for STACPUB Review**

No new suggestions to procedures of STACPUB review were put forward.

b) **Review of Proposals Resulting from the 1994 Meetings**

Of the 13 papers nominated at the June 1994 Meeting, 5 papers have been submitted, and 1 response of intent has been received.

In addition, 5 papers from outside the STACPUB nomination process were submitted since June 1994. Four of these are in the hands of the Associated Editors, and 1 has been edited and returned to the Secretariat.

c) **Review of Contributions to the 1995 Meetings**

STACPUB members were again able to focus their considerations on those documents which were suggested by authors. Members again undertook to offer comments as to how each document could be improved.

STACPUB considered 19 SCR Documents and nominated the following 16 including the standard papers on overview of environmental conditions: SCR Doc. 95/1, 9, 14, 18, 21, 25, 28 and 29 as a combined paper, 30, 31, 32, 43, 44, 45, 47 and 50. The Assistant Executive Secretariat was requested to invite the authors to submit them in a suitable form for consideration for publication, and the authors be given the comments from STACPUB members to improve their papers.

7. **Acknowledgements**

The Chairman closed the meeting and thanked the members for their contributions. He also thanked the Assistant Executive Secretary for his support and organization of most of the documentation for review and asked that he convey the Committee's appreciation to the staff of the Secretariat for their efforts in support of the NAFO publications.

A special thanks was afforded to K. H. Nygaard for his assistance while making a full contribution to the meeting as a member.

PART B

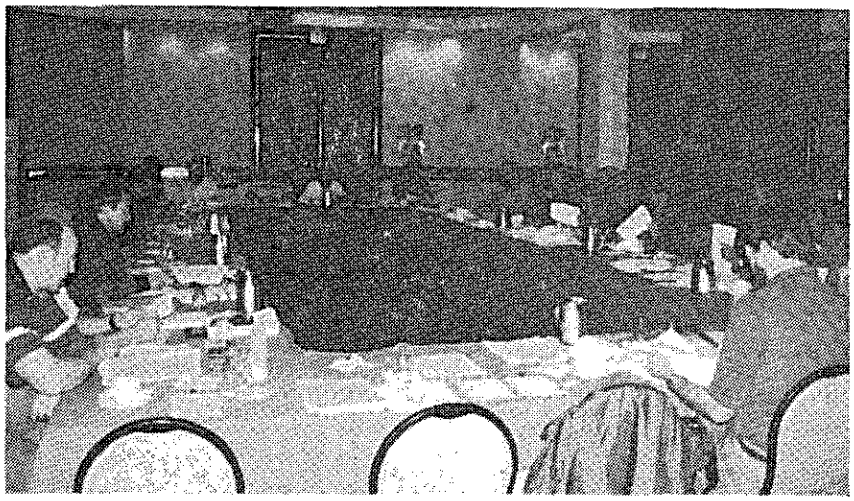
Scientific Council Annual Meeting, 9-15 September 1995

CONTENTS

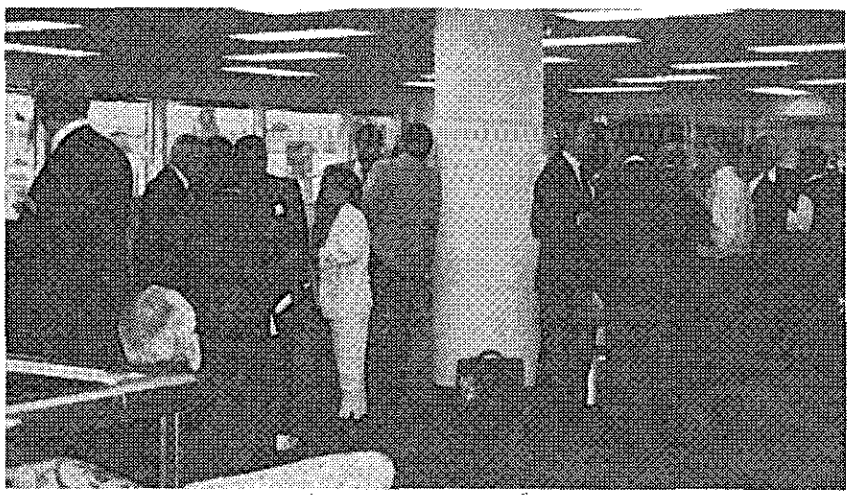
Group Photograph, Scientific Council, 9-15 September 1995

K. Yokawa, M L. Godinho. H. P. Cornus, Å. Nicolajsen, M. Stein, H. Siegstad, A. Avila de Melo, E. De Cárdenas, D. Power, F. Serchuk, L. Motos, D. B. Atkinson, J. Casey, W. B. Brodie, W. R. Bowering, H. Yamada, V. N. Shibanov, T. Murai, D. G. Parsons, H. Lassen, A. Vazquez

(From left to right)



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 Scientific Council Report, while Annex 2 gives the announcement of the 1997 Symposium on 'What Future for Capture Fisheries'. The List of Recommendations from this meeting are given in Part D, this volume.

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 Part E, this volume.

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 the Scientific Council responses to the Fisheries Commission are given below under Item VI 'Management Advice and Responses to Special Requests from the Fisheries Commission'.

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 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 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 was 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.

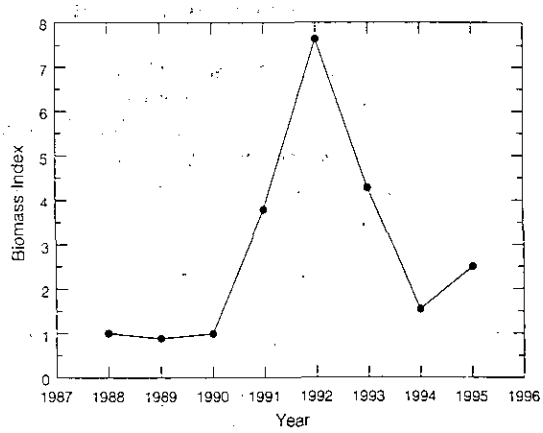
Assessment: No analytical assessment was available. Evaluation of the status of the stock was based on the interpretation of commercial fishery data (catch, effort and catch rates), the time series of research biomass indices and biological data from both sources.

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 was 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 was far from optimal and discussed this problem further in a response to a request from Canada (see Report of 7-21 June 1995 Meeting, in Part A, page 41).

b) Minimum Landing Size

The Scientific Council had 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 those responses 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 advised 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 square naut. miles, 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 have been caught in gill nets and offshore trawls. Similar data were 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 were 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 did 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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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 II: Uncertainty in consumption estimates associated with population size, residency, energy requirement and diet. *NAFO SCR Doc.*, No. 93, Serial No. N2615, 12 p.

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STENSON, G. B., M. O. HAMMILL, and J. W. LAWSON. Predation of Atlantic cod, capelin, and Arctic cod by harp seals in Atlantic Canada. *NAFO SCR Doc.*, No. 95, Serial No. N2617, 17 p

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 were very preliminary and there was 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) was 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.

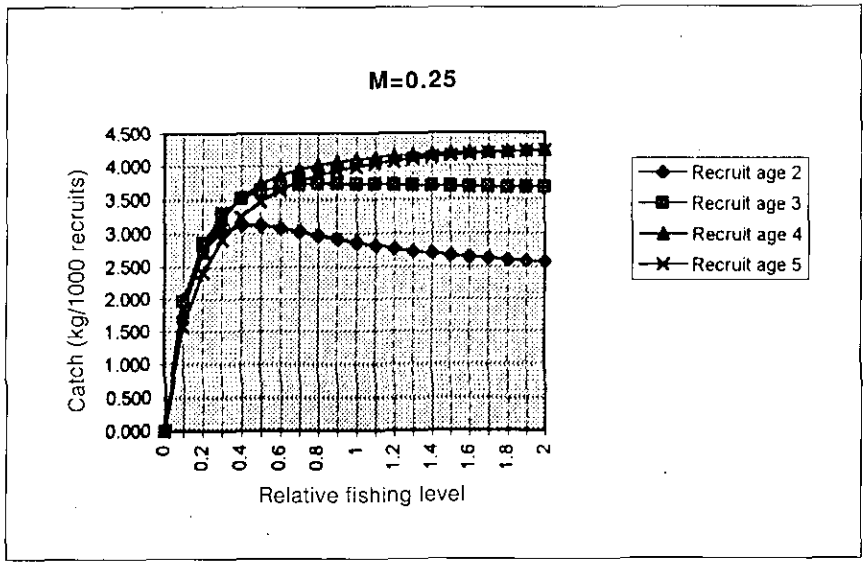
Results

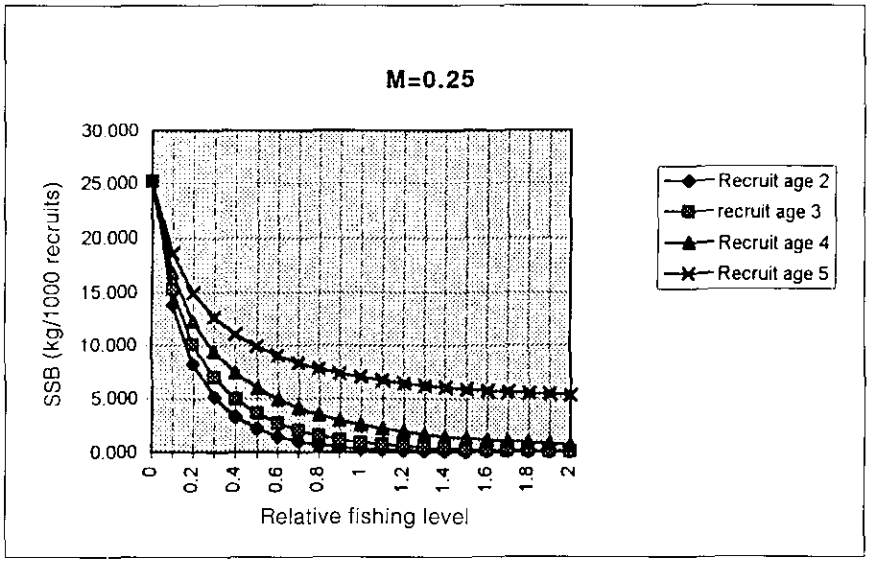
Results are presented in the figure below.

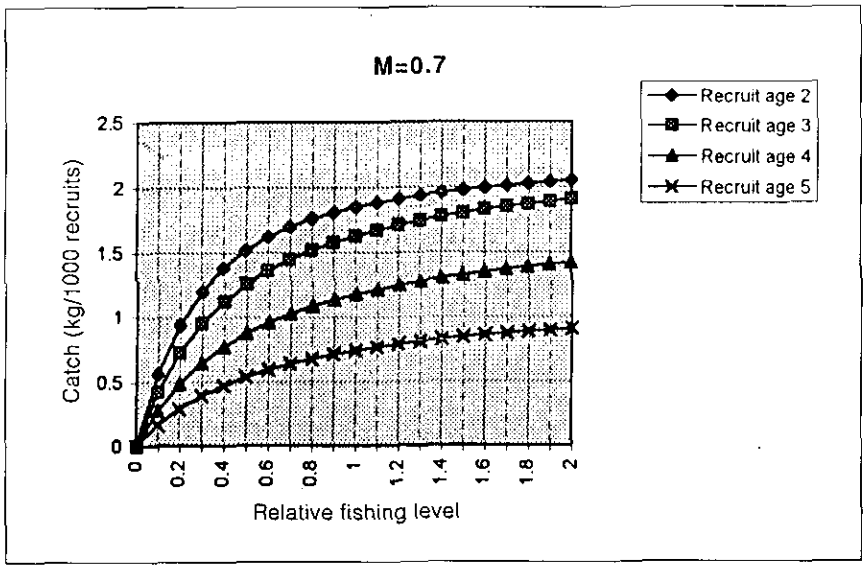
Yield - By increasing age at first capture, increases in yield were only foreseen for the lower value of M. Losses in yield were projected for the higher value of M.

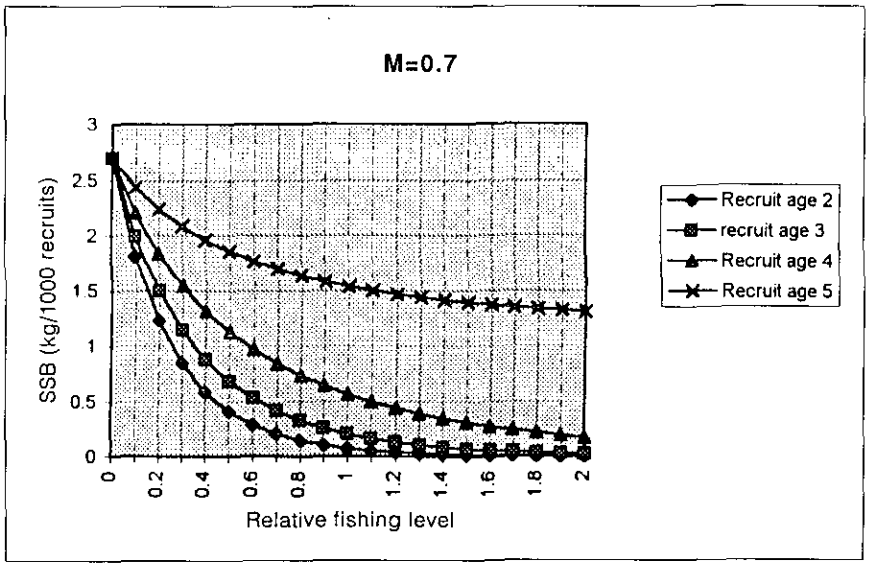
Spawning stock biomass - As expected, significant gains in SSB were predicted by increasing age at first capture under each assumption of M.

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 are as follows:

Nation	Minimum No. of vessels	Catch	Effort	CPUE	Fishing positions	No. Shrimp measured+	Shrimp discard	By-catch	Preliminary Total catch
CAN	7	X	X	X	X	26 381	X	X	939
EST	6	X	X	X					1 616
E/ESP	1								*158
E/PRT	1								*150
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
LTU	4								*675
NOR	20					42 899			*6 100
RUS	15								*2 500
Total	86					85 957			23 068

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

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. Rätz (EU-Germany), and 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.

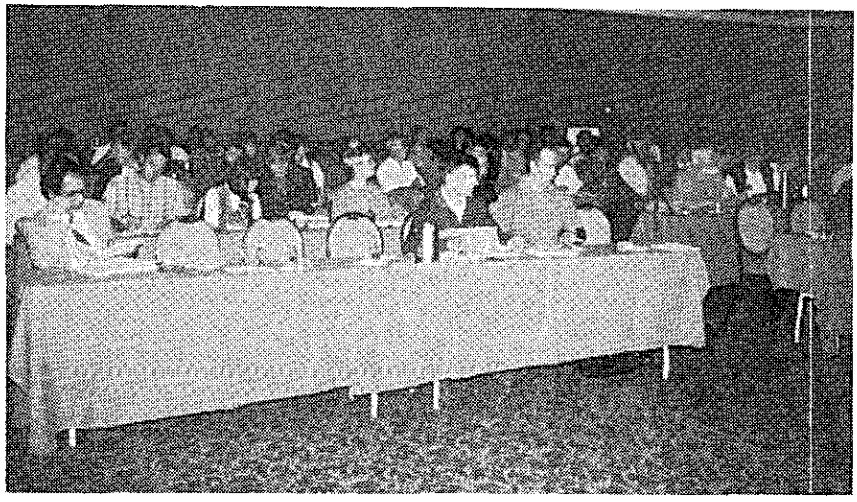
X. ADOPTION OF REPORTS

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.

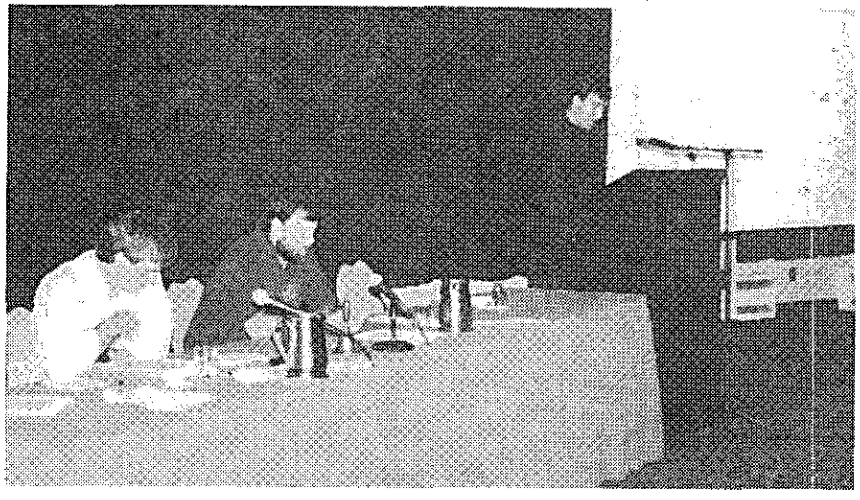
XI. ADJOURNMENT

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



CLOSING SESSION: G. B. STENSON, W. B. BRODIE, AND J. SIGURJONSSON (SPEAKER)

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)[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.

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[1] Symposium Paper Numbers are listed below.

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*.

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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.

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.

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* Symposium Paper Number

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

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.

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

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

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

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

Chairman: W. B. Brodie Rapporteur: 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) indicated 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
Estonia	0	1 081	1 616
EU-Denmark	800	400	0
EU-Portugal	0	0	150
EU-Spain	0	300	158
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
Russia	300	300	2 500
St. Vincent	0	75	0
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 (SCR Doc. 95/103; Fig. 1). Vessels from Greenland (SCR Doc. 95/101, Fig. 1-3) and Faroe Islands (SCR Doc. 95/105, Fig. 2 and 3) 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 (SCR Doc. 95/101, Fig. 2; SCR Doc. 95/103, Fig. 6 and 7).

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 than 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 (SCR Doc. 95/105, Table 3).

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 (SCR Doc. 95/101, pg. 5; SCR Doc. 95/103, pg. 3). 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 (SCR Doc. 95/103, pg. 4). Redfish was also the most dominant by-catch species taken by Greenland in both 1994 and 1995 (SCR Doc. 95/101, pg. 3). 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 (SCR Doc. 95/102). 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 (SCR Doc. 95/100). 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 larger, 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 had 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 were consistent with the commercial fishery data, in that respect.

The composition of the shrimp catches had 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 indicated 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 had already changed sex. It was 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 were 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 ranging 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 Subarea 2 + Division 3K and Divisions 3LMNO**

With respect to this question by Canada on Greenland halibut, STACFIS continued to be unable to respond adequately due to the significant shortfall in survey coverage over the area and depths required. No survey data were available for Div. 2GH for the last 7 years and were 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 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 Brèmerhaven, 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 could be finalized. 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 indicated that the species was 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 had not been published due to many outstanding submissions, and the 1995 compilation should now be underway. STACREC recognized 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 were being developed to prorate total reported landings by species among areas, and until these procedures were 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 considered 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					
	E/ESP	158						
	E/PRT	150						
	FRO	3 990	X					
	GRL	2 321	X	X	X			X
	ISL	4 269	X					
	LVA	350						
	LTU	675						
	NOR	6 100		X	X			X
	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 had 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 was 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 was 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 were currently under review, two papers had been promised for the end of October, and the status of another two papers was uncertain. It was 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 was 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.

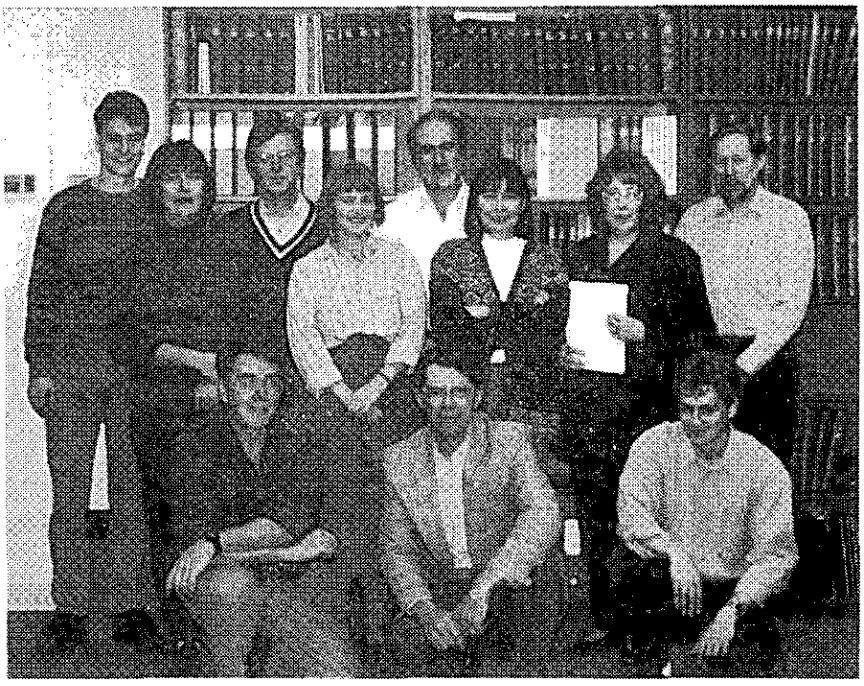
The Chairman noted that this was the last meeting under his leadership, and wished the incoming Chair H.-P. Cornus (EU-Germany) success in his work.

PART C

Scientific Council Meeting, 17-20 November 1995 Meeting

CONTENTS

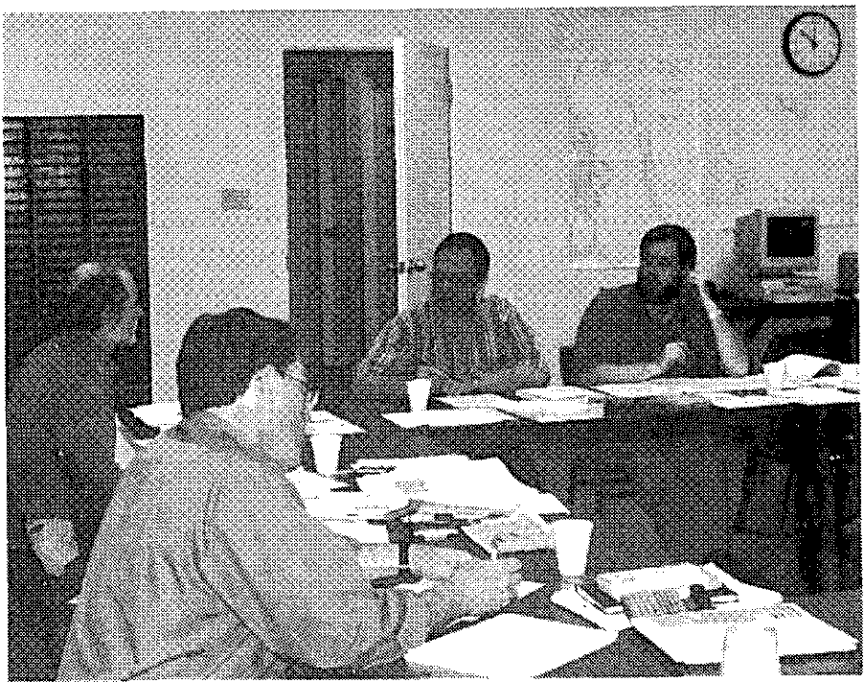
Participants of November 1995 Scientific Council Meeting



(From left to right)

Standing: Ole Folmer, Helle Siegstad, Dan Carlsson, Unnur Skúladóttir, Don Parsons, Louise Savard, Dorothy Auby, Per Kanneworff

Kneeling: Howard Powles, Steve Clark, Carsten Hvingel



(From left to right)

Meeting in Progress: Don Parsons, Howard Powles, Ray Bowering, Bill Brodie

REPORT OF SCIENTIFIC COUNCIL

Special Meeting, 17-20 November 1995

Chairman: W. R. Bowering Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada, during 17-20 November 1995. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), Iceland and the United States of America. The Executive Secretary and Assistant Executive Secretary were in attendance.

The opening session was called to order on 17 November 1995 at 1000 hr.

The Chairman, W. R. Bowering (Canada), welcomed representatives to this Special Meeting of the Scientific Council to conduct assessments on shrimp in Subareas 0 and 1, and Denmark Strait. The Assistant Executive Secretary was appointed rapporteur. The Chairman noted that the USA was joining NAFO, and he was particularly pleased to welcome S. H. Clark, National Marine Fisheries Service, Woods Hole, Massachusetts, USA, to this meeting. The meeting welcomed U. Skúladóttir (Iceland), as the ICES observer to this meeting.

In considering the Agenda, the Chairman noted that at its meeting in September 1995, the Council had recommended that a publication dealing with shrimp on Flemish Cap be considered at this meeting, and this matter be considered under 'Other Matters'. The Provisional Agenda was **adopted** (see Agenda III, Part D, this volume).

The Council noted that STACFIS would undertake the assessments of the stocks, while the prognoses and the advice would be undertaken by the Council.

The session was adjourned at 1015 hr.

The Council briefly convened on 18 November 1995 at 1545 hr to consider the presentation on the Flemish Cap shrimp.

The concluding sessions were convened on 20 November 1995, noting that the shrimp assessment reports had been prepared by STACFIS. The Council then addressed the requests of the Coastal States considering the results of the assessments and provided advice and recommendations. The meeting was adjourned at 1320 hr.

Summary reports of the assessments and other matters considered by the Scientific Council are given below in Sections II-IV. The Agenda, List of Research (SCR) Documents and the List of Participants of this meeting are given in Part D, this volume.

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

The Council noted that matters referred to STACFIS relating to assessments of Shrimp in Subareas 0 and 1 and Shrimp in Denmark Strait were addressed. The complete reports are given in Appendix I.

III. FORMULATION OF ADVICE

The Council reviewed the STACFIS assessments of shrimp in Subareas 0 and 1, and Denmark Strait and the agreed summaries are as follows:

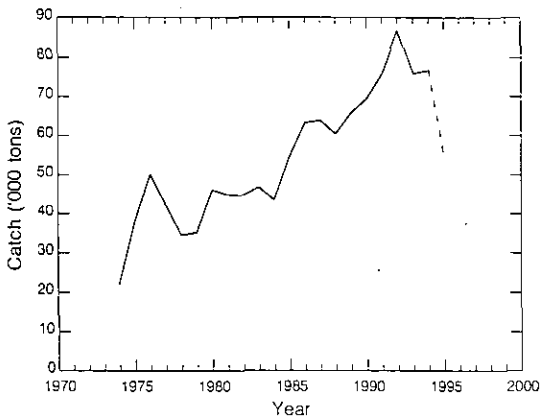
Shrimp in Subareas 0 and 1

Background: A small scale inshore fishery began in SA 1 during the 1930s. Since 1969 an offshore fishery has developed and the shrimp fishery is now the largest in Davis Strait.

Fishery and catches: The fishery is conducted mainly by Greenland and Canada. Recent catches from the stock are as follows:

	('000 tons)	
Year	Inshore	Offshore
1990	13.6	55.7
1991	16.3	59.4
1992	20.6	66.2
1993[1]	17.8	58.0
1994[1]	18.1	58.5
1995[1] (to Oct)	9.6	45.2

[1] Provisional.

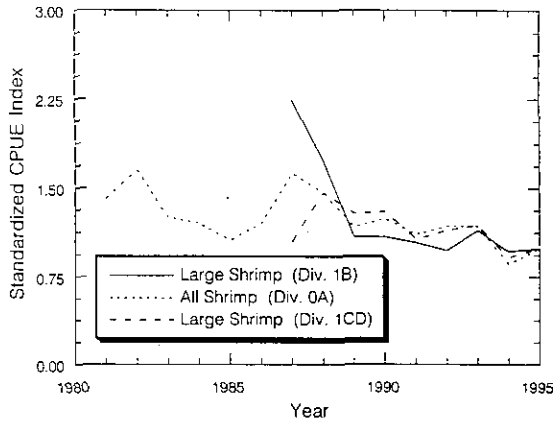


Data: Catch, effort and biological sampling data were available from the offshore fishery and catch and effort data for the inshore fleet. Time series of biomass indices and stock composition data were available from research surveys from both offshore and inshore areas.

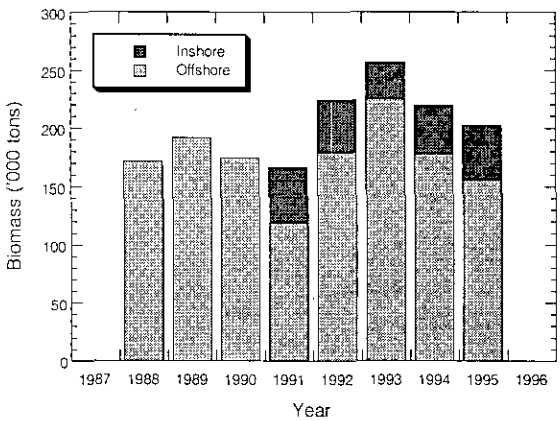
Assessment: No analytical assessment is available and fishing mortality is unknown. Evaluation of the status of the stock is based on interpretation of commercial fishery data (catch, effort, unstandardized and standardized catch rates), time series of research biomass indices and stock composition data.

CPUE: Standardized catch-rate indices from Div. 0A and Div. 1CD showed an overall decrease from 1987/88 to 1995, while the index for Div. 1B has been stable since 1989.

Recruitment: The 1985 year-class was strong and maintained catch rates in the early-1990s. Year-classes produced since have been weaker. The 1990 year-class dominated the 1995 catches in the survey and commercial fishery.



Biomass: Combined survey biomass indices from offshore and inshore were relatively stable over time although a decrease is indicated from 1993 to 1995.



State of the Stock: There are indications that the stock size has declined and the strong 1985 year-class has now passed through the fishery. As well, the abundance of males (as estimated from the surveys), the source of recruitment to the fishery, decreased since 1993.

Recommendations: Due to uncertainties about recruitment and the overall decrease in the abundance indices, it is recommended that total catches not exceed 60 000 tons, as recommended for 1995.

Special Comments: Advice on the 1995 catch level was partly based on use of past inshore catches as an estimate of long-term production. In light of concerns on stock status, the upward revision of inshore catches done in 1995 was not considered sufficient to justify an increase in the advised catch level. The Council expressed concern that recent catches have substantially exceeded the advised TACs.

Sources of Information: SCR Doc. 95/107, 110, 111, 113.

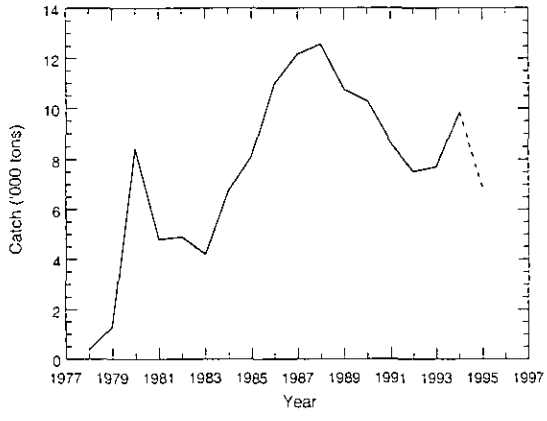
Shrimp in Denmark Strait

Background: The fishery for shrimp in limited areas of the Denmark Strait began in 1978. The fishery started exploiting new areas in 1993.

Fishery and Catches: This soon became a multi-national fishery with recent catches and TACs as follows:

	('000 tons)		
Year	Catch	TAC Recommended	TAC[1] Effective
1992	7.5	8	13.0
1993[2]	7.7	5	9.6
1994[2]	9.8	5	9.6
1995[2]	6.9	5	9.6

[1] On western side of midline.
[2] Provisional.



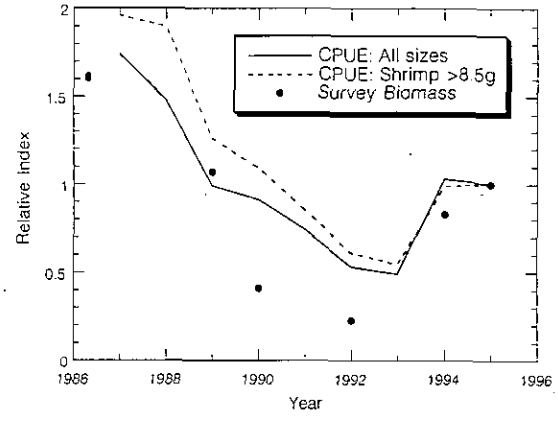
Data: Catch, effort and biological sampling data were available from the trawlers of several nations. Two time series of survey biomass indices were available, one from Norway for the years 1985 to 1989 and another from Greenland for the years 1989 to 1995, with associated biological samples.

Assessment: No analytical assessment is available and fishing mortality is unknown. Evaluation of the status of the stock is based on interpretation of commercial fishery data, the time series of survey biomass indices and biological data from both sources.

CPUE: Standardized CPUE indices have declined from peak values in 1987 to minimum values in 1992-93, subsequently increasing in 1994 and remaining stable from 1994 to 1995.

Recruitment: There are no immediate concerns for recruitment since the number of males in the surveys has increased substantially in the last two years.

Biomass: The biomass index declined from 1989 to 1992, and increased thereafter.



State of the Stock: The stock appears to be recovering from a low level.

Recommendations: For 1996, the catch should be limited to 5 000 tons to allow for continued improvement in stock size. This catch level should apply to the northern (traditional) and the southern (new) fishing areas combined.

Sources of Information: SCR Doc. 95/108, 109, 112, 114, 115.

IV. OTHER MATTERS

Considering a publication on the biology and fishery for shrimp on Flemish Cap (see Agenda III, Attachment 1, Part D, this volume), the Council was informed by D. G. Parsons (Canada) that the compilation of the publication on Flemish Cap Shrimp was underway. A draft report was tabled and members interested in contributing to and/or commenting on the publication were requested to communicate with D. G. Parsons before late-December. It was hoped that a manuscript for formal review would be ready in early-1996.

V. ADOPTION OF REPORTS

The Council met briefly at 1300 hr on 20 November 1995 and **adopted** the STACFIS Report. The report is given in Appendix I. The Council then **adopted** its own report.

VI. ADJOURNMENT

There being no further business, the Chairman thanked the participants for their long hours of work, the Chairman of STACFIS and the Secretariat for their able assistance in the conduct of the meeting.

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

Chairman: W. B. Brodie Rapporteur: Various

The Committee met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada, during 17-20 November 1995, to review the status of the shrimp stocks in Subareas 0 and 1, and Denmark Strait, as referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), Iceland and the United States of America.

I. STOCK ASSESSMENTS

1. **Shrimp in Subareas 0 and 1** (SCR Doc. 95/107, 110, 111, 113)

a) **Introduction**

In accordance with the recommendation by STACFIS in November 1993, the entire shrimp stock in Div. 0A, and Subarea 1 both north and south of 71°N, as well as inshore, is assessed as a single population.

Overall catches in the entire stock area increased until 1992 then decreased in 1993-94. Preliminary statistics indicate that catches in 1995 will be at the 1994 level (Fig. 1).

The nominal catch of shrimp in the offshore areas of Subarea 1 and the adjacent part of Subarea 0 (Div. 0A) increased from less than 1 000 tons before 1972 to almost 43 000 tons in 1976, fluctuated thereafter, stabilized around a level of 54 000 tons during 1985-88, then increased to 66 000 tons in 1992 and decreased to 58 000 tons in 1993 and 1994. Preliminary statistics for the offshore area in 1995 (January to October, Subarea 1) show total catches of about 43 000 tons (compared to 42 000 tons in the same months in 1994). The offshore fishery has been regulated by TAC since 1977.

Recent nominal catches and TAC (tons) for Shrimp in Div. 0A and Subarea 1 are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993[1]	1994[1]	1995[1,2]
Div. 0A Total	3 069	2 995	6 095	5 881	7 235	6 177	6 788	7 493	5 491	4 766	1 998
SA 1 Offshore	43 896	52 634	50 720	44 159	45 198	49 478	52 652	58 676	52 493	53 693	43 212
SA 1 Inshore	7 500	7 500	6 921	10 233	13 224	13 630	16 258	20 594	17 843	18 118	9 643
SA 1 Total	51 396	60 134	57 641	54 392	58 422	63 108	68 910	70 270	70 336	71 811	52 855
SA 0+1 Total	54 465	63 129	63 736	60 273	60 657	69 285	75 698	86 763	75 827	76 577	54 853
0+1 offshore catch	46 965	55 629	56 815	50 040	52 433	55 655	59 440	66 169	57 984	58 459	45 210
0+1 advised TAC[3]	36 000	36 000	36 000	36 000	44 000	50 000	50 000	50 000	50 000	50 000	60 000

[1] Provisional data.
[2] January-October.
[3] Until 1994 the advised TAC was only for offshore south of 71°N. After 1994, the advised TAC includes offshore north of 71°N and inshore.

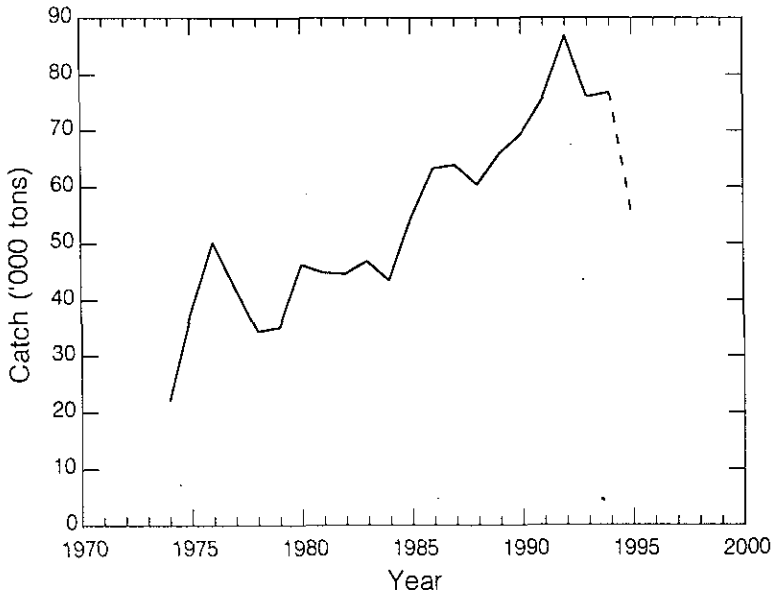


Fig. 1. Shrimp in Subareas 0 and 1: catches.

The West Greenland inshore shrimp fishery was relatively stable from 1972 to 1987 with estimated catches of 7 000-8 000 tons annually (except for 10 000 tons in 1974). A revision of the inshore catch statistics showed that catches in recent years have increased to over 20 500 tons in 1992, but decreased to 18 000 tons in 1993 and 1994. Preliminary data for 1995 (January-August) indicate catches at the same level as for the same period for 1994.

During the history of this fishery, the fishing grounds in Div. 1B have been the most important. Since 1987, however, catches have been continuously increasing in divisions south of Div. 1B.

The fishery in Div. 0A usually takes place from July to November. In Subarea 1 the fishery occurs in all months of the year, however, early in the year it is often confined to the southern divisions due to ice coverage in Div. 1A and Div. 1B. In 1994 and 1995 (Subarea 1) there was less ice than in previous years, and the northern divisions could be accessed one month earlier.

b) **Input Data**

i) **Commercial fishery data**

Fishing effort and CPUE (Fig. 2). Catch and effort data from the shrimp fishery in 1995 were available from fishing records from Canadian vessels in Div. 0A (SCR Doc. 95/107) and from Greenland logbooks for Subarea 1 (SCR Doc. 95/110).

Effort by large trawlers in Subarea 1 and in Div. 0A has been relatively stable in the 1990s. Twin trawls were introduced in 1995 on several trawlers, and this has been accounted for in analyses of effort data.

Because of seasonality in the catch rates and changes in the fleet over time, fishery data from Div. 0A, Div. 1B and Div. 1CD were analyzed using multiplicative models to produce standardized yearly catch rates.

Canadian fishery data from Div. 0A in 1981 to 1995 indicated an overall decrease in CPUE from 1987 to 1995. The estimates for 1994 and 1995 were the lowest in the fifteen year period (SCR Doc. 95/107, Table 5, Fig.4).

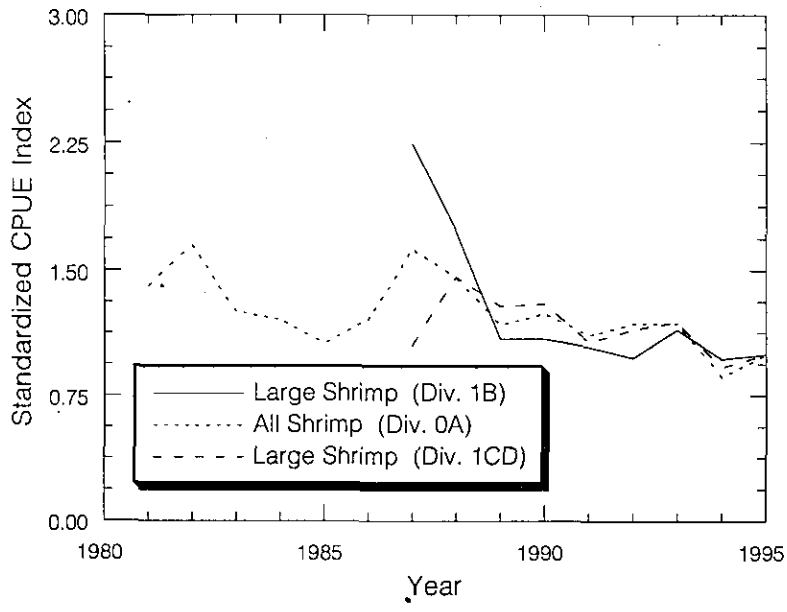


Fig. 2. Shrimp in Subareas 0 and 1: standardized CPUE indices from Div. 0A, Div. 1B and Div. 1CD.

From 1987 onward, logbook data from 33 Greenland trawlers, which record the shrimp catch by size category, were used to establish a standardized CPUE index for large shrimp >8.5 g (mainly females), for which unreported discarding is supposedly at a low level (SCR Doc. 95/110, Table 9, Table 11, Fig. 12). The index in Div. 1B showed a decrease from 1987 to 1989 followed by stability from 1989 to 1995. The index in Div. 1CD gradually decreased over time from 1988 to 1995.

The overall unstandardized catch rates from smaller Greenlandic vessels in the last five years showed no trend in both inshore and offshore areas (SCR Doc. 95/110, Fig. 2).

Length and age composition. Length frequency distributions obtained by observers were available from the commercial fishery in Div. 0A from 1981 to 1995 (SCR Doc. 95/107, Fig. 6) and in Subarea 1 from 1990 to 1995 (SCR Doc. 95/111, Fig. 14). The importance of the 1985 year-class was evident in 1990 as it recruited to the fishery, and in 1991-93, when it clearly dominated the catches. In 1995 this year-class no longer contributed substantially to either the total stock or the commercial catch.

Length samples of shrimp from the commercial catches in 1995 showed a dominant mode of 20 mm carapace length, representing the 1990 year-class (SCR Doc. 95/107, Fig. 5; SCR Doc. 95/111, Fig. 13).

Shrimp discards. In Div. 0A in 1994 and 1995, discarding was lower than in previous years, reflecting the recent favourable markets for all sizes of shrimp.

ii) **Research survey data**

Abundance estimates (Fig. 3). Trawl surveys have been conducted from 1988 in offshore areas (Subarea 1 + Div. 0A) and from 1991 in inshore Subarea 1 (SCR Doc. 95/111, 113).

The estimates of trawlable biomass are as follows:

Biomass ('000 tons)	1988	1989	1990	1991	1992	1993	1994	1995
Offshore (Subarea 1+Div. 0A)	172	192	175	119	179	225	178	158
Inshore (Div. 1A)	-	-	-	48	45	32	41	47
Total	-	-	-	167	224	257	219	205

Offshore: In July-September 1995, a stratified-random trawl survey was carried out in the main area of shrimp distribution in Div. 1A to 1E and the adjacent part of Div. 0A. The survey was carried out with a two-phase design, applying more stations in strata with high shrimp densities (SCR Doc. 95/113).

Biomass estimates from the survey in the period 1988-95 were variable around a mean level of 175 000 tons with a decrease from 1993 to 1995.

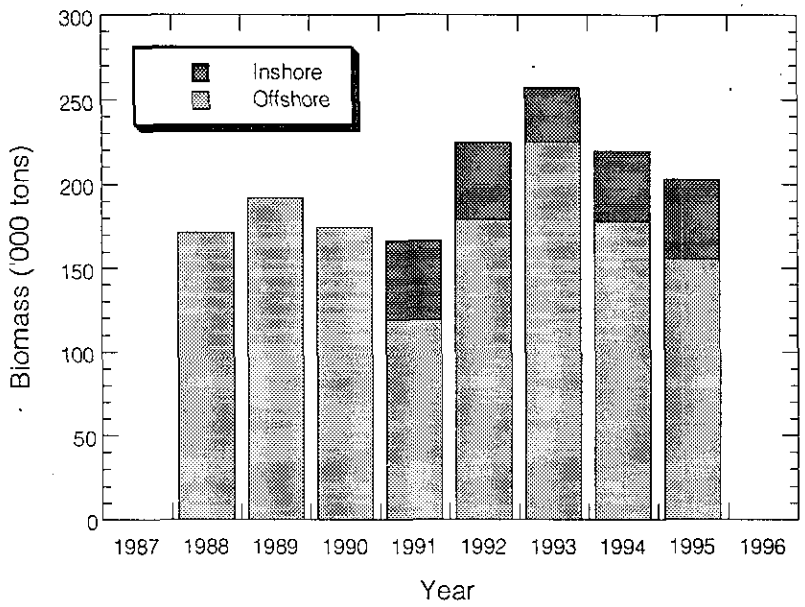


Fig. 3. Shrimp in Subareas 0+1: combined biomass estimates from inshore and offshore surveys.

Analysis of the research survey length frequency data (SCR Doc. 95/113, Fig. 5) showed the predominance of the 1985 year-class as males in 1989, 1990 and 1991, throughout the offshore area. The 1990 year-class dominated in the 1995 survey. However, year-classes produced in recent years appeared to be weaker than the 1985 year-class.

Older males and females were most abundant in the northern strata in the main area in 1995, while smaller males were more prevalent in the southern areas.

Abundance-at-age (in percent) for shrimp from Greenland offshore research survey data are given in the following table:

Age	1988	1989	1990	1991	1992	1993	1994	1995
1						1.3	0.8	2.3
2	1.6	1.2	2.8	1.0	2.7	5.4	4.2	2.1
3	1.3	12.2	3.5	3.8	9.3	8.6	7.7	4.9
4	13.3	42.3	10.6	10.4	11.9	18.0	21.1	15.6
5	27.4	18.5	39.2	13.3	21.4	25.7	22.3	32.8
6	24.3	10.2	17.3	45.1	33.7	21.1	23.9	20.3
7+	29.7	15.9	26.8	26.5	20.8	19.9	20.4	22.1
% males	69.9	84.4	73.5	73.5	78.9	80.1	79.6	77.9

Inshore: In August 1995 a stratified-random trawl survey also using a two-phased approach was conducted in the inshore areas in Disko Bay and Vaigat (Div. 1A) (SCR Doc. 95/111). The biomass estimates from the survey series in 1991-95 were variable around 45 000 tons with an increasing trend from 1993 to 1995.

The overall size compositions of shrimp from the inshore surveys were similar to those of the offshore in relation to the occurrence of modes.

c) **Assessment Results**

Standardized catch-rate indices from Div. 0A and Div. 1CD showed an overall decrease from 1987/88 to 1995, while the index for Div. 1B has been stable since 1989. Biomass indices from research vessel surveys for the offshore and inshore areas combined were variable, with a decrease from 1993 to 1995.

The 1985 year-class, which was the main contributor to the catch rates in the early-1990s, has passed through the population and no longer contributes to the fishery. Despite its high abundance, however, this year-class only served to maintain, rather than increase, the catch rates. More recent year-classes appear to be weaker, although the strengths of the 1992-94 year-classes cannot be evaluated at this time.

There are indications that the stock size has declined. As well, the abundance of males, the source of future recruitment to the fishery, has decreased since 1993.

d) **Research Recommendations**

For shrimp in Div. 0A and Subarea 1, STACFIS **recommended** for consideration at the November 1996 Meeting that:

- *a single combined standardized CPUE series be developed by incorporating fishing data from Div. 0A and Subarea 1. This should be used to investigate the effects of areas and seasons on CPUE;*

- *an analysis of survey and catch-rate information be conducted to show the relative importance of the northern and southern areas over time;*

- *samples from all surveys both offshore and inshore and from the commercial fishery, be analyzed for age composition to obtain estimates of year-class abundance and mortalities.*

STACFIS also **recommended** that:

- *sampling of the commercial fishery be improved to cover all components of the fishery by area and month.*

2. **Shrimp in Denmark Strait** (SCR Doc. 95/108, 109, 112, 114, 115)

a) **Introduction**

The fishery in Denmark Strait started in 1978 and has taken place primarily in the area of Strede Bank and Dohrn Bank as well as on the slopes of Storfjord Deep. The available fishing grounds at any given time depend heavily on the ice conditions. The traditional area extends from approximately 65°N to 67°30'N and between 26°W and 34°W. In 1993, a fishery started in areas between 60°30'N and 65°N and west of 35°W. Catches in the northern (traditional) area increased rapidly to 1980, declined and remained stable from 1981 to 1983, increased gradually to 1988 (12 500 tons) and then decreased again to 1994. In 1995 the catch in the northern area increased to 5 200 tons (January-October). Catches from the southern fishing area were 1 200 and 4 900 tons in 1993 and 1994, respectively, and decreased to 1 700 tons in 1995 (provisional). Catches for the whole area increased from 1992 to 1994 (Fig. 4).

Recent catches and TACs (tons) are as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993[1]	1994[1]	1995[1,2]
Catch north of 65°N											
eastern side	1 794	1 150	1 330	1 424	1 326	281	465	1 750	2 553	1 514	1 151
western side	6 316	9 814	10 848	11 125	9 416	9 994	8 192	5 764	3 950	3 358	4 052
Catch south of 65°N	-	-	-	-	-	-	-	-	1 191	4 950	1 704
Total	8 110	10 964	12 178	12 549	10 742	10 275	8 657	7 514	7 694	9 822	6 907
Advised TAC	5 000	-	-	-	10 000	10 000	10 000	8 000	5 000	5 000	5 000
Effective TAC western side	6 090	7 525[3]	7 725[3]	8 725[3]	9 025[3]	14 100	14 500	13 000	9 563	9 563	9 563

[1] Provisional catches.
[2] January-October.
[3] Not including Greenland fishery north of 66°30'N.

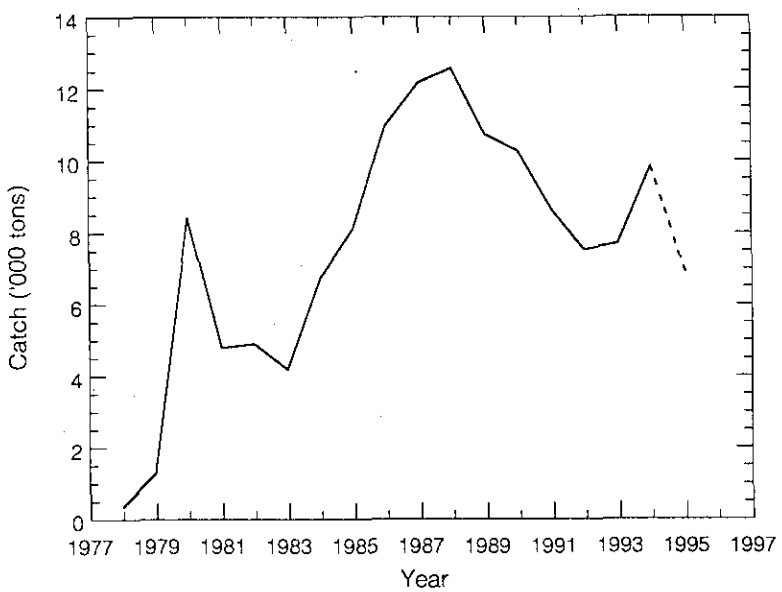


Fig. 4. Shrimp in Denmark Strait: catches.

b) **Input Data**

i) **Commercial fishery data**

Fishing effort and CPUE. Catch and effort data from logbooks were available from Greenland, Norway, Iceland, Faroe Islands and EU-Denmark since 1980, and from EU-France for the years 1980 to 1991. Although shrimp from the southern area are thought to belong to the same stock as those in the northern area, the catch rates as shown in the Fig. 5 and 6, and effort data pertain only to the area north of 65°N.

Between 1980 and 1989, total unstandardized effort increased from about 35 000 hours to more than 100 000 hours, declining thereafter to about 72 000 hours in 1993 and further to about 31 000 hours in 1994. There was a slight increase to 33 000 hours in 1995 (January-October). The fishery in the July-December period became more important at the end of the 1980s, accounting for approximately 50% of the total annual effort, whereas in the 1990s the spring effort has been the most important.

Unstandardized catch rates (Fig. 5) declined from 1980 to 1983, fluctuated from 1983 to 1987 then declined again to 1989 (SCR Doc. 95/115, Fig. 4; SCR Doc. 95/114, Table 12). Values for 1990-93 were similar to the low 1989 value at about 50% of the level seen in the early- to mid-1980s. In 1994 there was, however, a considerable rise in the catch rate and the 1995 value was similar to 1994.

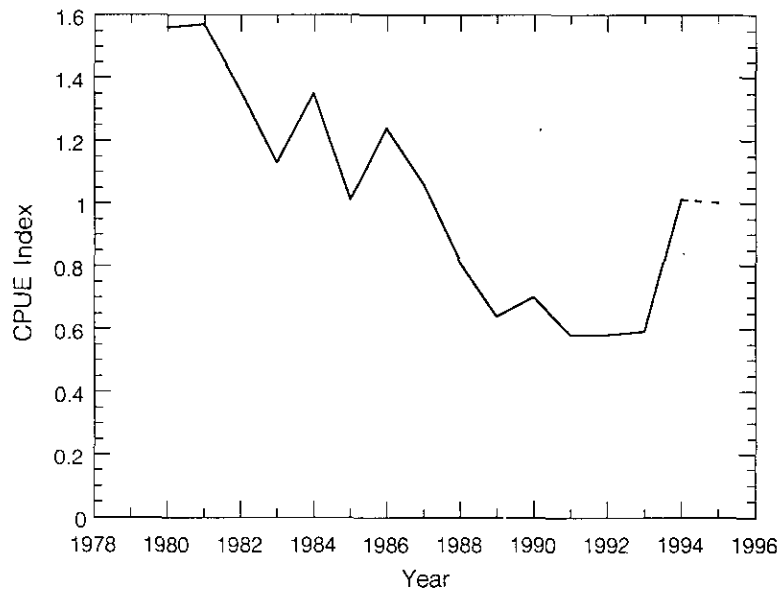


Fig. 5. Shrimp in Denmark Strait: unstandardized catch rates.

Standardized catch-rate series for Greenland vessels for large shrimp and all shrimp (Fig. 6) showed a continuous decline from 1987 to 1993 and a considerable increase in 1994. The 1995 value was approximately the same as that for 1994 (SCR Doc. 95/115, Fig. 5).

Biological data. Samples from the Icelandic fishery in the late-1980s were comprised mainly of females. In the early-1990s, males dominated catches while in 1995 females again made up more than 50% (SCR Doc. 95/115, Fig. 6).

Samples from the Greenlandic fishery showed fewer large females in 1993-95 compared to 1991-92 (SCR Doc. 95/115, Fig. 7; SCR Doc. 95/112, Fig. 10).

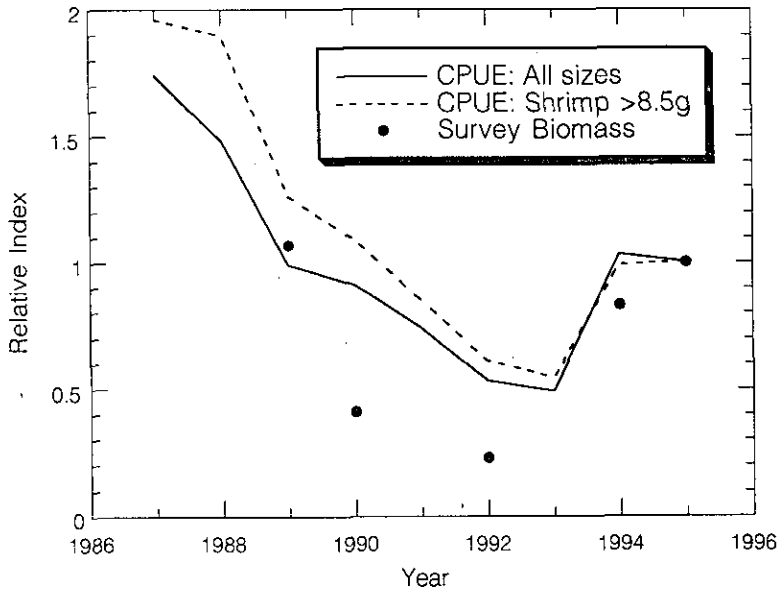


Fig. 6. Shrimp in Denmark Strait: standardized catch rate indices. Biomass indices from research surveys are shown as points. All indices are relative to the 1995 value.

ii) **Research survey data**

A trawl survey was conducted by Greenland in the Denmark Strait in September-October 1995, based on a two-stage sampling method using a spline technique. The biomass index declined from 1989 to 1992, and increased in 1994 and 1995 to almost the 1989 level (SCR Doc. 95/109). Because variance estimates were not available, it was not known whether the differences were statistically significant.

The Greenland survey showed an increase in the proportion of males from 1989 to 1992, which continued a trend from the 1985 to 1989 Norwegian surveys. In 1994 and 1995 the proportion of males was almost the same as 1992.

	Percent males									
Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Norway	41.4	53.5	58.5	58.0						
Greenland				63.1	62.5	-	78.3	-	74.5	74.2

The survey also showed a decrease in occurrence of both the largest males and the females between 1989 and 1992. Subsequent increases in the biomass estimate corresponded to an increase in numbers of both male and female shrimp (SCR Doc. 95/109). Although the 1995 biomass value was similar to that in 1989, stock composition was different; the estimated number of males was much larger in 1995 while that of females was lower.

It should be noted that since the trawl survey does not cover the whole area, biomass estimates should be looked upon as indices rather than absolute estimates.

c) **Assessment Results**

All indices declined to low levels in 1992-93 followed by an increase in 1994-95. Although these indices suggest an increase in abundance, the stock is still considered to be at a lower level than it was during the first half of the 1980s. In combination with increases in these indices, the high proportion of males in recent survey results may indicate good recruitment prospects.

STACFIS noted that high catches in the northern area in earlier years (over 10 000 tons per year) were followed by a decline in stock abundance indices. Following recent catches of 5 000-6 500 tons in the northern area, abundance indices are increasing. This could indicate that the earlier levels of catch were not sustainable and that recent levels may allow improvements in stock status.

3. **Other Business**

a) **Northern Shrimp in the Gulf of Maine**

A brief overview of the northern shrimp resource in the Gulf of Maine was presented. Catches were highest from 1969-72, then declined to very low levels in the late-1970s. Catches increased in recent years, but are still below the levels of the late-1960s.

b) **Flemish Cap Shrimp Meeting**

The Committee discussed the possibility of conducting the assessment of shrimp on Flemish Cap (Div. 3M) at the November Meeting rather than the Annual Meeting (September). It was agreed that rationale for a proposal be developed and tabled for discussion at the 1996 Annual Meeting of the Scientific Council.

c) **Acknowledgements**

There being no other business, the Chairman thanked the participants for their work, and the Secretariat for its assistance during this meeting. The meeting adjourned at 1130 hr on 20 November 1995.

PART D

Miscellaneous

CONTENTS

AGENDA I. SCIENTIFIC COUNCIL MEETING, 7-21 JUNE 1995

I. Opening (Chairman: H. Lassen)

1. Appointment of rapporteur
2. Adoption of agenda
3. Attendance of observers
4. Plan of work
5. Report of proxy votes (by Executive Secretary)
6. Establish Nominating Committee for officers of Scientific Council, STACREC and STACPUB.

II. Fisheries and Environment (STACFEN Chairman: M. Stein)

a) Chairman's introduction to this new Standing Committee on Fisheries and Environment
b) Discussion of terms of references; means to enhance cooperation in environmental research
c) Invited lecture (Dr. Andrew Thomas, Atlantic Centre for Remote-Sensing of the Oceans)
d) Special Session September 1996
e) Marine Environmental Data Service (MEDS) Report for 1994
f) Review of environmental studies in 1994
g) Overview of environmental conditions in 1994
h) Formation of advice based on environmental conditions in 1994
i) National representatives
j) Joint Russian/German data evaluation (ICNAF/NAFO data, status report)
k) Other matters

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

1. Opening

2. General review of catches and fishing activity.

3. Review of recommendations from 1994 meetings

4. Stock assessments

a) Stocks within or partly within the Regulatory Area, as requested by the Fisheries Commission with the concurrence of the Coastal State (Annex 1)(Shrimp in Div. 3M will be undertaken during the Annual Meeting in September 1995.):

- Cod (Div. 3NO; Div. 3M)
- Redfish (Div. 3LN; Div. 3M)
- American plaice (Div. 3LNO; Div. 3M)
- Witch flounder (Div. 3NO)
- Yellowtail flounder (Div. 3LNO)
- *Capelin* (Div. 3NO)
- Squid (Subareas 3 and 4)
- Greenland halibut (Subareas 2 and 3)

b) Stocks within the 200-mile fishery zone in Subareas 2, 3 and 4, as requested by Canada (Annex 2 and Annex 2A):

- Roundnose grenadier (Subareas 2 and 3)
- Silver hake (Div. 4VWX)
- [**Note** also Annex 2, Item 3 concerning cod in Div. 2J+3KL]

c) Stocks within the 200-mile fishery zone in Subarea 1 and at East Greenland as requested by Denmark on behalf of Greenland (Annex 3)(Northern shrimp in Denmark Strait and off East Greenland will be undertaken during a special meeting in November 1995.):

- Redfish (Subarea 1) (by species, if possible)
- *Other finfish and invertebrates (Subarea 1)*

d) Stocks overlapping the fishery zones in Subareas 0 and 1, as requested by Canada and by Denmark on behalf of Greenland (Annexes 2 and 3) (Northern shrimp in Subareas 0 and 1 will be undertaken during a special meeting in November 1995):

- Greenland halibut (Subareas 0 and 1)
- Roundnose grenadier (Subareas 0 and 1)

5. Ageing techniques and validation studies

a) Report on methods of ageing silver hake otoliths
b) Reports on the otolith exchanges of American plaice and Greenland halibut
c) Other ageing and validation studies reported

6. Gear and selectivity studies

7. Other matters

a) Review of arrangements for conducting stock assessments and documentation of assessments
b) Other items referred by the Scientific Council
c) Other business

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

1. Opening

2. Fishery statistics

a) Progress report on Secretariat activities in 1994/95

i) Acquisition of STATLANT 21A and 21B reports for recent years
ii) Acquisition of statistical information from other NAFO Standing Committees
iii) Publication of statistical information
iv) Considerations on non-availability of data

b) The CWP and review of STATLANT 21 forms

i) Report of CWP 16th Session, Madrid, March 1995
ii) STATLANT data and discrepancies in databases
iii) Proposals for *Ad hoc* Consultation, July 1996
iv) Consideration of CWP 17th Session, 1997

3. Biological sampling

a) Report on activities in 1994/95
b) Report by National Representatives on surveys conducted
c) Report on data availability for stock assessments (by Designated Experts)

4. Biological surveys

a) Review of survey activities in 1994 (by National Representatives and Designated Experts)
b) Surveys planned for 1995 and early 1996
c) Review of stratification schemes (new stratifications and changes)
d) Coordination of survey (Greenland halibut or other surveys - see Annex 1)

5. Non-traditional fishery resources in the NAFO Area

a) Statistics and sampling
b) Distribution data from surveys

6. Review of SCR and SCS Documents not related to assessments

7. Other matters

a) List of fishing vessels for 1992
b) Tagging activities
c) Update of information on conversion factors (see Fisheries Commission request of 1994)
d) Other business

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

1. Opening
2. Review of STACPUB membership
3. Review of scientific publications since June 1994
4. Production costs and revenues for Scientific Council publications
   a) Publication costs and revenues
5. Promotion and distribution of scientific publications
   a) Invitational papers for the Journal
6. Editorial matters regarding scientific publications
   a) Review of Editorial Board
   b) *Progress report of publication on western* Atlantic cod
   c) Progress report of publication on West Greenland cod
   d) Progress review of Journal issue of 1993 Symposium
   e) Considerations for publishing Symposium proceedings
   f) Progress review of publication of 1994 Special Session
7. Papers for possible publication
   a) Procedures for STACPUB review
   b) Review of proposals resulting from the 1994 meetings
   c) Review of contributions to the 1995 meeting
8. Other matters

VI. Collaboration with Other Organizations

1. Seventeenth Session of CWP and proposed *Ad hoc* Consultation

VII. Arrangements for Special Sessions

1. Progress report on the Special Session in 1995: joint NAFO/ICES Symposium on "The Role of Marine Mammals in the Ecosystem" (co-conveners: J. Sigurjonsson (Iceland) and G. B. Stenson (Canada))
2. Progress report on the Special Session in 1996
3. Topic for Special Session in 1997.

VIII. Future Scientific Council Meetings, 1995 and 1996

1. Annual Meeting in September 1995 (including assessment of Flemish Cap shrimp)
2. Special Meeting in November 1995 (assessment of Northern Shrimp in Subareas 0+1 and off East Greenland)
3. Other Scientific Council Meetings, 1995 and 1996

IX. Nomination and Election of Officers

X. Management Advice and Responses to Special Requests (Note: subject to possible further requests from the Fisheries Commission pertaining to Greenland halibut in Subareas 2 and 3)

1. Fisheries Commission
   a) Advice for TAC for 1996, and other appropriate management measures
   b) Special requests for management advice on fish and invertebrate stocks (see Annex 1 with specific reference to items 3, 4, 5 and 6)
      i) Information of stock separation on cod in Div. 2J+3KL
      ii) Implications of mesh size in mid-water trawls for redfish in Div. 3LN
      iii) Interrelation between seals and commercial fish stocks
      iv) Coordinated research on Greenland halibut
      v) Other requests

2. Coastal States (Annexes 2 and 3)

   a) Advice for TAC for 1996, and other appropriate management measures
   b) Special requests for management advice on fish and invertebrate stocks
   c) Management advice relevant to harp and hooded seals

XI. Other Matters

XII. Adoption of Reports and Recommendations

1. STACFIS
2. STACFEN
3. STACREC
4. STACPUB
5. Joint ICES/NAFO Working Group on Harp and Hooded Seals (see Annex 4 for Agenda)

XIII. Adoption of Scientific Council Report

XIV. Adjournment

ANNEX 1. FISHERIES COMMISSION'S REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1996 OF CERTAIN STOCKS IN SUBAREAS 3 AND 4

1. The Fisheries Commission with the concurrence of the Coastal State as regards the stocks below which occur within its jurisdiction, requests that the Scientific Council, at a meeting in advance of the 1995 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks or groups of stocks in 1996:

Cod (Div. 3NO; Div. 3M)
Redfish (Div. 3LN; Div. 3M)
American plaice (Div. 3LNO; Div. 3M)
Witch flounder (Div. 3NO)
Yellowtail flounder (Div. 3LNO)
Capelin (Div. 3NO)
Squid (Subareas 3 and 4)
Shrimp (Div. 3M)
Greenland halibut (Subareas 2 and 3)

2. The Commission and the Coastal State request the Scientific Council to consider the following options in assessing and projecting future stock levels for those stocks listed above:

a) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and management options evaluated in terms of their implications for fishable stock size in both the short and long term. As general reference points the implications of fishing at $F_{0.1}$, F_{1994} and F_{max} in 1996 and subsequent years should be evaluated. The present stock size and spawning stock size should be described in relation to those observed historically and those expected in the longer term under this range of options.

Opinions of the Scientific council should be expressed in regard to stock size, spawning stock sizes, recruitment prospects, catch rates and TACs implied by these management strategies for 1996 and the long term. Values of F corresponding to the reference points should be given and their accuracy assessed.

b) For those stocks subject to general production-type assessments, the time series of data should be updated, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference points should be the level of fishing effort or fishing mortality (F) which is calculated to be required to take the MSY catch in the long term and two-thirds of that effort level.

c) For those resources of which only general biological and/or catch data are available, no standard criteria on which to base advice can be established. The evidence of stock status should, however, be weighed against a strategy of optimum yield management and maintenance of stock biomass at levels of about two-thirds of the virgin stock.

d) Spawning stock biomass levels that might be considered necessary for maintenance of sustained recruitment should be recommended for each stock. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be offered that specifically respond to such concerns.

e) Presentation of the result should include the following:

i) for stocks for which analytical dynamic-pool type assessments are possible:

- a graph of yield and fishing mortality for at least the past 10 years.
- a graph of spawning stock biomass and recruitment levels for at least the past 10 years.
- a graph of catch options for the year 1996 over a range of fishing mortality rates (F) at least from $F_{0.1}$ to F_{max}.
- a graph showing spawning stock biomass at 1.1.1997 corresponding to each catch option.
- graphs showing the yield-per-recruit and spawning stock per-recruit values for a range of fishing mortality.

ii) for stocks for which advice is based on general production models, the relevant graph of production on fishing mortality rate or fishing effort.

In all cases the three reference points, actual F, F_{max} and $F_{0.1}$ should be shown.

3. The Fisheries Commission with the concurrence of the Coastal State requests that the Scientific Council continue to provide information, if available, on the stock separation in Div. 2J+3KL and the proportion of the biomass of the cod stock in Div. 3L in the Regulatory Area and a projection if possible of the proportion likely to be available in the Regulatory Area in future years. Information is also requested on the age composition of that portion of the stock occurring in the Regulatory Area.

4. The Scientific Council is asked to review all data available on the implications of using 90 mm minimum mesh size in mid-water trawls when fishing for redfish in Div. 3LN, in comparison to 130 mm. This should include consideration of fish lost during haulbacks.

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.

ANNEX 2. CANADIAN REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1996 OF CERTAIN STOCKS IN SUBAREAS 0 TO 4

1. Canada requests that the Scientific Council, at its meeting in advance of the 1995 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks in 1996:

Roundnose grenadier (Subareas 2 and 3)
Silver hake (Div. 4V, 4W and 4X)

It is also suggested that, subject to the concurrence of Denmark (Greenland), the Scientific Council, prior to the 1995 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1996 of the following stocks:

Shrimp (Subareas 0 and 1)
Greenland halibut (Subareas 0 and 1)
Roundnose grenadier (Subareas 0 and 1)

The Scientific Council has noted previously there was no biological basis for making two separate assessments for the Greenland halibut throughout Subareas 0-3, but has advised that separate TACs be maintained for different areas of the distribution of Greenland halibut. The Council is asked therefore, subject to the concurrence of Denmark (Greenland) as regards Subarea 1, to provide an overall assessment of status and trends in the total stock throughout its range and comment on its management, including any expansion of the responses to the questions asked in June 1993. In particular, the Council is asked to advise on appropriate TAC levels separately for SA 0+1, for SA 2 + Division 3K and for Divisions 3LMNO, and to make recommendations on the distribution of fishing effort within each of these three geographic areas. The Council is asked also to provide information on present harvest patterns in terms of yield per recruit and on distributional variation of the resource in recent years.

With respect to shrimp, it is recognized that the Council may, at its discretion, delay providing advice until later in the year, taking into account data availability, predictive capability, and the logistics of additional meetings.

2. Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for those stocks listed above:

a) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and implications of fishing at $F_{0.1}$ in 1996 and subsequent years should be evaluated: The present stock size should be described in relation to those observed historically and those to be expected at the $F_{0.1}$ level in both the short and long term. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be considered to rebuild the spawning stock. All results should be expressed in terms of stock sizes, catch rates and TACs implied for 1996 and the long term.

b) For those stocks subject to general production-type assessments, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference point should be the level of fishing effort (F) which is two-thirds that calculated to be required to take the MSY catch in the long term.

c) For those resources on which only general biological and/or catch data are available, no standard criteria on which to base advice can be established. The evidence on stock status should, however, be weighed against a strategy of optimum yield management and maintenance of stock biomass at levels of about two-thirds that of the virgin stock.

3. The Scientific Council is requested to review the status of the cod stock in Divisions 2J+3KL and to provide estimates of the current size of the total and spawning biomass, together with a description of recent trends. The Council is asked further to provide estimates of the immediate and long-term outlook for the abundance of this stock, including both total and spawning biomass.

William A. Rowat
Deputy Minister
Department of Fisheries and Oceans
Ottawa, Canada

ANNEX 2A. SPECIAL QUESTIONS FROM CANADA ON GREENLAND HALIBUT IN SA 2+3 FOR NAFO SCIENTIFIC COUNCIL, 7-21 JUNE 1995

1. Determine any trends in the size and age composition of Greenland halibut catches and provide advice on the conservation implications of the trends.

2. What are the implications for the conservation of the stock and long-term harvest in terms of yield-per-recruit and spawning biomass-per-recruit of fishing under three assumptions about the sizes of entry/full recruitment as:

   a) associated with current NAFO regulated mesh size;
   b) harvesting practices that delayed significant recruitment until 60 cm fish length;
   c) harvesting practices that permitted significant recruitment at 30 cm.

3. Determine any trends in the spawning stock biomass in SA 2+3 and in the proportion of mature fish in this area.

4. The 1990 year-class has appeared strong in research vessel catches and its strength is confirmed by large numbers found in commercial catches during the early part of 1995. At age five, it is many years away from contributing to the spawning stock. What changes in management of the fishery in 1995 and future years would be needed to minimize catches of this year-class while it is young and rapidly growing and allow it to make a) 25%, b) 50%, or c) 75% of the contribution to future spawning biomass that it would if none of it was caught at immature ages.

5. Research surveys of Greenland halibut in SA 2+3 declined from the late 1970s to the mid 1990s. The stock level in the mid 1980s is intermediate between the relatively high levels of the late 1970s and the current low abundance and could support a sustainable fishery in the long term. Provide strategy options to rebuild the trawlable biomass in SA 2+3 and the percent mature in the population within five and ten years to the approximate level of the mid 1980s.

6. By-catch of American plaice from Div. 3LNO in the Greenland halibut fishery has increased. This American plaice stock is under moratorium. Provide advice on ways to eliminate or minimize this by-catch.

W. A. Rowat
Deputy Minister
Department of Fisheries and Oceans
Ottawa, Canada

ANNEX 3. DENMARK (GREENLAND) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT OF CERTAIN STOCKS IN 1996

1. Denmark, on behalf of Greenland, requests the Scientific Council of NAFO in advance of the 1995 Annual Meeting, provide advice on the scientific basis for management of the following stocks in Subarea 1 in 1996 and as many years forward as data allow:

   i) Redfish (by species, if possible)
   ii) Any other stock of invertebrates and finfish of commercial interest, for which data allow a status report

   It is also suggested that, subject to the concurrence of Canada, advice be given for the following stocks overlapping Subareas 0 and 1:

   i) Greenland halibut
   ii) Roundnose grenadier

2. In the analyses on which management advice will be based, the following should be included:

   In its 1993 report, the Scientific Council has noted that the offshore component of **Greenland halibut**, in Subareas 0 and 1 was distributed equally between these Subareas. Further in its 1994 report, the Scientific Council has noted that the biomass of the inshore component in Subarea 1 was unknown. The Council is therefore asked to provide further information on following topics.

   a) Allocation of TACs to appropriate Subareas (within Subareas 0 and 1).
   b) Allocation of TAC for Subarea 1 inshore areas.

   The **Greenland halibut** stock in Subareas 0-3 is considered a single stock as noted in the Scientific Council Report, 1990. The Council is also asked to provide any new information on following topics:

   a) Reproductive status of the inshore stock component in Subareas 0 and 1, and the influence of recruitment variability to these areas.

   b) The impacts from the ongoing fisheries in Subareas 2 and 3, on the stock component in Subarea 1.

3. Denmark, on behalf of Greenland, further requests that the Scientific Council of NAFO before December 1995, provide advice on the scientific basis for management of the following stock in Subareas 0 and 1 (including Subarea 1 north of 71°N and Subarea 1 inshore) in 1996 and as many years forward as data allow:

   i) Northern shrimp (*Pandalus borealis*)

   Further, in cooperation with ICES, the Scientific Council is requested to advise on the scientific basis for management of the following stock in the Denmark Strait and off East Greenland:

   i) Northern shrimp (*Pandalus borealis*)

4. The Scientific Council should feel free to report on such other invertebrates and finfish stocks in Subarea 1 and on such other scientifically based management options for the above-mentioned Subarea 1 stocks, as it feels applicable.

J. B. Olsen
On behalf of the
Ministry for Fisheries, Hunting & Agriculture
Aslisarnermut, Piniarnermut, Nunalerinermullu Pisortaqarfik
Direktoratet for Fangst, Fiskeri og Landbrug

ANNEX 4. JOINT ICES/NAFO WORKING GROUP ON HARP AND HOODED SEALS[1]

5-9 June 1995

AGENDA

1. Opening Remarks

2. Meeting Arrangements
   - 2.1 Meeting schedule
   - 2.2 Appointment of rapporteur(s)
   - 2.3 Review of Terms of Reference
   - 2.4 Adoption of the Agenda
   - 2.5 Review of documentation

3. Harp Seals (*Phoca groenlandica*)
   - 3.1 Stock identity, distribution and migrations
   - 3.2 The Northwest Atlantic Stock
     - 3.2.1 Information on recent catches and regulatory measures
     - 3.2.2 Current research
     - 3.2.3 Biological parameters
     - 3.2.4 Population assessment
     - 3.2.5 Replacement yields
   - 3.3 The Greenland Sea Stock
     - 3.3.1 Information on recent catches and regulatory measures
     - 3.3.2 Current research
     - 3.3.3 Information on the state of the stock
   - 3.4 The White Sea and Barents Sea Stock
     - 3.4.1 Information on recent catches and regulatory measures
     - 3.4.2 Current research
     - 3.4.3 Information on the state of the stock

4. Hooded Seals (*Cystophora cristata*)
   - 4.1 Stock identity, distribution and migrations
   - 4.2 The Northwest Atlantic Stock
     - 4.2.1 Information on recent catches and regulatory measures
     - 4.2.2 Current research
     - 4.2.3 Biological parameters
     - 4.2.4 Population assessment
     - 4.2.5 Replacement yields
   - 4.3 The Greenland Sea Stock
     - 4.3.1 Information on recent catches and regulatory measures
     - 4.3.2 Current research
     - 4.3.3 Information on the state of the stock

5. Ecology of Seal Stocks
   - 5.1 Information on ecological changes
   - 5.2 Changes in biological parameters
   - 5.3 Ecological interactions

6. Future Research Needs

7. Future Activities of the Working Group

8. Recommendations

9. Other Business

10. Adoption of Report

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[1] The complete Report of the Joint ICES/NAFO Working Group on harp and hooded seals was published in SCS Doc. 95/16, Serial No. N2569.

TERMS OF REFERENCE

The proposed Terms of Reference for this Working Group are as follows:

The joint ICES/NAFO Working Group on Harp and Hooded Seals shall meet 5-9 June 1995 at NAFO Headquarters, Dartmouth, Nova Scotia, Canada, with G. Stenson, St. John's, Newfoundland, Canada, as Chairman to:

- Assess stock sizes, distributions and pup production of harp and hooded seals in the Northwest Atlantic and estimate replacement and sustainable yields both at present stock sizes and in the long term under varying options of age compositions in the catch.

- Assess the effects on harp and hooded seal populations of recent environmental changes or changes in food supply and possible interactions with other living marine resources in the North Atlantic.

- Provide proposals for future research programs.

Based on the report of the above-mentioned meeting, the Scientific Council will then at its June 1995 Meeting:

- Advise on catch options for harp and hooded seals in the NAFO area.

AGENDA II. SCIENTIFIC COUNCIL MEETING - 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."

AGENDA III. SCIENTIFIC COUNCIL MEETING, 17-20 NOVEMBER 1995

I. Opening (Chairman: W. R. Bowering)

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

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

1. Stock assessments (see Annexes 1 and 2)

   - Northern shrimp (Subareas 0 and 1)

   - *Northern shrimp (in Denmark Strait and off East Greenland)*

   – [**Note**: For Northern shrimp in Subareas 0 and 1, the assessment and TAC advice should include, if possible, the areas north of 71°N in Subarea 1 as well as the inshore region of Subarea 1.]

2. Other business

III. Formulation of Advice

1. Northern shrimp (Subareas 0 and 1)

2. Northern shrimp (Denmark Strait and off East Greenland)

IV. Other Matters

1. Publication of papers on Flemish Cap shrimp (see Attachment 1)

V. Adoption of Reports

VI. Adjournment

ANNEX 1. *EXTRACTED FROM :* CANADIAN REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1996 OF CERTAIN STOCKS IN SUBAREAS 0 TO 4

1. Canada requests that the Scientific Council, at its meeting in advance of the 1995 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks in 1996:

Roundnose grenadier (Subareas 2 and 3)
Silver hake (Div. 4V, 4W and 4X)

It is also suggested that, subject to the concurrence of Denmark (Greenland), the Scientific Council, prior to the 1995 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1996 of the following stocks:

Shrimp (Subareas 0 and 1)
Greenland halibut (Subareas 0 and 1)
Roundnose grenadier (Subareas 0 and 1)

With respect to shrimp, it is recognized that the Council may, at its discretion, delay providing advice until later in the year, taking into account data availability, predictive capability, and the logistics of additional meetings.

2. Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for those stocks listed above:

a) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and implications of fishing at $F_{0.1}$ in 1996 and subsequent years should be evaluated. The present stock size should be described in relation to those observed historically and those to be expected at the $F_{0.1}$ level in both the short and long term. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be considered to rebuild the spawning stock. All results should be expressed in terms of stock sizes, catch rates and TACs implied for 1996 and the long term.

b) For those stocks subject to general production-type assessments, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference point should be the level of fishing effort (F) which is two-thirds that calculated to be required to take the MSY catch in the long term.

c) For those resources on which only general biological and/or catch data are available, no standard criteria on which to base advice can be established. The evidence on stock status should, however, be weighed against a strategy of optimum yield management and maintenance of stock biomass at levels of about two-thirds that of the virgin stock.

William A. Rowat
Deputy Minister
Department of Fisheries and Oceans
Ottawa, Canada

ANNEX 2. *EXTRACTED FROM :* DENMARK (GREENLAND) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT OF CERTAIN STOCKS IN 1996

3. Denmark, on behalf of Greenland, further requests that the Scientific Council of NAFO before December 1995, provide advice on the scientific basis for management of the following stock in Subareas 0 and 1 (including Subarea 1 north of 71°N and Subarea 1 inshore) in 1996 and as many years forward as data allow:

i) Northern shrimp (*Pandalus borealis*)

Further, in cooperation with ICES, the Scientific Council is requested to advise on the scientific basis for management of the following stock in the Denmark Strait and off East Greenland:

i) Northern shrimp (*Pandalus borealis*)

J. B. Olsen
On behalf of the
Ministry for Fisheries, Hunting & Agriculture
Aslisarnermut, Piniarnermut, Nunalerinermullu Pisortaqarfik
Direktoratet for Fangst, Fiskeri og Landbrug

ATTACHMENT 1

At its meeting of 9-15 September 1995, the Scientific Council adopted the STACPUB report which contained the following text:

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

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

STACPUB **recommended** that *a draft be made available for discussion during the November 1995 Meeting on Shrimp in Davis and Denmark Straits.*

LIST OF RESEARCH AND SUMMARY DOCUMENTS

RESEARCH DOCUMENTS (SCR)

Doc. No.	Ser. No.	
95/1[a]	N2499	RIKHTER, V. A. On the population structure of beaked redfish (*Sebastes mentella* Travin) in the Irminger Sea as related to the hypothesis of the latter larvae into the North-Western Atlantic. (*10 pages, revised*)
95/2[a]	N2501	VYALOV, YU. A., and P. P. CHERNYSHKOV. Non-fishery factors impact - possible explanation of cod stock reduce in NAFO Divisions 2J+3KL. (9 pages)
95/3[a]	N2504	RÄTZ, H.-J. Redfish Subarea 1 (0-400 m): groundfish survey results, 1982-94 and length structure of German landings, 1962-78. (15 pages)
95/4[a]	N2505	RÄTZ, H.-J. Status of the demersal fish assemblage off West Greenland, 1982-94 (Divisions 1B-1F, 0-400 m). (6 pages)
95/5[a]	N2506	LLORET, J. Stock abundance and biomass, distribution and length structure of American plaice (*Hippoglossoides platessoides*, Fabricius 1780) off West Greenland (NAFO Divisions 1B-1F, 0-400 m), 1982-94. (11 pages)
95/6[a]	N2508	BECH, G. Retrieval of lost gillnets at Ilulissat Kangia. (5 pages)
95/7[a]	N2513	GLENN, G. F. Marine Environment Data Service Report for 1994. (18 pages)
95/8[a]	N2515	GORCHINSKY, K. V., P. I. SAVVATIMSKY, and G. B. RUDNEVA. Size-age composition of witch flounder (*Glyptocephalus cynoglossus*) catches in Divisions 3LMNO in 1980-1994. (14 pages)
95/9[a]	N2516	GERASIMOVA, O. V., and V. M. KISELEVA. Localization of Newfoundland cod spawning grounds during stock sharp reduction (from 1978-1991 Russian survey data). (10 pages)
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95/13[a]	N2520	VASKOV, A. A. Assessment of deepwater redfish stock in Division 3L by the results of a trawl survey in 1994. (5 pages)
95/14[a]	N2521	SKÚLADÓTTIR, U. The female sexual maturity of northern shrimp (*Pandalus borealis* Kr.) in Denmark Strait in the years 1985-1993 and a comparison of the nearest Icelandic shrimp populations. (15 pages)
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95/16[aa]	N2523	STENSON, G. B., R. A. MYERS, I-H. NI, and W. G. WARREN. Pup production of hooded seals (*Cystophora cristata*) in the Northwest Atlantic. (16 pages)

[a] Scientific Council Meeting, 7-15 June 1995

[aa] Papers issued at Joint ICES/NAFO Working Group on Harp and Hooded Seals, 5-9 June 1995

95/17[aa]	N2524	STENSON, G. B., M. O. HAMMILL, M. C. S. KINGSLEY, B. SJARE, W. G. WARREN, and R. A. MYERS. 1994 pup production of the Northwest Atlantic harp seals, *Phoca groenlandica*. (20 pages)
95/18[a]	N2525	NIELSEN, J. G., and J. BOJE. Sexual maturity of Greenland halibut at West Greenland based on visual and histological observations. (7 pages)
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95/20[aa]	N2527	SHELTON, P. A., G. B. STENSON, B. SJARE, and W. G. WARREN. Model estimates of harp seal numbers at age for the Northwest Atlantic. (19 pages)
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95/23[a]	N2531	YOKAWA, K., H. SHIMIZU, O. JORGENSEN, and H. YAMADA. Results of a stratified random bottom trawl survey off West Greenland in 1994. (12 pages)
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95/32[a]	N2541	STEIN, M. Climatic conditions around Greenland - 1994. (18 pages)
95/33[a]	N2542	COLBOURNE, E., and G. MERTZ. Spatial and temporal variability in the CIL on the Newfoundland and Labrador Shelves. (14 pages)
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95/43[a]	N2552	DRINKWATER, K. F., E. COLBOURNE, and D. GILBERT. Overview of environmental conditions in the Northwest Atlantic in 1994. (60 pages)
95/44[a]	N2554	HUNT, J. J. Evaluation of changes in weight-at-age and growth rate for 4VWX silver hake, 1983-94. (12 pages)
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95/46[a]	N2557	MURPHY, E. F., and C. A. BISHOP. Cod in Divisions 2J+3KL estimates of biomass and age composition for the portion of the stock in the NAFO Regulatory Area from Canadian research vessel surveys. (8 pages)
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95/49[a]	N2560	Seal hunting statistics for Greenland 1993 and 1994, according to the new system of collecting information, compared to the previous Lists-of-Game. (17 pages)
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[a] Scientific Council Meeting, 7-15 June 1995
[aa] Papers issued at Joint ICES/NAFO Working Group on Harp and Hooded Seals, 5-9 June 1995

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95/57[a]	N2571	MYERS, R. A., G. MERTZ, W. R. BOWERING, and P. S. FOWLOW. The biological limits of overexploitation of Greenland halibut, *Reinhardtius hippoglossoides*. (8 pages)
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95/59[a]	N2574	WALSH, S. J., and D. POWER. Abundance and biomass of American plaice populations on the Grand Banks as derived from the juvenile groundfish surveys, NAFO Divisions 3LNO. (21 pages)
95/60[a]	N2575	BISHOP, C. A., J. T. ANDERSON, E. COLBOURNE, G. R. LILLY, and R. A. MYERS. Cod in NAFO Divisions 2J+3KL. (15 pages)
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95/71[a]	N2586	CORNUS, H. P., and D. POWER. Assessment of the redfish stocks in NAFO Division 3M (Flemish Cap) in 1994. (15 pages)
95/72[a]	N2589	DE CÁRDENAS, E., and M. L. GODINHO. An assessment of the cod stock in NAFO Division 3M. (5 pages)
95/73[a]	N2590	VAZQUEZ, A., A. AVILA DE MELO, E. DE CÁRDENAS, and R. ALPOIM. An assessment of the cod stock in NAFO Division 3M. (8 pages, revised)

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95/76[a] N2593 SHOWELL, M. A., and M. C. BOURBONNAIS. Assessment of the 4VWX silver hake population in 1994. (22 pages)

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95/80[b] N2597 MOORE, S. E., and D. P. DEMASTER. Cetaceans habitats in the Alaskan Arctic. (18 pages)

95/81[b] N2598 GRIFFIN, R. B. An investigation of relationships between odontocete distributions and zooplankton abundances. (26 pages)

95/82[b] N2604 FERTL, D., and D. LEATHERWOOD. Cetacean interactions with trawls: a preliminary review. (34 pages)

95/83[b] N2605 BOGSTAD, B., K. H. HAUGE, and Ø. ULLTANG. MULTSPEC - a multispecies model for fish and marine mammals in the Barents Sea. (47 pages)

95/84[b] N2606 MERRICK, R. L. Current and historical role of apex predators in the Bering Sea ecosystem. (20 pages)

95/85[b] 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). (16 pages)

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95/89[b] N2611 BOYLE, G. J. An operant methods of investigating prey selection in seals. (15 pages)

95/90[b] N2612 TRITES, A. W, D. PAULY, and V. CHRISTENSEN. Competition between fisheries and marine mammals for prey and primary production in the Pacific Ocean. (22 pages)

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[a] Scientific Council Meeting, 7-21 June 1995
[b] Scientific Council Annual Meeting, 9-15 September 1995

95/92[b] 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*). (13 pages)

95/93[b] 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. (12 pages)

95/94[b] 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. (11 pages)

95/95[b] 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. (17 pages)

95/96[b] 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*). (18 pages)

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95/100[b] N2622 SAINZA, C. Northern shrimp (*Pandalus borealis*) on Flemish Cap in July 1995. (7 pages)

95/101[b] N2624 SIEGSTAD, H., and C. HVINGEL. The Greenland fishery for northern shrimp (*Pandalus borealis*) on Flemish Cap, NAFO Division 3M, in 1994 and 1995. (9 pages)

95/102[b] N2625 COLBOURNE, E. Oceanographic conditons on the Flemish Cap during the summery 1995, with comparisons to the 1961-1990 average. (12 pages)

95/103[b] 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. (10 pages)

95/104[b] N2627 RODRÍGUEZ-MARÍN, E. Feeding relationships of demersal fish in Flemish Cap in summer, 1993-1994). (15 pages)

95/105[b] N2628 NICOLAJSEN, Å. Biomass estimate of the northern shrimp stock on Flemish Cap (Division 3M) for 1993 and 1994. (17 pages)

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95/109[c] N2648 CARLSSON, D. M., and P. KANNEWORFF. Trawl survey for shrimp (*Pandalus borealis*) in Denmark Strait, 1995. (14 pages)

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[b] Scientific Council Annual Meeting, 9-15 September 1995
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95/2[a] N2497 NAFO SECRETARIAT. Provisional index and list of titles of research and summary documents of 1994. (29 pages)

95/3[a] N2498 ROWAT, W. A. Canadian request for scientific advice on management in 1996 of certain stocks in Subareas 0 to 4. (2 pages)

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95/5[a] N2502 NAFO SECRETARIAT. Catches of selected species by stock area and country for the period 1983-93. (26 pages)

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95/8[a] N2509 ROBERGE, M. M., and M. SINCLAIR. Canadian research report for 1994. (12 pages)

95/9[a] N2511 NAFO SECRETARIAT. Reports of the CWP on Atlantic Fishery Statistics (CWP). (40 pages)

95/10[a] N2510 NAFO SECRETARIAT. Notes of statistical activities and publications since June 1994. (2 pages)

95/11[a] N2514 NAFO SECRETARIAT. List of biological sampling data for 1993. (23 pages)

95/12[a] N2530 YOKAWA, K. Japanese research report for 1993. (4 pages)

95/13[a] N2534 AVILA DE MELO, A. M., R. ALPOIM, M. L. GODINHO, and E. SANTOS. Portuguese research report for 1994. (53 pages)

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[a] Scientific Council Meeting, 7-15 June 1995
[c] Scientific Council Meeting, 17-20 November 1995

95/14[a]	N2553	HVINGEL, C. Denmark/Greenland research report for 1994. (6 pages)
95/15[a]	N2555	DE CÁRDENAS, E., S. JUNQUERA, and A. VAZQUEZ. Spanish research report for 1994. (13 pages, revised)
95/16[aa]	N2569	WORKING GROUP ON SEALS. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. (40 pages)
95/17[a]	N2587	NAFO SECRETARIAT. A compilation of research vessel surveys on a stock by stock basis. (19 pages)
95/18[a]	N2588	LASSEN, H. Special Session, September 1996. (5 pages)
95/19[a]	N2599	NAFO. Report of Scientific Council, 7-21 June 1995 Meeting. (177 pages)
95/20[b]	N2630	WIGLEY, S. E., R. K. MAYO, H. MUSTAFA, and F. M. SERCHUK. United States research report for 1994. (7 pages)
95/21[b]	N2632	NAFO. Report of Scientific Council, 9-15 September 1995 Meeting. (52 pages)
95/22[c]	N2655	NAFO. Report of Scientific Council, 17-20 November Meeting. (25 pages)

[a] Scientific Council Meeting, 7-15 June 1995
[aa] Papers issued at Joint ICES/NAFO Working Group on Harp and Hooded Seals, 5-9 June 1995
[b] Scientific Council Annual Meeting, 9-15 September 1995
[c] Scientific Council Meeting, 17-20 November 1995

LIST OF REPRESENTATIVES, ADVISERS/EXPERTS AND OBSERVERS, 1995

CANADA

		Meetings
Representatives:		
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	A B
Beckett, J.S.	Fisheries Research Branch, Dept. of Fish. & Oceans, 200 Kent St., Ottawa, Ont. K1A 0E6 Phone: +613-990-0279 - Fax: +613-954-0807	A B
Bishop, C.A.	Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-662-2053 - Fax: +709-772-4188	A
Brodie, W.B.	Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-3288 - Fax: +709-772-4188 - E-mail: brodie@nflorc.nwafc.nf.ca	A B C
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	A B C
Parsons, D.G.	Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-2093 - Fax: +709-772-4105 - E-mail: parsons@nflorc.nwafc.nf.ca	B C
Powles, H.	Sr. Policy Advisor, Invert. & Pacific Marine Fish, 200 Kent St., Ottawa, Ontario K1A 0E6 Phone: +613-990-0285 - Fax: +613-954-0807 - E-mail: howard.powles@nor.ottwpo.dfo.mpo.X400.gc.ca	C
Advisers/Experts		
Mertz, G.J.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1 Fax: +709-772-4188 - E-mail: mertz@nflorc.nwafc.nf.ca	A
Morgan, M.J.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-2262 - Fax: +709-772-4188 - E-mail: morgan@nflorc.nwafc.nf.ca	A
Murphy, E.F.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-5479 - Fax: +709-772-4188 - E-mail: murphy@nflorc.nwafc.nf.ca	A
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@nflorc.nwafc.nf.ca	A
Power, D.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-4935 - Fax: +709-772-4188 - E-mail: powers@nflorc.nwafc.nf.ca	A B
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	B
Stansbury, D.E.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-0559 - Fax: +709-772-4188 - E-mail: stansbury@nflorc.nwafc.nf.ca	A
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	B
Walsh, S.J.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-5478 - Fax: +709-772-4918 - E-mail: walsh@nflorc.nwafc.nf.ca	A
Winters, G.H.	Northwest Atlantic Fisheries Centre, Box 5667, St. John's, Newfoundland A1C 5X1 Phone: +709-772-2001 - Fax: +709-772-4188	A
Blackwood, G.	Fisheries Resource Conservation Council of Canada, P. O. Box 8700, St. John's, Nfld Phone: +709-729-3735 - Fax: +709-729-6082	A
Drinkwater, K.F.	Coastal Oceanog., Dept. of Fish. & Oceans, BIO, P. O. Box 1006, Dartmouth, N.S. B2Y 4A2 Phone: +902-426-2650 - Fax: +902-426-2256 - E-mail: k_drinkwater@bionet.bio.dfo.ca	A
Branton, R.M.	Marine Fish Div., Dept. of Fish. & Oceans, BIO, P. O. Box 1006, Dartmouth, N.S. B2Y 4A2 Phone: +902-426-3537 - Fax: +902-426-1506 - E-mail: b_branton@bionet.bio.dfo.ca	A
Halliday, R.G.	Marine Fish Div., Dept. of Fish. & Oceans, BIO, P. O. Box 1006, Dartmouth, N.S. B2Y 4A2 Phone: +902-426-3240 - Fax: +902-426-1506 - E-mail: r_halliday@bionet.bio.dfo.ca	A B

A = Scientific Council Meeting, 7-21 June 1995
B = *Scientific Council Annual Meeting, 9-15 September* 1995
C = Scientific Council Meeting, 17-20 November 1995

		Meetings		
Showell, M.A.	Marine Fish Div., Dept. of Fish. & Oceans, BIO, P. O. Box 1006, Dartmouth, N.S. B2Y 4A2 Phone: +902-426-2937 - Fax: +902-426-7827 - E-mail: m_showell@bionet.bio.dfo.ca	A		
Hunt, J.J.	Marine Fish Div., Dept. of Fish. & Oceans, Biological Station, St. Andrews, N.B. E0G 2X0 Phone: +506-529-8854 - Fax: +506-529-4274	A		
Glenn, G.F.	Marine Environmental Data Service (MEDS), 200 Kent St., Ottawa, Ontario K1A 0E6 Phone: +613-990-0257 - Fax: +613-993-4658 - E-mail: glenn@ottmed.meds.dfo.ca	A		
Savard, L.	Dept. of Fish. & Oceans, Maurice Lamontagne Inst., P.O. Box 1000, Mont-Joli, Que G5H 3Z4 Phone: +418-775-0615 - Fax: +418-775-0542			C
Morin, B.	Dept. of Fish. & Oceans, Maurice Lamontagne Inst., P.O. Box 1000, Mont-Joli, Que G5H 3Z4 Fax: +418-775-0542	A		
Mathias, J.A.	Freshwater Inst. Sci. Lab., Dept. of Fish. & Oceans, 501 University Cres., Winnipeg R3T 2N6 Phone: +204-983-5155 - Fax: +204-984-2403 - E-mail: mathias@wpgdfo.wpg.dfo.ca	A		

CUBA

Representative:

Padilla, O. Leiva	Cuban Fishing Fleet, Avenida Desamparado, S/N, Puerto Pesquero de la Habana	A		

DENMARK

GREENLAND

Representative:

Nygaard, K.H.	Greenland Institute of Natural Resources, Box 570, 3900 Nuuk, Greenland Phone: +299 21095 - Fax: +299 25957 - E-mail: naturins@greennet.gl	A		

Advisers/Experts

Carlsson, D.M.	Greenland Institute of Natural Resources, Tagensvej 135, 1, DK-2200 Copenhagen N. Phone: +45 318 54444 - Fax: +45 358 21850 - E-mail: grfidmc@inet.uni.c.dk			C
Jørgensen, O.A	Greenland Institute of Natural Resources, Tagensvej 135, 1, DK-2200 Copenhagen N. Phone: +45 318 54444 - Fax: +45 358 21850 - E-mail: grfidmc@inet.uni.c.dk	A		
Kanneworff, P.	Greenland Institute of Natural Resources, Tagensvej 135, 1, DK-2200 Copenhagen N. Phone: +45 318 54444 - Fax: +45 358 21850 - E-mail: grfidmc@inet.uni.c.dk			C
Kapel, F.O.	Greenland Institute of Natural Resources, Tagensvej 135, 1, DK-2200 Copenhagen N. Phone: +45 318 54444 - Fax: +45 358 21850 - E-mail: grfifok@inet.uni.c.dk		B	
Bech, G.	Greenland Institute of Natural Resources, Box 570, 3900 Nuuk, Greenland Phone: +299 21095 - Fax: +299 25957 - E-mail: naturins@greennet.gl	A		
Folmer, O.	Greenland Institute of Natural Resources, P. O. Box 570, DK-3900, Nuuk, Greenland Phone: +299 21095 - Fax: +299 25957 - E-mail: naturins@greennet.gl			C
Hvingel, C.	Greenland Institute of Natural Resources, P. O. Box 570, DK-3900, Nuuk, Greenland Phone: +299 21095 - Fax: +299 25957 - E-mail: naturins@greennet.gl			C
Siegstad, H.	Greenland Institute of Natural Resources, P. O. Box 570, DK-3900, Nuuk, Greenland Phone: +299 21095 - Fax: +299 25957 - E-mail: naturins@greennet.gl		B	C

FAROE ISLANDS

Representative:

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

A = Scientific Council Meeting, 7-21 June 1995
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C = Scientific Council Meeting, 17-20 November 1995

Meetings

EUROPEAN UNION (EU)

Representatives:

Armstrong, D.W.	Directorate General for Fisheries, Commission of European Union, 200 Rue de la Loi, 1049 Brussels, Belgium Phone: +32 2 235 7277 - Fax: +32 2 295 2579	A
Astudillo, A.	Commission of the European Union, Rue Joseph II, 99, 1040 Brussels, Belgium Phone: +322 296 119 - Fax: +322 296 6046	B
Lassen, H.	Danish Inst. for Fish. Research, Charlottenlund Slot, DK-2920, Charlottenlund, Denmark Phone: +45 33 963352 - Fax: +45 33 963333 - E-mail: hl@dfu.min.dk	A B

Advisers/Experts

Avila de Melo, A.	Instituto Nacional de Investigaçao das Pescas, Av. de Brasilia, Lisbon, Portugal Phone: +3511 301 7361/0814 - Fax: +351 1301 5948	A B
Godinho, M.L.	Instituto Nacional de Investigaçao das Pescas, Av. de Brasilia, Lisbon, Portugal Phone: +3511 301 7361/0814 - Fax: +351 1301 5948	A B
Mahé, J.-C.	IFREMER, Station de Lorient, 8, Rue François Toullec, 56100 Lorient, France Phone: +97 87 7310 - Fax: +97 83 4106 - E-mail: jean.claude.mahe@ifremer.fr	A
Cross, D.	Commission of the European Union, Statistical Office, Batiment Jean Monet, Rue Alcide De Gasperi, 2920 Luxembourg (Grand Duchy) Phone: +352 4301 37249 - Fax: 352 4301 37318 - E-mail: david.cross@eurostat.cec.be	A B
Cornus, H.P.	Institut für Seefischerei, M. Palmaille 9, D-22767, Hamburg, Federal Republic of Germany Phone: +49 40 38905194 - Fax: +49 40 38905263 - E-mail: internet.100565.1223@compuserve.com	A B
Stein, M.	Institut für Seefischerei, M. Palmaille 9, D-22767, Hamburg, Federal Republic of Germany Phone: +49 40 38905194 - Fax: +49 40 38905263 - E-mail: internet.100565.1223@compuserve.com	A B
Rätz, H-J.	Institute for Sea Fisheries, Fischkai 35, 27572 Bremerhaven, Federal Republic of Germany Phone: +49 471 73473 - Fax: +49 471 73127	A
Motos, L.,	AZTI, Instituto para la Ciencia y Tecnologia Pesquera, Av. Satrustegi 8, 20008 - San Sebastian, Spain Phone: +34 43 214124 - Fax: +34 43 212162	A B
De Cárdenas, E.	Instituto Español de Oceanografia, Aptdo 240, Santander, Spain Phone: +34 42 275033 - Fax: +34 42 275072	A B
Junquera, S.	Instituto Español de Oceanografia, Cabo Estay - Canido, Apdo. 1552, Vigo, Spain Phone: +34 86 492111	A
Vazquez, A.	Instituto de Investigaciones Mariñas, Muelle de Bouzas, Vigo, Spain Phone: +34 86 231930 - Fax: +34 86 292762 - E-mail: AVAZQUEZ@IIM.CSIC.ES	A B
Casey, J.	MAFF, Directorate of Fisheries Research, Fisheries Laboratory, Pakefield Rd., Lowestoft (Suffolk), England NR33 OHT, United Kingdom Phone: +44 150 2524251 - Fax: +44 150 2524511 - E-mail: j.casey@dfr.maff.gov.UK	A B

ICELAND

Representative:

Sigurjonsson, J.	Marine Research Institute, Skulagata 4, P. O. Box 1390, 121-Reykjavik Phone: +354 552 0240 - Fax: +354 562 3790 - E-mail: johann@hafro.is	B
Skúladóttir, U.	Marine Research Institute, Skulagata 4, P. O. Box 1390, 121-Reykjavik Phone: +354 552 0240 - Fax: +354 562 3790 - E-mail: unnur@hafro.is	C

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		Meetings	

JAPAN

Representative:

Yokawa, K.	Distant-water Groundfish Section, National Research Institute of Far Sea Fisheries, Fishery Agency, 7-1, Orido 5 chome, Shimizu-shi, Sizuoka, 424 Phone: +81 54 3340715 - Fax: +81 54 3359642	A	B

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: +033 2658301 - Fax: +033 2622359		B
Yamada, H.	49 Kokubu-Machi, Nagasaki 850 Phone: +95 8228158 - Fax: +95 8214494		B

RUSSIA

Representative:

Rikhter, V.A.	Atlantic Research Institute of Marine Fisheries and Oceanography AtlantNIRO 5 Dmitry Donskoy Street, Kaliningrad, 23600 Phone: +70 112 21 5645 - Fax: +70 112 21 9997	A	
Troyanovsky, F.M.	Dir., Polar Res. Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, 183763 Phone: +47 789 10158 - Fax: +47 78 910518 - E-mail: PINRO@IMR.NO		B

Advisers/Experts

Lisovski, S.F.	PINRO, 6 Knipovich Street, Murmansk, 183763 Fax: +47 789 10518 - E-mail: PINRO@IMR.NO	A	
Shibanov, V.N.	PINRO, 6 Knipovich Street, Murmansk, 183763 Phone: +47 789 10423 - Fax: +47 789 10518 - E-mail: PINRO@IMR.NO	A	B
Volochine, A.	PINRO, 6 Knipovich Street, Murmansk, 183763 Fax: +47 789 10518 - E-mail: PINRO@IMR.NO	A	
Goussev, G.V.	Fish. Committee of the Russian Fed., 12 Rozhdestvensky Boul., Moscow K-31, 103045 Fax: +70 95 9219594	A	
Videneev, Yu.	Welsford Place, Ste. 2202, 2074 Robie Street, Halifax, Nova Scotia, Canada B3K 5L3 Phone: +902-425-6270 - Fax: +902-423-0943	A	

UNITED STATES OF AMERICA (USA)

Clark, S.H.	National Marine Fisheries Service, NEFSC, 166 Water St., Woods Hole, MA 02543 Phone: +508-548-5123, Fax: +508-548-5124 - E-mail: Sclark@whsun1.wh.whoi.edu		C

OBSERVERS

Serchuk, F.M.	National Marine Fisheries Service, NEFSC, 166 Water St., Woods Hole, MA 02543-1097, USA Phone: +508-548-5123 - Fax: +508-548-5124 - E-mail: Fserchuk@whsun1.wh.whoi.edu		B
Wigley, S.E.	National Marine Fisheries Service, NEFSC, 166 Water St., Woods Hole, MA 02543-1097, USA Phone: +508-548-5123 - Fax: +508-548-5124 - E-mail: Swigley@whsun1.wh.whoi.edu	A	

A = Scientific Council Meeting, 7-21 June 1995
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C = Scientific Council Meeting, 17-20 November 1995

Meetings

ICES Rep. (H.P. Cornus)	Institut für Seefischerei, Palmaille 9, D-22767, Hamburg, Germany Phone: +49 40 38905194 - Fax: +49 40 38905263 - E-mail: internet.100565.123@compuserve.com	B
ICES Rep. (U. Skúladóttir)	Marine Research Institute, Skulagata 4, P. O. Box 1390, Reykjavik Phone: +354 552 0240 - Fax: +354 562 3790 - E-mail: unnur@hafro.is	C

NAFO SECRETARIAT

L. Chepel, Executive Secretary
T. Amaratunga, Assistant Executive Secretary
F. D. Keating, Administrative Assistant
S. M. Goodick, Accounting Officer
B. J. Cruikshank, Senior Clerk-Secretary
D. C. A. Auby, Clerk-Secretary
F. E. Perry, Desktop Publishing/Documents Clerk
R. A. Myers, Graphic Arts/Printing Technician
B. T. Crawford, Graphic Arts/Printing Technicaian
G. M. Moulton, Senior Statistical Officer
C. L. Kerr, Statistical Clerk
B. L. Marshall, Statistical Clerk

PARTICIPANTS OF WORKING GROUP ON HARP AND HOODED SEALS

CANADA

Stenson, G. B.	(Chairman) Dept. of Fisheries & Oceans, P. O. Box 5667, St. John's, Newfoundland A1C 5X1
Sjare, B. L.	" " " " " " "
Chabot, D.	Institut Maurice Lamontagne, DFO, C. P. 1000, Mont-Joli, Quebec G5H 3Z4

DENMARK (GREENLAND)

Kapel, F. O.	Greenland Institute of Natural Resources, Tagensvej 135, 1, DK-2200 Copenhagen N, Denmark
Rosing-Asvid, A.	Greenland Institute of Natural Resources, P. O. Box 570, DK-3900 Nuuk, Greenland

NORWAY

Nilssen, K. T.	Norwegian Institute of Fisheries & Aquaculture, Breivika, P. O. Box 2511, N-9002 Tromsø
Øien, N.	Instit. of Marine Research, Dept. Marine Resources, P. O. Box 1870 Nordnes, N-5024 Bergen
Øritsland, T.	" " " " " " "

USA

Waring, G. T.	Northeast Fisheries Science Center, NMFS/NOAA, 166 Water St., Woods Hole, MA 02543

N.B. The list of participants of the 6-8 September 1995 Symposium is appended to the Report of the Symposium.

LIST OF RECOMMENDATIONS IN 1995

PART A

Scientific Council Meeting, 7-21 June 1995

SCIENTIFIC COUNCIL

IV. RESEARCH COORDINATION

2. **Fisheries Statistics**

b) **Report of the 16th Session of CWP and Preparation for the 17th Session** (page 9)

The Council accepted the review done by STACREC on the Report of the 16th Session of CWP, and endorsed the view that NAFO has a long history which other international bodies of CWP can draw upon.

The Council endorsed the **recommendation** that the Assistant Executive Secretary attend the *ad hoc* consultation planned for July 1996 in Rome. The Council also endorsed the **recommendation** that NAFO should work to ensure that CWP meetings of regional interest be held as needed.

The Council noted that the proposed venue being considered for the 17 Session of CWP was Hobart, Australia. An alternative is EUROSTAT office in Luxembourg. The Council endorsed the **recommendation** that the Chairman of STACREC and the Assistant Executive Secretary should attend, and concurred that with advanced planning and the use of discount airfares, the cost of participation at either site would be similar.

The Council endorsed the **recommendation** that the 2nd World Fisheries Congress meeting (to be held 28 July-2 August, 1996, in Brisbane, Australia) be brought to the attention of the General Council and Fisheries Commission and propose that there be attendance as well as a presentation describing NAFO's experiences.

4. **Biological Surveys**

d) **Coordination of Surveys** (page 10)

The Council acknowledged the STACREC decision on the need to coordinate research surveys. The Council addressed issues regarding a synoptic survey for Greenland halibut throughout its range of abundance in response to the request by the Fisheries Commission. The Council endorsed the **recommendation** that parties interested in a synoptic survey for Greenland halibut meet and formulate such a plan.

5. **Non-traditional Fishery Resources in the NAFO Area** (page 10)

The Council endorsed the **recommendation** that analyses of distribution and abundance of non-traditional species be conducted for the extensive survey databases and the results presented at the June 1996 Scientific Council Meeting.

VIII. FUTURE SCIENTIFIC COUNCIL MEETINGS

5. **INTERNET Communication Among Scientists** (page 13)

The Council noted that the use of E-mail is commonplace for most of the scientists involved with work on the Scientific Council. The Council **recommended** that *the Secretariat obtain access to this INTERNET communication facility*. The cost of this form of communication competes well with other forms and the method is much faster.

X. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS

b) Responses to Special Requests for Management Advice by the Fisheries Commission

iv) **Coordinated research on Greenland halibut** (page 29)

The issue of coordinated research relative to Greenland halibut was considered by STACREC with respect to the need for a synoptic survey for Greenland halibut. It was suggested that such a survey would require one or two years planning time and it was **recommended** that *parties interested in a synoptic survey meet and formulate a plan.* A group should be formed from these parties to set dates and specify vessel and scientific staff requirements. The plan would describe the Scientific Council's requirements with respect to the question.

STACFIS

Redfish in Div. 3M

Redfish as by-catch in the shrimp fisheries (page 76)

.... there were no further data for 1994 available during this meeting. Furthermore, this information is necessary if STACFIS is to evaluate the effectiveness of separator grates currently in use in the shrimp fishery. STACFIS therefore strongly **recommended** that *relevant data on by-catch of small redfish in the shrimp fisheries on Flemish Cap in 1994 and 1995 should be made available prior to the Scientific Council meeting in June 1996.*

Redfish in Div. 3L and 3N

i) **Commercial fishery data** (page 78)

STACFIS was uncertain whether these indices were reflective of the trends in the population or simply reflect the experience of the Portuguese fleet. Nonetheless, the Committee considered it more appropriate if the Div. 3NO data could be disaggregated and, accordingly, **recommended** that *future analyses of Portuguese observed catch-rate data for redfish be presented separately by Division.*

ii) **Research survey data** (page 79)

STACFIS concluded that a further look into these and other survey data for redfish in Div. 3LN and 3O is warranted and accordingly **recommended** that *(1) data in Div. 3LNO be analyzed further to determine if a relationship exists between Div. 3O and Div. 3LN that may help in the interpretation of the indices of abundance; and (2) data be examined to evaluate the appropriateness of Div. 3LN and Div. 3O as management units for redfish.*

Silver hake in Div. 4VWX

i) **Commercial fishery data** (page 81)

STACFIS expressed concern that for silver hake in Div. 4VWX, the interaction effects between month and year in the silver hake CPUE model may be influencing the results, and **recommended** that *these effects be investigated in future.*

American plaice in Div. 3LNO

ii) **Research survey data**

USSR/Russian survey (page 88)

STACFIS recognized the importance of the Russian spring survey data in providing an index of abundance for American plaice in Div. 3LNO and **recommended** that *the estimates from the 1993 and 1994 surveys be made available in June 1996 if possible.*

d) **Research Recommendations** (page 90)

It was **recommended** that *where ever possible, ageing for American plaice from all surveys in Div. 3LNO be made available for the June 1996 Meeting of the Scientific Council.*

STACFIS also noted the extension of distribution of American plaice to deeper water, more than in the past. Recognizing that the stratification scheme for the Div. 3LNO area includes depths to 1 500 m, STACFIS **recommended** that *survey coverage be extended to depths of recent distribution of American plaice.* STACFIS further **recommended** that *the year round occurrence of American plaice in these depths be investigated.*

Witch flounder in Div. 3N and 3O

d) **Recommendations** (page 95)

It was **recommended** that *where ever possible the most up to date catch-at-age data from the surveys for witch flounder in Div. 3NO witch flounder be made available for the June 1996 Meeting.*

Greenland halibut in Subarea 0 + Div. 1B-1F

e) **Research Recommendations** (page 104)

Neither catch-numbers-at-age, weights-at-age data nor CPUE data were available for Greenland halibut Div. 0B offshore for 1994, and STACFIS **recommended** that *these data should be presented at the June meeting in 1996, in order to continue the time series already established.*

The joint Japan/Greenland survey covers Subarea 1 only and STACFIS **recommended** that *surveys should be conducted in Subarea 0 as well, in order to obtain a more detailed assessment of the stock status in the area.*

The question of whether the Cumberland Sound Greenland halibut stock contributes to the SA 0+1 stock needs to be resolved. STACFIS **recommended** that *a tagging program be initiated in Cumberland Sound to ascertain whether adult fish move into Davis Strait. The degree of spawning activity should be examined at the same time.*

Greenland halibut in Div. 1A

d) **Research Recommendations** (page 107)

The basic problem for the assessment of Greenland halibut in Div. 1A is the age determinations, similar to the assessment for the offshore stock in SA 0+1, and STACFIS therefore **recommended** that *a special effort should be directed to resolve these problems.*

Greenland halibut in Subarea 2 + Div. 3KLMNO

d) **Recommendations** (page 112)

STACFIS noted that length and age frequency data from the 1994 Canadian commercial fishery of Greenland halibut in Subarea 2 + Div. 3KLMNO was not available, which made it difficult to fully evaluate the 1994 fishery, and STACFIS therefore **recommended** that *the most up-to-date data be made available for the June 1996 Meeting.*

Roundnose grenadier in Subareas 0 and 1

ii) **Research survey data** (page 114)

A Canadian survey in 1986 gave a biomass estimate for Subareas 0+1 of 110 000 tons, of which 90% was found in Subarea 1. USSR and GDR have conducted surveys covering both Subareas 0+1 in 1987, 1988 and 1990, and STACFIS **recommended** that *the biomass estimates of roundnose grenadier from these surveys should be presented at the June meeting in 1996.*

Capelin in Div. 3NO

ii) **Research survey data** (page 117)

STACFIS also noted that the USSR/Russian acoustic estimates have been presented for capelin in Div. 3LNO combined rather than separated by Division, and it was **recommended** that *in future, estimates of capelin biomass be provided separated by Division.*

STACREC

2. **Fisheries Statistics**

iii) **Proposals for CWP *Ad Hoc* Consultation** (page 125)

In preparation for the 17th Session of CWP, *Ad Hoc* Consultation is planned for July 1996 in Rome. It has been a practice of the Scientific Council to send representation to these meetings and STACREC **recommended** that *the Assistant Executive Secretary attend the Ad hoc Consultation in July 1996.* It was noted that with CWP moving towards a global approach there would probably be some meetings that NAFO would not be able to attend. It was felt that consultation meetings should offer the opportunity to meet on a regional basis so that the concerns unique to the Atlantic could be addressed. In accordance with the views expressed by the General Council, STACREC **recommended** that *the Scientific Council request the CWP to ensure that meetings of regional interests should be held as needed by regional member organizations.*

iv) **Consideration of CWP 17th Session** (page 125)

The CWP members were requested to confirm if this venue was suitable by October 1995. An alternative venue suggested was the EUROSTAT office in Luxembourg. STACREC discussed the invitation and **recommended** that *as in the past the Chairman of STACREC and the Assistant Executive Secretary should attend as NAFO representatives and the Scientific Council may at a later date propose a national representative as well.*

v) **World Fisheries Congress Second Meeting** (pages 125 and 126)

It was felt that the NAFO experiences would be valued globally, particularly, in the management of high seas fisheries, and also enhance NAFO's image. STACREC accordingly, **recommended** that *Scientific Council bring the 2nd World Fisheries Congress to the attention of the General Council and Fisheries Commission and propose that there be attendance as well as a presentation describing NAFO's experiences.*

4. **Biological Surveys**

d) **Coordination of Surveys** (page 131)

STACREC **recommended** that *parties interested in a synoptic survey for Greenland halibut meet and formulate such a plan.*

5. **Non-traditional Fishery Resources in the NAFO Area**

b) **Distribution Data From Surveys** (page 131)

It was recommended at the September 1994 Meeting of STACREC that efforts be made to analyze data on distribution and abundance of non-traditional species for presentation at the June 1995 Meeting. The only reported analysis being conducted was that by Canadian scientists, but documentation was not available at present. STACREC again **recommended** that *analyses of distribution and abundance of non-traditional species be conducted for the extensive survey databases and the results presented at the June 1996 Scientific Meeting.*

PART B

Scientific Council Annual Meeting, 9-15 September 1995

SCIENTIFIC COUNCIL

IV. RESEARCH COORDINATION

Research Coordination for Greenland Halibut, Formulation of Research Proposal for Synoptic Survey (page 144)

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

Shrimp in Division 3M (page 174)

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

Acquisition of STATLANT Data

Publication of Statistical Information (page 179)

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 (page 179)

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 (page 181)

..... 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 (page 181)

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

Status of Papers on Shrimp in Division 3M for a Single Publication (page 184)

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.*

PART C

Report of Scientific Council, 17-20 November 1995 Meeting

STACFIS

I. STOCK ASSESSMENTS

Shrimp in Subareas 0 and 1

d) **Research Recommendations** (page 199)

For shrimp in Div. 0A and Subarea 1, STACFIS **recommended** for consideration at the November 1996 Meeting that:

- *a single combined standardized CPUE series be developed by incorporating fishing data from Div. 0A and Subarea 1. This should be used to investigate the effects of areas and seasons on CPUE;*
- *an analysis of survey and catch-rate information be conducted to show the relative importance of the northern and southern areas over time;*
- *samples from all surveys both offshore and inshore and from the commercial fishery, be analyzed for age composition to obtain estimates of year-class abundance and mortalities.*

STACFIS also **recommended** that:

- *sampling of the commercial fishery be improved to cover all components of the fishery by area and month.*