PART A

Scientific Council Meeting, 5-19 June 1996

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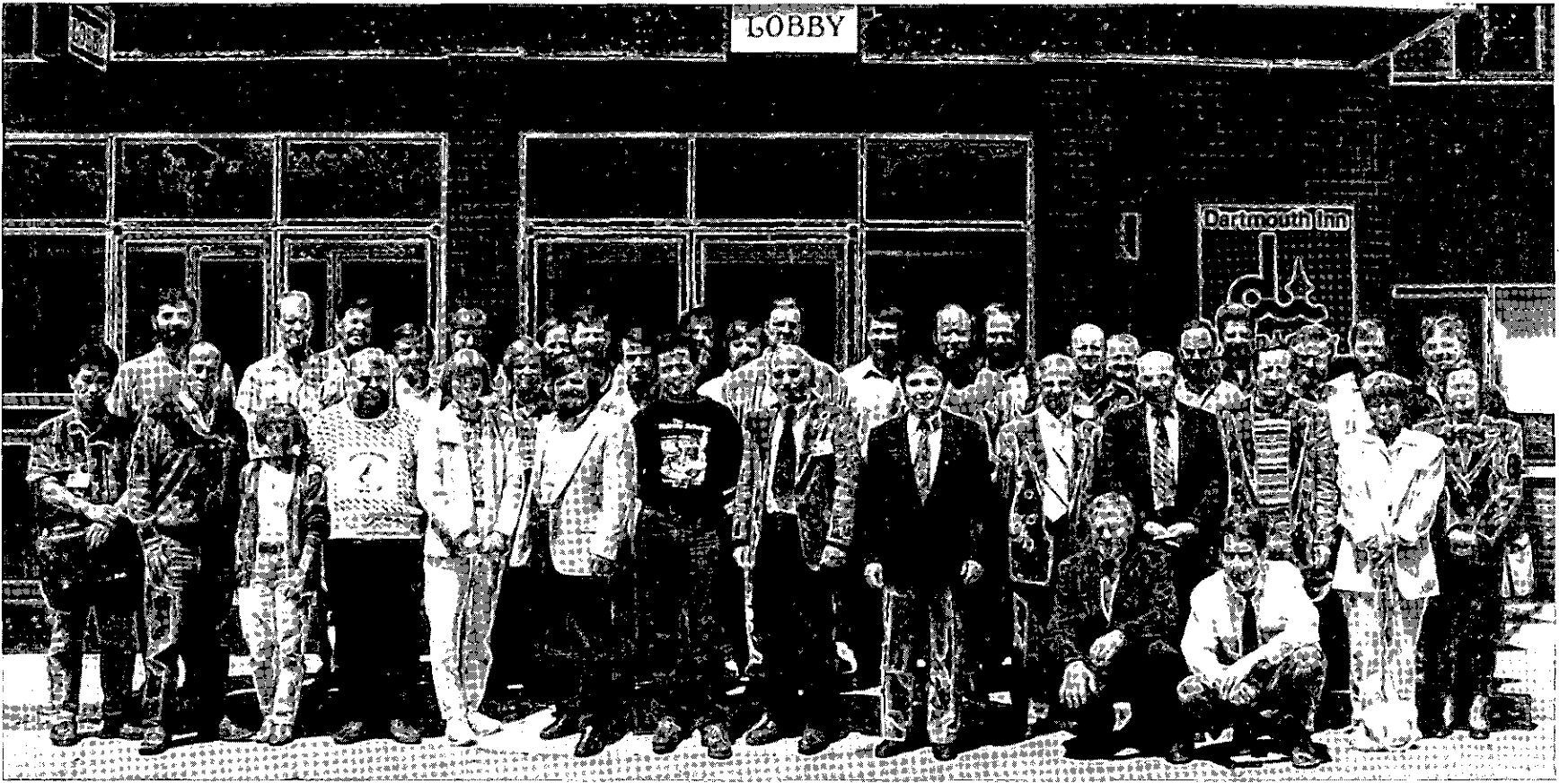


REPORT OF SCIENTIFIC COUNCIL

5-19 June 1996

Chairman: W. R. Bowering Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at the Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada during 5-19 June 1996, to consider the various matters listed in its agenda.

Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union (France, Germany, Portugal, Spain and United Kingdom), Japan, Russian Federation and the 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 work distribution of the Scientific Council and its Committees.

The opening session of the Council was called to order at 1005 hours on 7 June 1996.

The Chairman welcomed everyone to the third consecutive year at this venue for this meeting. The Assistant Executive Secretary was appointed rapporteur.

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 Latvia, Lithuania and Norway to record their abstentions during any voting procedures.

In introducing the provisional agenda, the Council noted that there were three additional items that needed to be addressed under item X. 'Other Matters', and these were included. 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 H. P. Cornus (EU-Germany) and K. Nygaard (Denmark-Greenland) was accepted for the purpose of nominating Chairmen to the Standing Committee on Fishery Science (STACFIS) and the Standing Committee on Fisheries Environment (STACFEN).

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 then addressed the specific requests on management advice listed under Agenda item IX, 1 and 2. Having determined the data availability, it was agreed the Council would consider these items as reports became available from the various representatives.

The opening session was adjourned at 1100 hours on 5 June 1996.

The Council reconvened at 0900 hours on 12 June 1996 to address some specific requests for management advice (Agenda item IX, 1 and 2), as reported in the relevant section below.

The session was adjourned at 1140 hours on 12 June 1996.

The Council reconvened at 1700 hours on 17 June 1996 to consider management advice on various stocks. These discussions were continued through 18 June 1996, when other outstanding matters on the agenda were also addressed.

The concluding session was convened at 0930 hours on 19 June 1996.

The Council then 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 5-19 June 1996. Noting minor changes as noted during this review would be made by the Chairman and the Assistant Executive Secretary.

The meeting was adjourned at 1030 hours on 19 June 1996.

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-XII.

II. FISHERIES ENVIRONMENT (see STACFEN Report, App. I)

1. Opening

The Council welcomed the STACFEN report as presented by Chairman, M. Stein (EU-Germany). The Council was pleased to receive a summary of the Committee's deliberations as presented below. For the first time, in September 1996 the Chairman of STACFEN will present a formal overview to the Fisheries Commission on trends in environmental conditions in the Northwest Atlantic with particular reference to 1995. The presentation is summarized in the following section based on the deliberations of STACFEN.

2. Summary of the Committee's Report

a) Review of Environmental Conditions

The Council noted that 13 documents dealing with environmental issues were reviewed. Extremely cold air temperatures were observed in winter off West Greenland, conditions which were similar to the winters of the early-1990s when record low temperatures were observed. Above normal air temperatures began in April, persisted through most of the summer and reached a maximum in November. It was emphasized that, although 1995 showed relative warming, compared to recent years, this does not signify a change in the longer-term negative trend in air temperatures that has persisted over the last 30 years. Ice conditions were near normal off East Greenland and along the Labrador Sea during the first few months of 1995 although coverage was more extensive than normal in the northeastern Labrador Sea area in the early spring. During the autumn of 1995, ice extent off East Greenland and Baffin Island were near normal. Colder-than-normal ocean temperatures were observed in the upper 200 m off Southwest Greenland whereas in the Irminger layer (200-300 m) temperatures appeared to have declined slightly while salinities had increased.

Based on previous studies which showed a negative relation between cod recruitment off West Greenland and salinity of the Irminger water layer during the previous autumn, the high salinities would suggest the likelihood of poor cod recruitment.

Variability in near-bottom temperatures collected during the EU-German groundfish surveys off West Greenland from 1982 to 1995 were compared to changes in demersal fish assemblages and distribution: Correlation analyses failed to find a relationship between cod distribution and temperature, but it was shown that temperature does appear to influence growth rates and size of fish.

Moderate air temperatures during the late autumn of 1995 and the winter of 1995/96 resulted in below normal ice cover extent and concentration off the east coast of Labrador and Newfoundland. The warming trend that began during the autumn of 1995 at Station 27 east off Newfoundland, continued into the winter and spring of 1996. This represents the first time in almost a decade that

the near bottom temperatures were above their long-term mean. Temperatures throughout much of the water column over the Grand Bank and along eastern Newfoundland were also above normal. The temperature increase is attributed, in part, to reduced ice cover, i.e. the heat that in recent years was being used to melt ice, in 1995 went into heating the water column.

There was less cold intermediate layer (CIL) waters over the shelf and core temperatures had increased. Meteorological, sea ice and oceanographic data during early-1996, all point to moderating conditions relative to the cold conditions of the early-1990s.

Monthly monitoring of surface and bottom temperatures on a transects across the Middle Atlantic Bight and the Gulf of Maine showed generally warmer-than-normal conditions during 1995, with an annual anomaly of upwards of 1.6K near-bottom over the shelf portion of the Middle Atlantic Bight. Surface salinities were above average for the year in the Middle Atlantic Bight.

A study of the relationship between atmospheric, sea ice and oceanic variability in the Labrador Sea area with those in the Barents Sea showed high negative correlations between two widely separated regions for several variables including air temperature, ice coverage, and water temperature. It was noted that while recent cooling has occurred in the Labrador Sea region, conditions in the Barents Sea have been very mild. The cause of the negative relationship was suggested to be related to the large-scale atmospheric wind patterns, i.e. the North Atlantic Oscillation (NAO). When the NAO is high, the Icelandic Low strengthens and the northwest winds over the Labrador Sea intensify, carrying cold air farther south. This produces more ice and colder ocean temperatures. At the same time over northern Europe the southwest winds intensify carrying warm air masses farther north causing warm conditions to develop in the Barents Sea. This leads to less ice and warmer ocean temperatures. The contrast between the high cod abundance in the warm Barents Sea with the low abundance in the cold Labrador Sea during recent years was highlighted.

b) **Overview of Environmental Conditions in 1995**

The Council noted the presentation of the annual overview paper, based on several long-term oceanographic and meteorological data sets, as well as from available research documents. The overview presentation reported that cold winter air temperatures were again observed in the Labrador Sea region but they were generally not as low as in previous years. For the remainder of the year they were generally warmer than or near normal. At the southern boundary of NAFO Convention Area, air temperatures were generally warmer than normal throughout the year, except for November and December when temperatures dropped below normal.

The NAO index was strongly positive but a strong eastward shift in the Icelandic Low and Bermuda-Azores High resulted in their exerting less influence in the Northwest Atlantic than in other high NAO index years.

The volume extent of the CIL water off Newfoundland during the summer decreased in 1995 to below the long-term mean and was at its lowest value since the early-1980s. This was due to a decline in the amount of CIL water off southern Labrador and northern Newfoundland, in contrast to the Grand Bank, where the amount of CIL water increased slightly relative to 1994.

Deep water temperatures on the Scotian Shelf (Emerald Basin) and in the Gulf of Maine remained high during 1995, while in Cabot Strait they decreased to near normal values. The high temperatures on the Scotian Shelf and in the Gulf of Maine are believed to be due to the influence of warm slope waters penetrating into the deep basins.

Cold waters were observed near-bottom and at intermediate depths over the northeastern Scotian Shelf and off southwestern Nova Scotia continuing a trend that began in the mid- to late-1980s. In the latter region, temperatures appeared to be warming although they remained below normal. No evidence of warming was observed in the northeastern Scotian Shelf.

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

1. **Opening**

The Council accepted the report of STACFIS as presented by Chairman W. B. Brodie (Canada). The Council noted the Committee addressed the assessment and other requests referred to it by the Council.

2. General Review of Catches and Fishing Activity

The Council noted again the convenience of conducting a review on the first day of the STACFIS Meeting. Noting the STATLANT data were not available in many cases, the Council agreed with estimates of catches derived by STACFIS for each stock.

The Council expressed its serious concerns that STATLANT 21A data were once again not available from many Contracting Parties for the assessment work of STACFIS. As stated also by STACREC, the Council recognized the need to bring this matter to the attention of the General Council and to the Contracting Parties. The Council regretted again that the general review of fishery trends could not be undertaken at this meeting and that this section would be omitted again in this report.

3. Stock Assessments

The Council noted that STACFIS evaluated the status of stocks referred to it. The assessment reports are given in the Report of STACFIS in Appendix II. The agreed summaries and the conclusions of these assessments as prepared by the Council are presented on a stock-by-stock basis in Section IX of this report, along with the other management advice in response to the requests by the Fisheries Commission and the Coastal States.

4. Ageing Techniques and Validation Studies

a) Silver Hake Ageing Methodology Report

The Council noted with regret that the long awaited Methodology Report will not be produced.

b) Report of the ICES Redfish Ageing Workshop

The Council was appreciative of the report presented by the co-convener, D. B. Atkinson (Canada), on the meeting held during 4-8 December 1995. The Council welcomed the comments on the goals of the Workshop, and concurred with STACFIS on the importance of the recommendations presented at the Workshop.

c) Update on Joint ICES/NAFO Workshop on Ageing of Greenland Halibut

The Council noted a Workshop will be held during 26-29 November 1996, with W. R. Bowering (Canada) as a co-convener. Observing the participation will be from a wide background, the Council hoped the Workshop will produce valuable information for the work of the Scientific Council.

5. Other Matters

a) Report on Comparative Trawl Surveys

The Council noted the discussions on the Canadian trawl surveys, and noted the details presented on the subject in three SCR Documents as stated in the STACFIS report.

The Council was informed of the comparative trials conducted between two research vessels and the different fishing gear, as conducted by the Canadian Department of Fisheries and Oceans in Newfoundland. The Council noted the work conducted on Greenland halibut, and looked forward to information on the ongoing work on American plaice, witch flounder and redfish. The Council endorsed the STACFIS **recommendation** that *comparative fishing trials take place in May 1997 while EU-Spain and Canada are conducting their surveys in the Regulatory Area in Div. 3NO.*

The Council noted the detailed description presented to STACFIS on the autumn 1995, Canadian random-stratified survey in Div. 2J and 3KLNO.

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

1. **Opening**

The Council welcomed the report of STACREC as presented by Chairman D. Power (Canada), observing that matters referred by the Council were addressed.

2. **Fisheries Statistics**

a) **Progress Report on Secretariat Activities in 1994/95**

The Council agreed with STACREC that the current situation of delays of two to three years in delivery of data from some Contracting Parties was undesirable. It was noted that the submission deadlines of May 15 (STATLANT 21A) and June 30 (STATLANT 21B) were adopted into the Rules of Procedure for the Scientific Council. The Council endorsed the **recommendation** of STACREC that *the Scientific Council inform the General Council that submission of data has not improved but in fact the situation had deteriorated, and emphasised that the Scientific Council work is seriously stifled by the lack of fishing data in time for the June Meeting.*

The Council noted in February 1996 the Secretariat provided a list of documents from other NAFO Standing Committees to Designated Experts for use in the assessment process, and agreed this be done on an annual basis.

The Council noted that Statistical Bulletin Volume 42 containing 1992 data was published but was seriously concerned that Statistical Bulletin Vol. 43 and 44 are delayed due to non-availability of data.

The Council welcomed that the STATLANT database at the Secretariat was being transferred in to Microsoft Access software to provide a means for responding in a timely fashion to short-notice requests for information and that this system should be fully implemented prior to the September 1996 meeting.

With respect to the divergence between the 'official' nominal catches reported in STATLANT forms and those from other sources used in stock assessments, the Council endorsed the STACREC **recommendation** that *a special note be appended to the appropriate sections of all documents reporting STATLANT data, indicating that users of the data should note that the actual catches for some species/stocks may differ from those reported in the document.* As such the user should also be directed to the relevant Scientific Council Reports for information on the assessments. In addition, with regard to previously published Statistical Bulletins, the Council endorsed the **recommendation** that *a special note be circulated to recipients of previous issues of the Statistical Bulletin indicating that the Scientific Council had in some years used estimated catches from other sources of data to determine actual catch levels for stock assessment purposes.*

b) **Gear Codes**

The Council noted the STATLANT 21B questionnaire had been modified to include a code for a new twin trawl that was being utilized in the Div. 3M shrimp fishery.

c) **Catches not Specified by Species**

The Council acknowledged that the Canadian Maritime region and the Canadian Newfoundland Region had responded to the request to clarify the reporting of catches of non-specified flounder but that South Korea have not responded to date.

The Council also noted that in the Regulatory Area, roughhead grenadier had been reported as roundnose grenadier by EU-Spain and EU-Portugal and agreed with STACREC that catches should be reported by species as outlined in the Guidelines for the STATLANT forms.

d) **Reporting of Catches for *Pandalus borealis***

The Council noted the potential errors resulting from *Pandalus borealis* being reported as both northern deepwater prawn and pink (= pandalid) shrimp particularly in Div. 3M, and that significant catches of *P. montagui* have been taken in Div. 0B. The Council agreed with STACREC that the

Designated Experts and shrimp scientists should address this matter at the Annual September 1996 Meeting.

e) **Catch Statistics for Seals**

The Council acknowledged that the statistics have been clarified as far as possible, and endorsed the decision of STACREC that footnotes be attached to seal statistics published in the Statistical Bulletin, to inform the users of the inconsistencies.

f) **Preparation for CWP 17th Session, March 1997**

The Council noted the Inter-agency Consultation in preparation for the 17th Session of CWP was scheduled to take place 9-10 July 1996 in Rome, Italy and endorsed that the Assistant Executive Secretary would attend. The 17th Session of CWP is scheduled for the 3-7 March 1997 in Hobart, Tasmania. The Council noted the Assistant Executive Secretary would prepare an outline of statistical activities of NAFO, and also agreed that STACREC examine definitions of fishing effort and other items listed in the STATLANT questionnaires for presentation to CWP. The Council noted the recommendation in 1995 that along with the Chairman of STACREC, the Assistant Executive Secretary would represent NAFO at the 17th Meeting of CWP. The Council also **recommended** that *a representative from Japan be requested to attend the meeting to represent the Scientific Council at the 17th Session of the CWP.*

3. **Biological Sampling**

The Council noted that the Provisional List of Biological Sampling for 1995 was prepared by the Secretariat (SCS Doc. 96/11). Data from commercial fisheries pertinent to stock assessments were also tabulated, and National Representatives reported their sampling programs for the 1995 commercial fisheries to STACREC.

4. **Biological Surveys**

a) **Review of Survey Activities in 1995**

The Council noted an inventory of biological surveys conducted, and a more detailed account of the survey data available for 1995 relative to their stocks, was tabled by National Representatives and Designated Experts.

b) **Surveys Planned for 1996 and Early-1997**

The Council noted an inventory of biological surveys planned for 1996 and early-1997, as submitted by National Representatives and Designated Experts, was compiled by the Secretariat.

c) **Review of Stratification Schemes**

The Council noted that a document was tabled in STACREC outlining errors and subsequent corrections to the stratification scheme in Div. 3P . The errors occurred in the transcribing of the NAFO line separating Div. 3P and Div. 4V onto stratification charts and that the charts were revised reflecting the true line. In the process of revising the charts more precise positions based on pilot references were also determined for lines defined in part by headland points of reference. The Council endorsed the view of STACREC that these revised references would be useful to facilitate the drawing of accurate stratification charts, yet would not alter the basic statistical areas for reporting purposes, but would require a change to the text in NAFO Convention Annex III describing the scientific and statistical Subareas, Divisions and Subdivisions. Accordingly, in order to provide an accurate position of headland references relative to Div. 3P (NAFO Handbook, 1996, see text with respect to Subarea 3 on pages 43-45), as described in SCR Doc. 96/55, Serial No. N2731, the Council **recommended** to the General Council that *the NAFO Convention text in Annex III relative to Div. 3P be revised as follows:*

- *define "Cape Ray" as 47°37.0' north 59°18.0' west*
- *define "Cape North" as 47°02.0' north 60°25.0' west*
- *replace "Burgeo Island" with 47°30.7' north 57°43.2' west*
- *replace 46°50' north 58°50' west with 46°50.7' north 58°49.0' west.*

d) **Update on Coordination of Surveys**

The Council separately addressed this agenda item (see item IX.b). The Council also noted that 1996 will be the last year for the Flemish Cap survey but that a proposal had been forwarded to the European Commission to continue this time series. The Council endorsed that the Flemish Cap survey was an important source of information relative to providing advice for many stocks in Div. 3M.

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

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

The Council noted no documentation was available to address a recommendation that distribution and abundance of non-traditional species based on extensive survey databases be conducted and presented at this meeting, but data should be available for the June 1997 Meeting.

6. **Review of SCR and SCS Documents**

The Council noted that STACREC reviewed six documents.

7. **Other Matters**

a) **Tagging Activities**

The Secretariat compiled a list of tagging activities in 1995 (SCS Doc. 95/7). The Council endorsed the **recommendation** of STACREC that *scientists undertaking any tagging activities inform the Secretariat in order that the information may be widely circulated, and hence better returns may be obtained.*

b) **Scientific Data Collection by the New Observer Program**

The Council noted that the new Pilot Observer Program adopted by the Fisheries Commission for 01 January 1996 to 31 December 1997 required 100% coverage of vessels fishing in the Regulatory Area. It was also noted that these observers shall carry out such scientific work based on the advice of Scientific Council. The Council welcomed the concept that more extensive sampling were possible under the new observer scheme but regretted that existing national sampling programs were being reduced because of the new program. The Council concurred with STACREC and endorsed the following suggestions as it relates to the new program: (i) current national sampling programs should be maintained at least at a minimum level of sampling until the observers under the new scheme are adequately trained in biological sampling (ii) training of the observers should be in concurrence with national sampling or national observer programs, and (iii) sampling by observers be under the direction of the national laboratories where scientific information is processed.

c) **Other Business**

The Council noted that the triennial publication List of Fishing Vessels is rarely used from a fisheries science standpoint. Noting also that other NAFO Standing Committees were not much interested in this publication, the Council concurred with the STACREC **recommendation** that *the Secretariat discontinue the soliciting and publication of such information, and discontinue the List of Fishing Vessels.* The Council noted that a possible alternate source of the data may be available from Contracting Party reports of vessels fishing within the Regulatory Area.

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

1. **Opening**

The Council welcomed the STACPUB report as presented by M. Stein (EU-Germany) on behalf of the Chairman of STACPUB who had to return home on an urgent matter.

2. Review of STACPUB Membership

The Council agreed with STACPUB views that although 5 new Contracting Parties have joined NAFO in recent years and more publications for review are foreseen, that it was not necessary to expand the number of members at this time, particularly noting that any changes would require a change in the Rules of Procedure. Apart from the change of Chairman, no other changes had been made since June 1995.

3. Review of Scientific Publications Since June 1995

The Council was pleased to note that Journal Volume 18, containing 6 miscellaneous papers, 1 note and 2 notices (115 pages) was published with the publication date of April 1996.

The Council agreed that Journal Volume 19 should to be issued containing papers presented at the NAFO 1993 Symposium on "Gear Selectivity/Technical Interactions in Mixed Species Fisheries",as soon as possible.

The Council was pleased with the progress with the Journal publication of the proceedings of the NAFO/ICES 1995 Symposium on "The Role of Marine Mammals in the Ecosystem", noting 26 papers have been received and are in advanced stages of the review process by Editors and the issue is expected to be completed in late-1996 or early-1997.

The Council noted that Studies Number 23, containing 6 miscellaneous papers and 3 notices (95 pages) was published with a publication date of September 1995.

The Council was pleased with the fast turn-around time in publishing Studies Number 24, containing, 12 papers presented at 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". The Council acknowledged the expedient publication of this issue.

The Council was also pleased with the progress on Studies Number 25, containing 5 miscellaneous papers and a special issue of Studies containing papers presented at the Joint ICES/NAFO Working Group on Harp and Hooded Seals held during 5-9 June 1995.

The Council noted that *NAFO Statistical Bulletin*, Vol. 42 for 1992 was published without EU-France (Metropolitan) and France (St. Pierre and Miquelon) data, in October 1995.

The Council expressed concern that although the deadline for submission of STATLANT 21B reports for 1993 was 30 June 1994, data were still outstanding from Faroe Islands, Norway, France (St. Pierre and Miquelon) and USA, and the reports from Russia are also awaiting clarification.

Similarly concern was expressed with the delays with *NAFO Statistical Bulletin*, Vol. 44 for 1994 data.

With respect to the List of Fishing Vessels, the Council agreed that the publication is of little practical value, and considering the costs of production involved endorsed STACPUB **recommendation** that *the publication of the "List of Fishing Vessels" be discontinued.*

4. Production Costs and Revenues for Scientific Council Publications

a) Publications Costs and Revenues

The Council noted that no significant departures from those of previous years production and revenue costs were observed.

5. Promotion and Distribution of Scientific Publications

a) Invitational Papers

The Council looks forward to the publication of the invitational paper by R.G Halliday and A.T. Pinhorn on comparison of management methods and resource trends in North Atlantic fishery management in the near future.

The Council also looks forward to an invitational paper by M. Stein on the climatic variability in the Labrador Sea based on the Russian/German Data Evaluation Project.

b) **Distribution of Abstracts From Research Documents**

The Council noted the STACPUB discussion on the uneven distribution of abstracts from research documents to literature databases, particularly to ASFA, and agreed with the STACPUB **recommendation** that *abstracts of SCR Doc. and SCS Doc. be propagated to ASFA through the national ASFA representative.*

6. **Editorial Matters Regarding Scientific Publications**

a) **Review of Editorial Board**

The Council noted that Associate Editors G.P. Ennis (Canada) and S.A. Murawski (USA) had requested to withdraw from the Editorial Board. The Council endorsed the STACPUB sincere appreciation of the dedicated, analytical and comprehensive work done by the Associate Editors and extended best wishes.

Noting also two other Associate Editor positions were already vacant, the Council endorsed the appointment of A. Richards (USA) as Associate Editor on Invertebrate Fisheries Biology, H. Rätz (EU-Germany) as Associate Editor on Vertebrate Fisheries Biology, F. Sherchuk (USA) as Associate Editor on Vertebrate Fisheries Biology and P.A. Shelton (Canada) as Associate Editor on Biomathematics, be invited to the Editorial Board.

The Council Chairman agreed to write letters of appreciation and welcome letters to the members of the Editorial Board mentioned.

The Council noted with pleasure the progress made by STACPUB toward publishing many other single issues of the Journal and Studies. The Council found this approach to promote these two publications to be a good one.

7. **Papers for Possible Publication**

a) **Procedures for STACPUB Review**

The Council noted new initiatives by STACPUB to identify additional potential publications. The Council accepted the STACPUB nomination of 16 papers selected by this method. The Council also welcomed the review of 22 other Research Documents dealing with Cod in Div. 2J and 3KL for a single issue in Studies.

VI. ARRANGEMENTS FOR SPECIAL SESSIONS

1. **Progress Report on Workshop in 1996**

The Convener (H. Lassen - EU-Denmark) extended his apologies for not being able to be present at the 5-19 June 1996 meeting, but indicated he will visit the Secretariat during 24-28 June 1996 to finalize the arrangements for the 4-6 September 1996 Workshop on 'Assessment of Groundfish Stocks Based on Bottom Trawl Survey Results'. The Council was informed that discussions were progressing with the session Chairman to structure the talks, the computer presentations and the hands-on work. The Workbook was expected to be drafted by mid-August, 1996. Taking into account the computer availability at the new venue in St. Petersburg, Russia, and the specialized software needed for the Workshop, the Convener and the session Chairmen were working together to accomplish a successful and timely Workshop. The Council was informed that the high interest level expressed by scientists will likely result in 30-35 participants at the Workshop.

2. **Progress Report on the Special Session in 1997**

The Council was informed by the Convener, H. Lassen (EU-Denmark), that the arrangements for this Symposium on 'What Future for Capture Fisheries' were progressing as planned, and the general schedule proposed in September 1995 seems quite appropriate. The Convener and the Assistant Executive Secretary were making contacts with potential keynote speakers. Further details will be made available to the Council during the September 1996 Meeting.

The Council was informed that the Executive Secretary of the Marine Institute at Memorial University of Newfoundland had invited the Secretariat to consider locating the Symposium at his Institute. The Council welcomed the opportunity and agreed the facilities being offered would be quite attractive to the participants. The Assistant Executive Secretary was accordingly requested to convey the Council's acceptance of the offer, and requested him to continue with the organizational details.

3. Proposals for Special Session in 1998

The request for proposals from the Chairman was received with a formal suggestion titled 'Causes and Effects of Changes in Growth, Condition and Maturity of Groundfish' and a view that the subject of 'Criteria for Opening Fisheries Under Moratoria' would be important and urgently needed.

The Council found the first title quite attractive but agreed a more detailed description and the general focus for such a meeting should be presented for consideration by the Council at its meeting in September 1996.

The Chairman also requested the members to think of other topics that should be considered at the September 1996 Meeting.

VII. FUTURE SCIENTIFIC COUNCIL MEETINGS, 1996 AND 1997

1. Annual Meeting in September 1996

The Council confirmed that the Scientific Council Meeting with respect to the Annual Meeting will be during 7-13 September 1996, which includes 2 extra days (7-8 September) to accommodate the stock assessment of Shrimp in Div 3M. The Meeting will be preceded by the Special Session Workshop on 'Assessment of Groundfish Stocks based on Bottom Trawl Survey Results' during 4-6 September 1996. The Council made special note of the new venue for these meetings in St. Petersburg, Russia.

2. Special Meeting in November 1996

The Council agreed that the Special meeting of the Scientific Council for the assessment of Shrimp in Subareas 0 and 1 and Denmark Strait will be held at NAFO headquarters, Dartmouth, Nova Scotia, during 15-18 November 1996.

3. Scientific Council Meeting, June 1997

The Council noted no changes to the provisional dates set for the 4-18 June 1997 meeting of the Scientific Council, scheduled to be held in Dartmouth, Nova Scotia.

VIII. NOMINATION AND ELECTION OF OFFICERS

1. Chairmen of STACFIS and STACFEN

The Chairman's proposal (5 June 1996) to appoint a Nominating Committee composed of H. P. Cornus (EU-Germany) and K. Nygaard (Denmark-Greenland) was accepted by the Council. On 18 June the Chairman requested the Nominating Committee to present its proposal for the Chairmanships of STACFIS and STACFEN. Noting H. P. Cornus had to leave the meeting on an urgent matter, K. Nygaard reported that the Committee had consultations with representatives and was ready to nominate J. Casey (EU-United Kingdom) for STACFIS and M. Stein (EU- Germany) for another term for STACFEN. There being no further nominations, and noting that the appointments were for two-year terms beginning at the end of the September 1996 Annual Meeting, the Council elected both nominees by unanimous consent.

IX. MANAGEMENT ADVICE AND RESPONSES TO SPECIAL REQUESTS

1. Fisheries Commission

a) Advice for TACs for 1997, and Other Management Measures

For stocks within or partly within the Regulatory Area as requested by the Fisheries Commission, the following are the responses in the requested sequence. The Council agreed to conduct the assessment of shrimp in Div. 3M at its Annual Meeting during 7-13 September 1996.

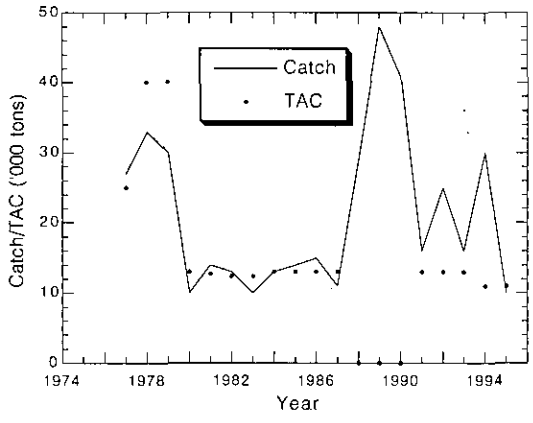
Cod in Division 3M

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

Fishery and Catches: Catches exceeded the TACs from 1988 to 1994, however were below the TAC in 1995. Large catches of small fish were caught by the trawl fishery in the most recent years. By-catches were estimated to be low in the shrimp fishery during 1993 to 1995.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	16	0	13
1994	30	0	11
1995	10	0	11
1996		11	11

[1] Provisional.



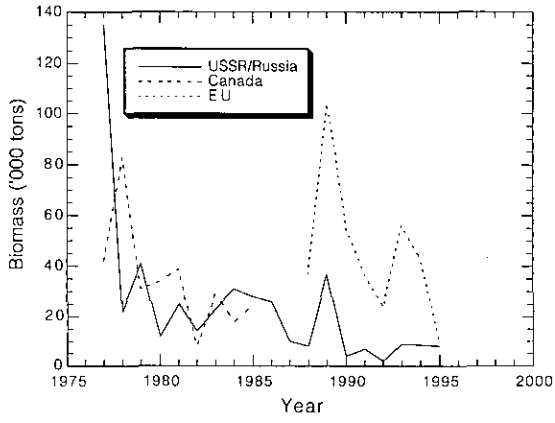
Data: Length and age composition of the catch were available for Portuguese trawlers and gillnetters as well as observed CPUE data. Data were also available from two bottom-trawl surveys (from Russia and EU) which covered the distribution area of the stock.

Assessment: An analytical assessment was presented which was only used to infer trends in stock.

Fishing mortality: Has been very high in recent years.

Recruitment: The 1985 and 1991 year-classes were the most abundant in recent years. The 1991 year-class was heavily exploited in 1994. The 1992 to 1994 year-classes appeared to be weak and were the lowest in the EU survey time series.

Biomass:



State of the Stock: The total stock biomass in 1995 is the lowest on record. Recruitment at age 3 is expected to be poor in both 1996 and 1997. The decrease in the age-at-maturity of the stock is interpreted as a reaction of the population to the decline of the stock.

Recommendation: No directed fishery for cod in Div. 3M in 1997. Also, by-catch of cod in fisheries directed to other species on Flemish Cap must be kept at the lowest possible level.

Special Comments: The opportunistic recruitment based fishery for cod in Div. 3M has been the main cause of the present stock status. To rebuild the stock it will require several years with no directed fishery for cod. Scientific Council could not determine if the low level of by-catch in the shrimp fishery only reflects the low stock size of cod.

Sources of Information: (SCR Doc. 96/7, 30, 32, 54, 64, 81; SCS Doc. 96/12)

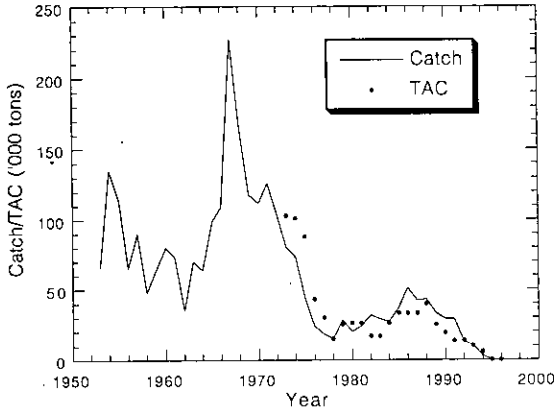
Cod in Divisions 3N and 3O

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.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	9.7	10.2	10.2
1994[2]	2.7	6.0	6.0
1995	0.2	0.0	0.0
1996	-	0.0	0.0

[1] Provisional.
[2] No directed fishery after mid-year.



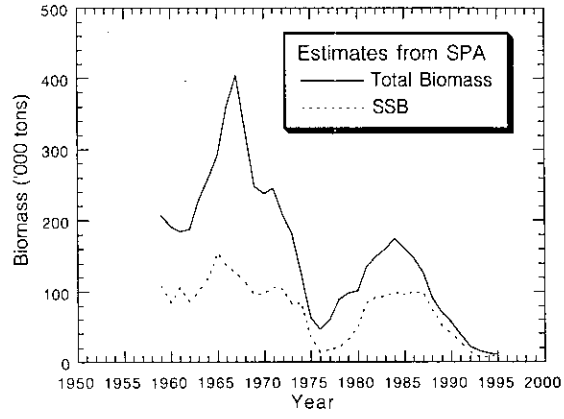
Data: Limited catch-at-age data were available from Portuguese gillnet and otter trawl by-catch. Russian research survey data were available up to 1993. Stock abundance, biomass and age structure were available from two Canadian and one EU-Spain groundfish surveys.

Assessment: An analytical assessment was presented which was used only to infer trends in the stock.

Fishing Mortality: Has been reduced on all ages due to the imposition of a moratorium.

Recruitment: Year-classes since 1982 appear to be weak. The current estimates of the 1989 and 1990 year-classes at age 3 are much lower than previously estimated.

Biomass: The 1995 total (ages 3+) and spawning stock biomass (ages 6+) estimates are the lowest in the time series.



State of the Stock: The stock was at an all time low in 1995 and was represented mainly by 2 year-classes (1989 and 1990).

Recommendation: There should be no directed fishing for cod in Div. 3N and 3O in 1997. By-catches in fisheries targeting other species should be kept at the lowest possible level.

Sources of Information: SCR Doc. 96/49, 80; SCS Doc. 96/12

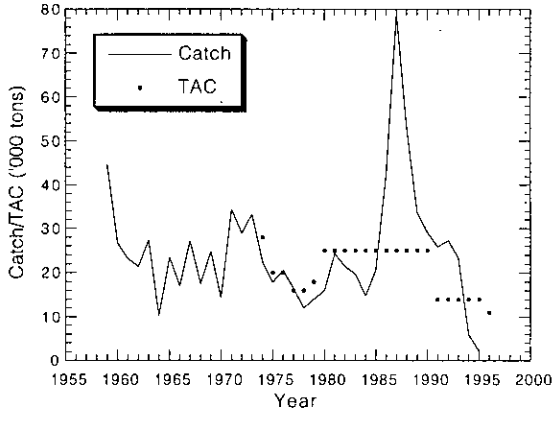
Redfish in Divisions 3L and 3N

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, in particular Div. 3O, is unclear and further investigations are necessary to clarify the integrity of the Div. 3LN management unit.

Fishery and Catches: The 1995 catch was about 2 000 tons, the lowest historically. This was only the second year since 1985 that the TAC was not exceeded. The reduction is primarily due to reduced effort. Substantial catches, as much as 24 000 tons have been taken by non-Contracting Parties since 1987. These countries did not fish in Div. 3LN in 1995.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	23	14	14
1994	6	14	14
1995	2	14	14
1996		14	11

[1] Provisional.



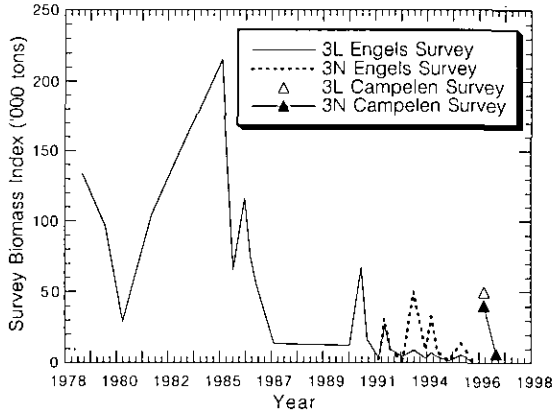
Data: Catch-rate indices were derived for Div. 3L and 3N based on NAFO database. Catch-rate index for Div. 3L and Div. 3NO were based on Portuguese observed data. Separate bottom trawl surveys were conducted by both Canada and Russia in Div. 3L and 3N.

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

Fishing Mortality: Assumed to have declined in 1995 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 are already recruiting to the fishery.

State of the Stock: Continues 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: Although there is concern for the future given the general lack of good recruitment, the Council has no basis to change its advice from 1995. Total catches of redfish in Div. 3LN should not exceed 14 000 tons in 1997.

Special Comments: The Council was pleased to note that catches in the past two years were below the agreed TAC. From 1992 to 1994 catches by non-Contracting Parties have ranged from 1 000 to 10,000 tons annually, however, in 1995 they did not fish in Div. 3LN.

Sources of Information: SCR Doc. 96/76; SCS Doc. 96/12.

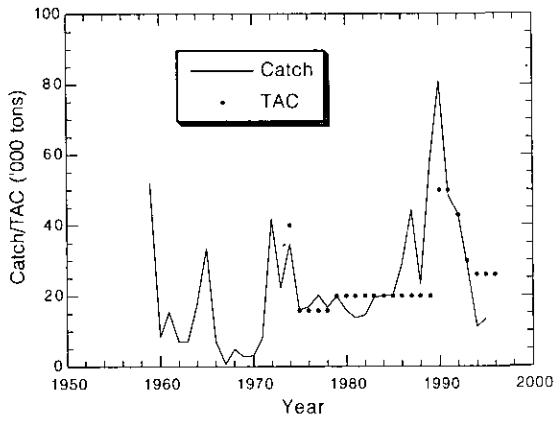
Redfish in Division 3M

Background: 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. They are reported combined in the commercial fishery.

Fishery and Catches: Directed fishing on redfish in Div. 3M in 1995 was mainly conducted by non-Contracting Parties, EU-Portugal and Russia. As was the case in 1994, catches by the Baltic states were low due to decreased effort. The Spanish redfish catches were mainly by-catch in the cod fishery.The Portuguese fleets also aimed at cod and Greenland halibut. Total catches dropped from 29 000 tons in 1993 to 11 000 tons in 1994 and increased only slightly to 13 500 tons in 1995.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	29	20	30
1994	11	20	26
1995	13	20	26
1996		20	26

[1] Provisional.



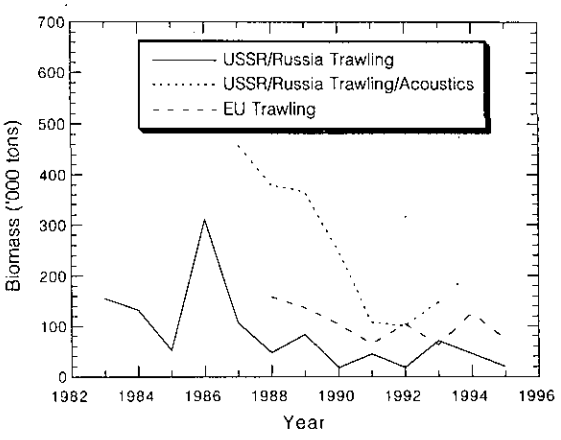
Data: Length and age data and CPUE data were available for only a small part of the catches. There is still the problem of unreported catches by non-Contracting Parties. Results from two bottom trawl surveys (EU and Russia) were available for estimation of trawlable biomass.

Assessment: Due to insufficient data, analytical assessment could not be done.

Fishing Mortality: Fishing mortality is expected to have been reduced due to the reduction of effort from 1993 to 1994 and 1995.

Recruitment: Survey results indicate no strong recruitment since the year-classes of 1989 to 1990. However, it is not clear if this reflects poor recruitment or by-catches in the shrimp fishery.

Biomass:



The size of spawning stock biomass is unknown.

State of the Stock: The overall trawlable biomass appears to have stabilized at a low level since 1991.

Recommendation: Catches higher than 40 000 tons for most of the period 1986 to 1992 were observed to coincide with a decline in trawlable biomass.The level of catches in the period 1975 to 1985, when stable conditions were observed, was about 20 000 tons. Scientific Council recommends that total catches of redfish in Div. 3M not be allowed to exceed 20 000 tons in 1997 and by-catch of juvenile redfish in the shrimp fishery should be kept at the lowest possible level.

Special Comments: Catching the recommended TAC of 20 000 tons would result in a significant increase in fishing effort. Scientific Council is not able to evaluate the effect of such a development. The survey trawlable biomass now consists mainly of immature fish. It would not be prudent to allow an increase in the exploitation of these young redfish as they will not reach maturity for another few years.

Some commercial catches of redfish come from areas outside the survey area.

Preliminary data from the Icelandic 1996 shrimp fishery on Flemish Cap indicate that redfish of 7 to 20 cm length are being taken as by-catch. Yield-per-recruit analysis suggests that about 25 000 tons of commercial yield was lost as a result of by-catches in the shrimp fishery during 1993-95.

Sources of Information: SCR Doc. 96/9, 54, 64; SCS Doc. 96/3, 12, 13, 14.

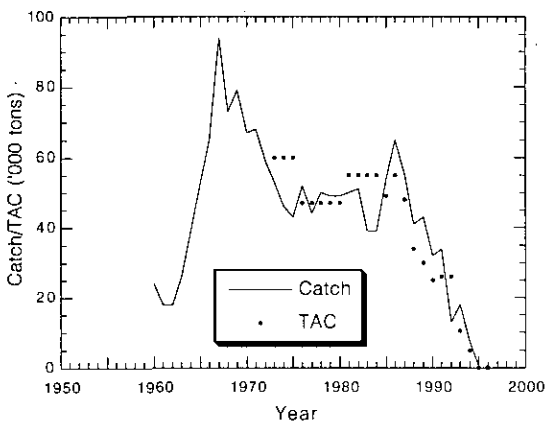
American Plaice in Divisions 3L, 3N and 3O

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 a moratorium in 1995 and 1996.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	17	10.5	10.5
1994	7	4.8	4.8[2]
1995	0.6	0	0
1996		0	0

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

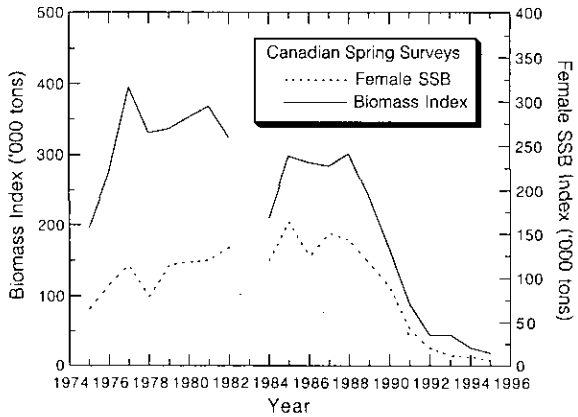


Data: Biomass and abundance data were available from several surveys. Limited sampling data from by-catch by Portuguese vessels were available.

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

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:



State of the Stock: Canadian spring and autumn surveys showed a large decline in biomass since the mid-1980s, agreeing with the decline observed in CPUE in the fishery. Although it is believed that the stock remains at a low level, recent stability or increases in some other, shorter indices are not consistent with the longer time series. These inconsistencies in survey trends could not be resolved at this time.

Recommendation: An approach, consistent with that taken in 1995, should be adopted until the various indices can be better evaluated. No fishing on American plaice in Div. 3LNO in 1997.

Sources of Information: SCR Doc. 95/51, 96/49, 61, 75; SCS Doc. 96/12

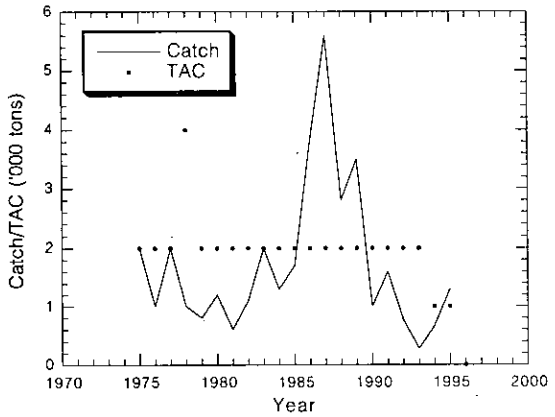
American Plaice in Division 3M

Background: The stock on Flemish Cap occurs mainly at depths shallower than 400 m.

Fishery and Catches: Catches are taken mainly by otter trawl. Primarily a by-catch fishery for Contracting Parties since 1992. More than 75% of the catch was taken by non-Contracting Parties in 1995.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	0.3	2	2
1994	0.7	1	1
1995	1.3	1	1
1996	-	0	0

[1] Provisional.

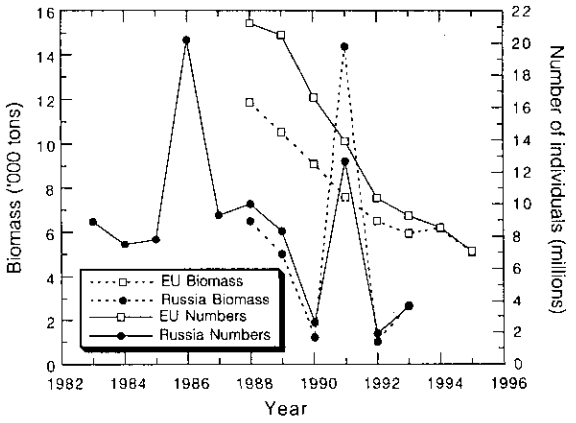


Data: Abundance and biomass indices from surveys are available from Russia (1983-93) and EU (1988-95).

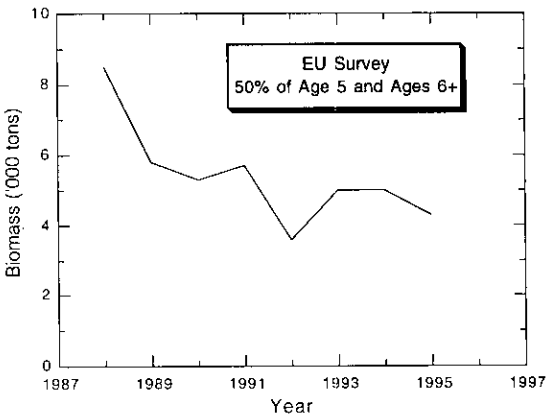
Assessment: No analytical assessment was possible. A comparison of catch levels with EU survey data indicated that the exploitation level decreased from 1991 to 1993, but more than doubled from 1994 to 1995.

Recruitment: Only weak year-classes were recruited to the EU survey since 1990.

Biomass and Abundance:



The SSB index remained more or less stable in 1990-94 before declining in 1995.



State of the Stock: The stock appears to be in a very poor condition.

Recommendation: There should be no directed fishery on this stock in 1997. By-catch should be kept at the lowest possible level.

Special Comments: It is anticipated that SSB will not increase in the near future because of recent poor recruitment.

Sources of Information: SCR Doc. 96/54, 64; SCS Doc. 96/12.

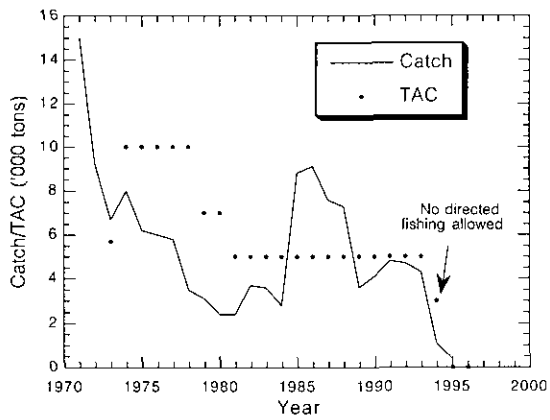
Witch Flounder in Divisions 3N and 3O

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.

Fishery and Catches: Catches exceeded the TAC by large margins during the mid-1980s, but since then have been near the level of the TAC. The catches in 1994 and 1995 were 1 100 tons and 400 tons, respectively, including unreported catches.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	4.4	5	5
1994	1.1	3	3[2]
1995	0.4	0	0
1996	-	0	0

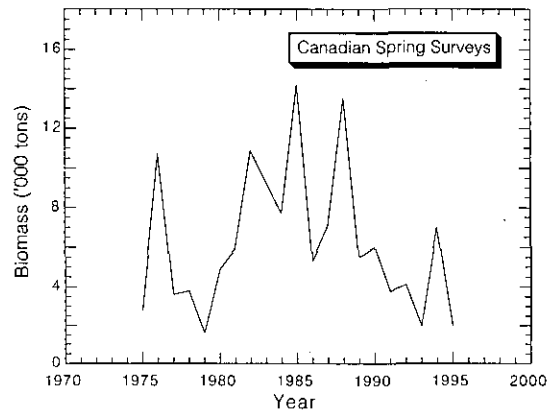
[1] Provisional.
[2] No directed fishing allowed.



Data: Abundance and biomass data were available from Canadian spring surveys during 1971-95 and autumn surveys during 1990-94 as well as EU-Spain surveys during spring 1995 and 1996. No ageing data were available since 1993.

Assessment: No analytical assessment was possible.

Biomass:



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

Recommendation: No fishing on witch flounder in 1997 in Div. 3N and 3O to allow for stock rebuilding. By-catches be kept at the lowest possible level.

Sources of Information: SCR Doc. 96/49, 70; SCS Doc. 96/12.

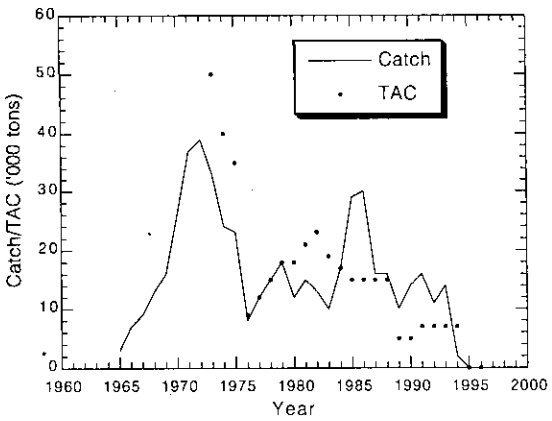
Yellowtail Flounder in Divisions 3L, 3N, and 3O

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 1995 and catches were taken as by-catch in other fisheries.The TAC has been exceeded each year from 1984 to 1993.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	14	7	7
1994	2	7	7[2]
1995	0.1	0	0
1996		0	0

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



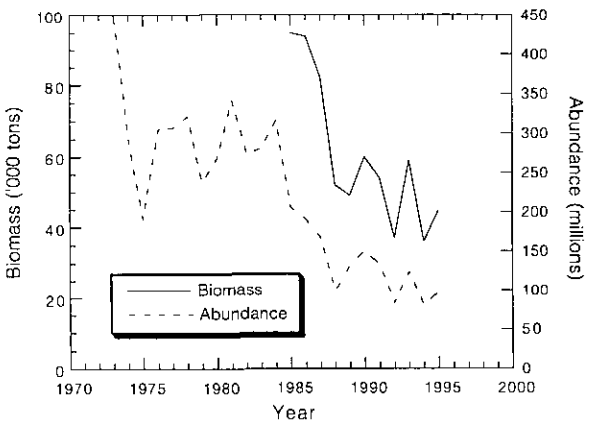
Data: Catch-at-age and CPUE were available from 1965 to 1993 but not for 1994 or 1995. Abundance and biomass indices were available from annual Canadian spring (1975-96) and autumn (1990-95) bottom trawl surveys, annual juvenile bottom trawl surveys (1986-94) and also EU-Spanish surveys in the NAFO Regulatory Area (1995-96).

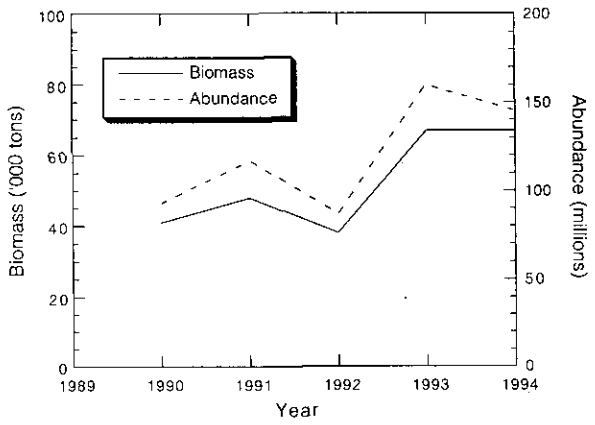
Assessment: No analytical assessment possible due mainly to uncertainties with catch and catch-at-age data. The stock area has contracted in recent years and this change could influence catch rates in the research surveys.

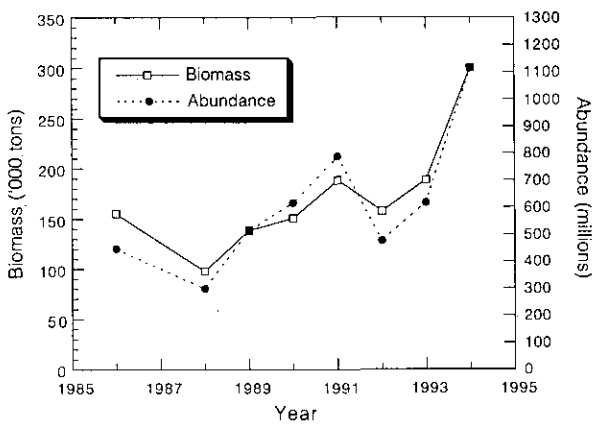
Fishing Mortality: Has been reduced on all ages due to moratorium.

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 estimates-at-age of these year-classes from the juvenile survey, however, were considered anomalously high.

Biomass:







State of Stock: The stock has been relatively stable since the late-1980s at a level lower than the early- to mid-1980s.

Recommendation: There should be no directed fishing of yellowtail flounder in 1997. By-catches should be kept at the lowest possible level to allow the stock to rebuild.

Sources of Information: SCR Doc. 96/49, 66, 74.

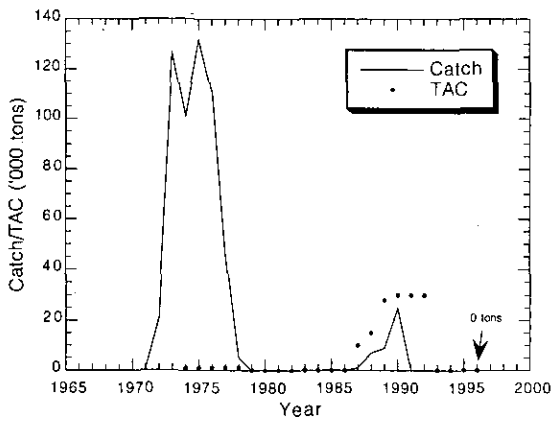
Capelin in Divisions 3N and 3O

Background: Spawning occurs in the area of the southeast shoal in Div. 3N.

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

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	+	0	0
1994	+	0	0
1995	-	0	0
1996	-	0	0

[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:

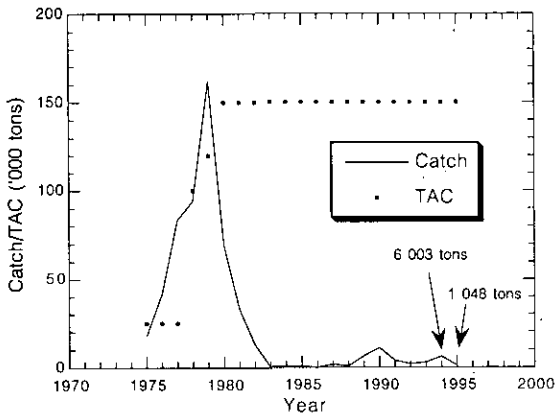
Squid in Subareas 3 and 4

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

Fishery and Catches: The only catch in 1995 was as by-catch.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	2.8	-	150
1994	6.0	-	150
1995	1.0	-	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:

Greenland Halibut in Subarea 2 and Divisions 3KLMNO

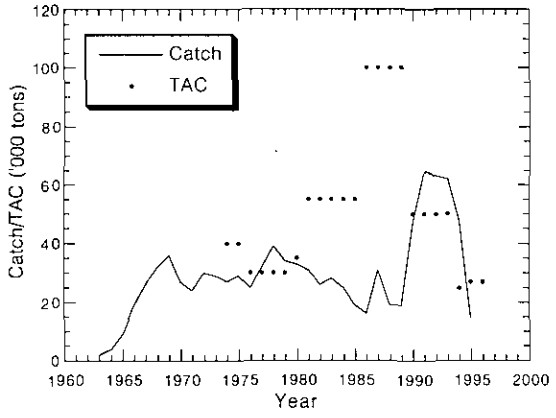
Background: The Greenland halibut stock in Subarea 2 and Div. 3KLMNO is considered to be part of a biological stock complex which includes Subareas 0 and 1.

Fishery and Catches: Catches increased sharply in 1990 due to a developing fishery in the Regulatory Area in Div. 3LMN and continued at high levels during 1991-94. The catch was only 15 000 tons in 1995 as a result of new management measures introduced by the Fisheries Commission. This catch is 75% lower than the average of the previous 5 years. Canadian catches were relatively stable during 1988-91 but declined considerably in 1992-95 to their lowest levels observed since the fishery began in the 1960s.

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

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	(42-62)	50	50
1994	(48-53)	-	25
1995	15	<40	27
1996	-	-	27

[1] Provisional.
[2] Established autonomously by Canada in 1993-94 and NAFO Fisheries Commission in 1995-96.



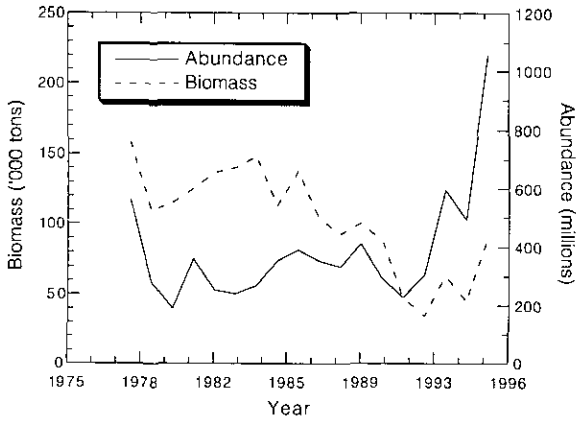
Data: CPUE data were available from otter trawl fishery in Canadian zone and Portuguese otter trawl fishery in the Regulatory Area of Div. 3LN. Abundance and biomass indices were available from research vessel surveys of Canada, EU and Russia. No data available for Div. 2GH.

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

Fishing Mortality: Not precisely known but believed to be above sustainable levels during 1990-94. Substantially lower in 1995 as a result of significant reductions in fishing effort.

Recruitment: The 1990 and 1991 year-classes were estimated to be better than average in both the 1994 and 1995 assessments. No new data were available in the current assessment to further confirm this view. Early indications from survey data suggest that the 1992, 1993 and 1994 year-classes may also be above average abundance. However, additional estimates at older ages are necessary to establishing confidence in these observations.

Biomass:



State of the Stock: In its 1994 and 1995 assessments, the Council concluded that the fishery has been, in recent years, exploiting this stock well above levels which may be considered sustainable. Available stock indicators in the current assessment (survey results and catch rates in commercial fisheries) also suggested a significant decline in stock size since the late-1980s up to 1995, particularly among the older age groups (10+). Improved recruitment is indicated for all year-classes from 1990 to 1994.

Recommendation: The Council is unable to advise on a specific level of TAC for 1997. However, this TAC should not exceed the current level until it is clear that the fishable stock is increasing at that catch level. With the substantial reduction in F experienced in 1995 and anticipated in 1996 combined with improved recruitment prospects, this stock should show signs of recovery over the next couple of years.

The Council reiterates its concern 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 over exploitation. It is noted also that such exploitation results in foregoing much potential yield. The Council again recommends that measures be considered to reduce, as much as possible, the exploitation of juvenile Greenland halibut.

Sources of Information: SCR Doc. 96/8, 33, 34, 35, 39, 54, 72, 73; SCS Doc. 96/3, 12, 13.

b) **Ongoing Requests for Management Advice by the Fisheries Commission**

The following are the responses to these ongoing requests by the Fisheries Commission:

i) **Stock Separation of Cod in Div. 2J+3KL and Proportion of Biomass of the Cod Stock in the Regulatory Area** (SCR Doc. 96/65)

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). To date this work has been able to define distinct north-south differences within the Div. 2J+3KL stock complex. Work continues with goals of identifying inshore or bay stocks and other distinct populations in the offshore if they exist. The ability to identify distinct elements of the stock complex may have implications on how this stock is managed in the future.

Estimates of the proportion of the cod biomass in Div. 3L in the Regulatory area were updated to include the 1995 research vessel survey data. The results from autumn surveys showed biomass in 1994 in the Regulatory Area (9.7%) to be the highest in the time series. The 1995 spring survey estimate was 26.2% down from the 1994 estimate of 63% 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 (1995 value in brackets)	Average proportion (%)
Winter	1985-86	23.8-26.8	25.3
Spring	1977-95	0.4-63.1 (26.2)	11.2
Autumn	1981-95	0.5-9.7 (1.6)	3.4

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 1995, showed that the proportion of the cod stock 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 1995, 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 (%) 1981-95	1995 Autumn %
2J	30	23
3K	34	38
3L	36	38

Survey data indicated that the proportion of total stock biomass occurring in the Regulatory Area was less than 10% in winter and 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) **Interrelation between seals and commercial fish stocks**

The Scientific Council, at its September 1995 Meeting, established an *ad hoc* Working Group for that meeting alone, to undertake matters related to the request from the Fisheries Commission on seal-fish interactions. The Working Group dealt particulary with information and recommendations arising from the September 1995 Joint NAFO/ICES Symposium on "The Role of Marine Mammals in the Ecosystem". A 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 was presented to the Scientific Council for consideration. The results were presented to the Fisheries Commission in response to its request.

No new data were available for review at the current meeting, however, the Council **recommended** that *any new information, particularly with respect to food consumption of seals and the fish-seal interactions should be made available to the Scientific Council for consideration at its June 1997 Meeting.*

iii) **Coordinated research on Greenland halibut**

At its 1995 September Meeting (*NAFO Sci. Coun. Rep.*, 1995, pages 148-149) the Scientific Council developed a comprehensive proposal for a synoptic survey for Greenland halibut from Davis Strait to the Flemish Cap. It was recognized that to carry out such a program would require considerable commitment in time, vessel support and funding. While the concept of a synoptic survey has not been advanced since September 1995 there have been several steps taken to deal with certain shortcomings regarding the limited survey coverage for Greenland halibut. During 1996 the following new surveys have been conducted or planned:

1) Two stratified-random groundfish surveys primarily directed for Greenland halibut were conducted in winter and spring respectively by Russia in the NAFO Regulatory Area.

2) A stratified-random survey by Japan in NAFO Div. 2GH during summer directed towards Greenland halibut.

3) A stratified-random survey by Canada in Div. 2GH directed towards groundfish and shellfish.

4) Canadian autumn surveys for groundfish and shellfish in Div. 2J and 3KLNO will be expanded to cover depths to 1 500 m from the current 1 000 m in Div. 2J and 3K and 730 m in Div. 3LNO. In addition, the survey will be extended to cover Div. 3M.

5) The Japan-Greenland survey series in Subarea 1 for Greenland halibut was discontinued after the 1995 survey, however, a new survey series by Greenland will begin in 1996 using the newly acquired research vessel in Greenland.

6) A special longline survey by EU was conducted in the Regulatory Area in 1996 to depths of 3 000 m, in order to determine the bathymetric limits of Greenland halibut.

7) The EU-Spain stratified-random survey, Div. 3NO, initiated in 1995 has been expanded to depths of 1 100 m in 1996 from 730 m in 1995.

iv) **TAC for Greenland halibut in Subarea 2 + Div. 3K and Div. 3LMNO**

During its meeting in September 1995, the Council reviewed all available information on distribution and abundance of Greenland halibut (*NAFO Sci. Coun. Rep.*, 1995, page 147) in order to address this same request. It was then concluded that due to very limited survey coverage throughout the stock management area, a comprehensive abundance distribution map could not be constructed and as a result, the Scientific Council could not determine proportional stock composition among the areas in question. No new data were available in advance of this June 1996 Meeting to provide an adequate response to this question. The Council reiterated that until survey coverage is extended throughout the range of the management area a precise estimate of proportional distribution will not be available.

v) **Further measures to protect juvenile fish of regulated species, e.g. area/seasonal closures** (SCR Doc. 96/63)

Scientific Council reviewed information on the distribution of yellowtail flounder, cod and American plaice in Div. 3NO from Canadian trawlers during 1985-93, and from research vessel surveys during 1986-94. Some new data from surveys on the distribution of yellowtail flounder was discussed, as well as a summary of previous information on cod and American plaice. The fishery data showed changes in fleet behaviour over the time period and indicated areas of overlap in the fisheries for all three species. Survey data indicated that the combined distribution of juvenile yellowtail flounder, American plaice, and cod covers much of the Regulatory Area in Div. 3NO. These data, which focused on yellowtail flounder, also indicated areas where yellowtail juveniles are concentrated in nursery grounds along with adult fish. This overlap of juveniles and adults in the Regulatory Area, which has been identified for this stock many times in the past, has been fished in the past by fleets using small meshed trawls, resulting in excessive catches of juvenile fish. Although adult yellowtail flounder are mixed with juveniles in the nursery grounds straddling the NAFO Regulatory Area, in Div. 3NO, there is a much larger stock area, primarily inside the 200-mile limit, where relatively few juvenile yellowtail flounder occur. This is not the case for American plaice, where juveniles co-occur with adults over wide areas of the Grand Bank.

The Council discussed the idea of a closed area to protect juvenile fish. A species such as yellowtail flounder, with a single, well-defined nursery area should benefit from a closed area through enhanced juvenile survival, resulting in a probable increase in the outflow of adults to the fishable stock. It was concluded that if such a measure were to be successful, it would have to be a year-round closure to all gears likely to catch juveniles of that species, as seasonal or fleet-specific closures have generally not been successful in other areas. A sufficiently large closed area would also offer protection to other species, although some fisheries would be impacted more than others, depending on the boundaries of the area.

More traditional measures such as effort (catch) restrictions, mesh size regulations, and improved selectivity of fishing gear can also contribute to the protection of juveniles of regulated species. However, the Council noted that these measures have not been fully successful in the past in controlling fisheries in this area, due to the lack of enforcement. It is hoped that recent initiatives such as the Observer Program, and enforcement against effort by non-Contracting Parties on the Nose and Tail of the Bank will be more successful in regulating fisheries. A closed area, if implemented, would not replace other management measures for affected fisheries, but it could be considered in conjunction with these measures.

Scientific Council recognized that at present it is unable to quantify the effects of closing an area to fishing. However, some of the benefits of a closed area would be to act as a natural refuge and to increase juvenile survival by ensuring that more of these fish survive the harvesting process. A closed area would require a precise definition of the species to be protected, careful definition of the boundaries with regard to species distribution, and a thorough understanding of the fisheries which would be affected.

At present, fisheries for cod, yellowtail flounder, American plaice and some other species

on the Grand Bank are under moratoria, meaning that no fishing effort for these species would be displaced immediately by implementing a closed area on the Grand Bank. However, when these moratoria are ended, the effects on some fleets could be considerable if a closed area is instituted. Scientific Council, recognizing both the potential benefits, as well as the consequences to fishing fleets of closed areas, recommended that further work be carried out on the topic of closed areas. Such work should focus on further definition of the distribution of cod and American plaice on the Grand Bank, as well as on *quantifying potential* benefits to fish stocks and impacts on fishing fleets.

vi) **Optimum minimum fish sizes** (SCR Doc. 96/60)

The Council examined information on yield and spawning stock biomass per-recruit for the stock of American plaice (*Hippoglossoides platessoides*) in Div. 3LNO with a view to specifying an optimal size at first capture (SCR Doc. 96/60). The analysis presented, indicated that significant gains, in terms of maximum yield-per-recruit, can not be realised by restricting the size of first entry into the fishery due to the flat-topped nature of the yield-per-recruit curve. However, the analysis was conducted using input parameters for combined sexes, and due to uncertainty in some input parameters, namely natural mortality rates and different growth coefficients for each sex, the Council was unable to determine conclusively whether this was in fact the case.

The analysis also indicated that significant gains in spawning stock biomass-per-recruit could be achieved through an increase in size at first capture. The Council therefore considered whether an alternative management objective relating to a safe level of spawning-stock biomass-per-recruit would be appropriate for this stock. However, the time-series of data on spawning stock size and recruitment currently available, is insufficient to define a stock recruitment relationship. The Council concluded that at present, it was not possible to identify a safe level of spawning stock size.

The analysis also compared exploitation levels in the most recent period of the fishery (1989-91) with those observed between 1975 and 1984. The results indicated that at the exploitation level observed in the 1989-91 period, codend mesh size for trawls, would have to be significantly increased to achieve a level of spawning stock biomass-per-recruit equivalent to that achievable at the exploitation level observed before the expansion of the fishery into the Regulatory Area in 1985. However, these results may exaggerate the differences between the two time periods since no account of discarded catch was considered in deriving the exploitation patterns used, especially that for the earlier time period. The analysis also assumed 100% survival of fish that escape through the meshes.

The Council therefore concluded that at present, it was unable to specify an optimal minimum size for American plaice in Div. 3LNO.

2. Coastal States

a) Advice for TACs for 1997, and Other Management Measures

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 which address these particular stocks.

The Council agreed to conduct the assessments on northern shrimp in Subareas 0+1 and Denmark Strait at a Council meeting during 15-18 November 1996.

The Council was requested by Canada to review the status of the cod stock in Divisions 2J+3KL and to provide estimates of the current size of the total spawning stock biomass, together with a description of recent trends. The response is as follows:

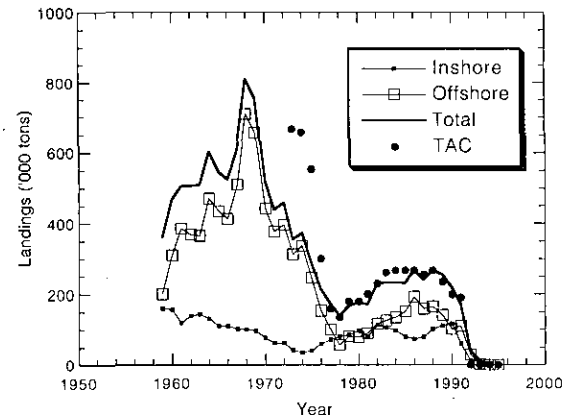
Cod in Divisions 2J, 3K and 3L

Background: Cod in these Divisions are considered a single stock complex. However, genetic and tagging data suggest the existence of relatively discrete sub-components. Extensive migrations occur, particularly between the inshore and the offshore. Some fish overwinter inshore. The relationship between inshore and offshore fish is poorly understood.

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 in 1993 and 1994, but not in 1995.

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Agreed
1993	11	0	0
1994	1.8	0	0
1995	0.3	0	0
1996	-	0	0

[1] Provisional.



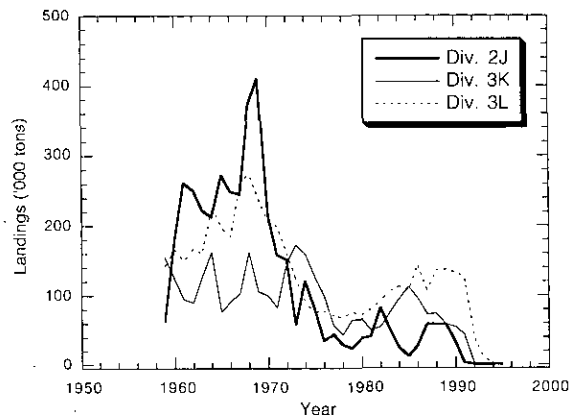
Data: 18 SCR documents addressing various aspects of the stock form the basis for this assessment.

Assessment: Stock status was estimated based on survey abundance indices and biological data.

Fishing Mortality: Multiplicative model analyses of the autumn Canadian groundfish survey numbers-at-age data indicate that total mortality reached a peak of 1.5 on the 1987 cohort. The portion attributable to fishing mortality is uncertain but probably high. Subsequent cohorts have benefited from the imposition of the moratorium in 1992. Analyses of tagging data showed different selectivities among gear and changes over time in the case of some gear.

Recruitment: Multiplicative model analyses of the autumn Canadian groundfish numbers-at-age data indicate that all recent year-classes have been extremely weak. There is some uncertainty regarding the relative strength of the 1986 and 1987 year-classes which appeared strong at younger ages but subsequently were in low abundance in the surveys. A variety of indices in addition to the autumn survey were examined, including pelagic juvenile surveys, coastal bottom seine surveys and demersal juvenile surveys. The ability of these indices to distinguish between strong and weak year-classes has not yet been determined.

Biomass: Autumn research vessel bottom trawl survey indices of biomass and abundance have indicated severe declines in recent years and the 1995 estimate is again extremely low, although not directly comparable to previous estimates because of a change in gear. Virtually no fish older than age 7 have been found in the surveys after 1992. The only aggregation of cod that was studied in 1995 was in Smith Sound, Trinity Bay, Newfoundland, estimated by hydroacoustics to be 17 000 tons. These fish were in spawning condition.



State of the Stock: The stock remains at a very low level, probably in the order of 1% of that in the early-1980s. 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 weight and condition of cod which began in the late-1980s appears to have been reversed in the most recent years.

- Since about 1990, the average age at first maturity has declined, possibly a response to population declines.

- Ocean conditions are moderating relative to the cold early-1990s. This may be beneficial to biotic factors such as growth rates.

Sources of information: SCR Doc. 96/2, 19, 20, 21, 22, 23, 40, 42, 43, 44, 45, 47, 48, 52, 56, 57, 59, 62.

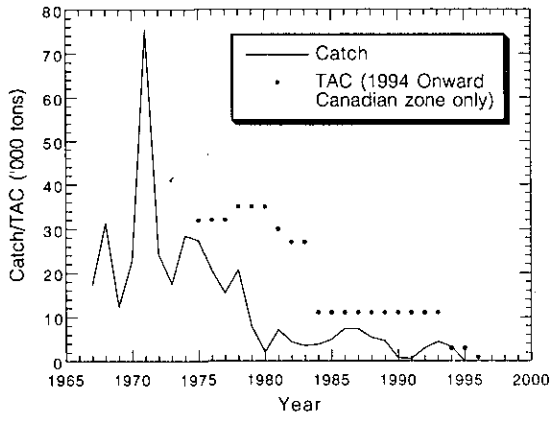
Roundnose Grenadier in Subareas 2 and 3

Background: Roundnose grenadier are found throughout Subareas 2 and 3 although the request for advice applies only to that portion of the resource lying within Canada's 200-mile economic zone. 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: Before the extension of jurisdiction by Canada, catches averaged about 26 000 tons, but have only averaged about 4 000 tons since then. The reported catch for 1995 was only 59 tons. Although the traditional fishery was inside the Canadian zone, catches in recent years have primarily been from the Regulatory area. In this area, roundnose grenadier are taken as by-catch in the Greenland halibut fishery.

	Catch[1] ('000 tons)	TAC[2] ('000 tons)
1993	4	11
1994	3	3
1995	+	3
1996		1

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



Data: There were no recent commercial data available from the fishery inside the Canadian Zone or the Regulatory Area except catch information. Survey data from Canadian deepwater surveys to Div. 3KLMN were available for 1991, 1994 and 1995, and were reviewed by Scientific Council in 1995. No more recent data were available.

Assessment:

Biomass: Cannot be determined.

State of the Stock: Not possible to evaluate.

Recommendation: There are no new data available, and therefore Scientific Council is unable to provide any advice for this stock.

Sources of Information: SCR Doc. 96/12, 34, 39, 54, 69; SCS Doc. 96/12, 13.

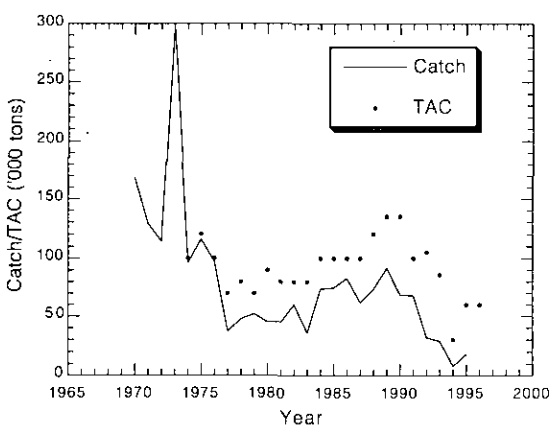
Silver Hake in Divisions 4V, 4W and 4X

Background: Silver hake in these Divisions are found in deep, warmer waters of the central Scotian Shelf, generally off the continental slope 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 1995 catch was substantially below the TAC due to reduced effort and allocations to parties which did not participate in the fishery. In 1995 Canada continued the regulatory changes implemented in 1994 to minimize cod, haddock, and pollock by-catches - the Small Mesh Gear Line was repositioned to restrict fishing to water deeper than 190 m (although with some exemptions), and use of a separator grate in codends was mandatory. A Canadian small boat fishery caught 300 tons in 1995, and is experiencing good success in 1996, fishing in experimental small mesh areas in Emerald and LaHave Basins.

	Catch ('000 tons)	TAC Set ('000 tons)	Projected catch at $F_{0.1}$ ('000 tons)
1993	29[1]	86[2]	75
1994	8[1]	30	51 (40)[3]
1995	18[1]	60	79 (59)[5]
1996	18[4]	60	64

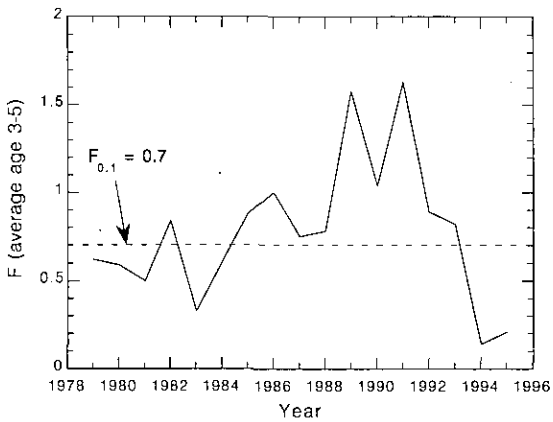
[1] Provisional.
[2] Includes additional 11 000 tons allocated by Canada in the expectation that not all allocations would be harvested.
[3] See special comments, *NAFO Sci. Coun. Rep.*, 1993, pg. 153.
[4] Estimated.
[5] See special comments, *NAFO Sci. Coun. Rep.*, 1994, pg. 31.



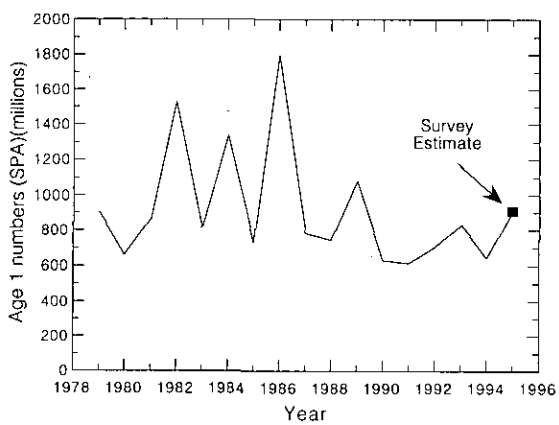
Data: Catch, effort and sampling data were collected from the commercial fishery by Canadian observers. Abundance and biomass by age were derived from the Canadian July Div. 4VWX research vessel survey. An estimate of the 1995 year-class strength was obtained from the October Canada/Russia 0-group survey.

Assessment: Catch-at-age from 1979 to 1995 were included in a bias correcting formulation of ADAPT using research vessel surveys (0-group and July survey for ages 1+) and age disaggregated non-standardized CPUE as tuning indices.

Fishing Mortality: Average F for ages 3-5 (the main age groups in the fishery) was estimated to be 0.2 in 1995.

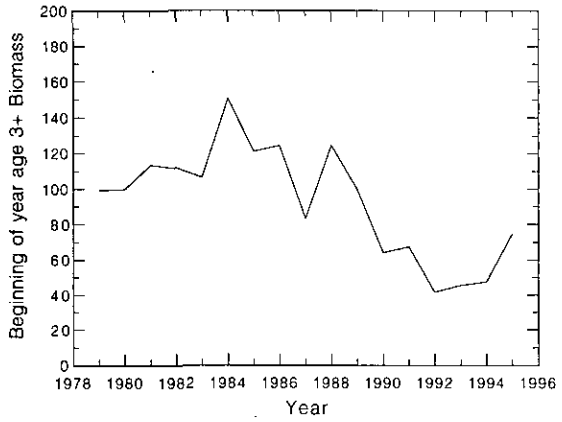


Recruitment: The 1995 year-class is estimated from the juvenile survey to be 1.28 billion fish. The strength of the 1994 year-class was estimated from the July survey as 1.10 billion, but this was averaged with the 1994 estimate for the O-group survey of 0.78 billion, reflecting a conservative approach. The average of the two estimates was 0.9 billion fish. Both the 1994 and 1995 year-classes are thought to be above the 10 year geometric mean of 0.8 billion from SPA.



Mean Weights-at-age: Commercial mean weight-at-age has dropped sharply since 1992 but appears to have stabilized at lower levels in 1995. Projections were based on an average mean weight-at-age for the most recent three years (1993-95) only, as the year-classes presently observed to be small at age are expected to remain small at age throughout their lifespan.

Biomass: Total fishable biomass (beginning of year age 3+) showed a declining trend from 1984 to 1992, but has increased in more recent years.



Forecast:

Option Basis	Predicted catch (1997)
$F_{0.1}$ = 0.70	49 000

State of the Stock: Estimates of fishing mortality in 1994 and 1995 were well below the $F_{0.1}$ level. Survey estimates of numbers and biomass have shown an increase, while the reductions in weights-at-age noted since 1992 have stabilized. Strengths of the incoming 1994 and 1995 year-classes are estimated to be above average, and fishable biomass has increased since 1992. 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 1997 is projected to be about 50 000 tons.

Special Comments: A retrospective pattern where F was underestimated and numbers overestimated was present in the results of the population analysis. The degree of overestimation of numbers ranged between 10 and 30%, with a tendency to increase with age. Numbers from the population analysis were adjusted, on an age-by-age basis, for projection purposes. Similar adjustments for retrospective patterns were made in the 1993 and 1994 assessments (see special comments, *NAFO Sci. Coun. Rep.*, 1993, pg. 153 and *NAFO Sci. Coun. Rep.*, 1994, pg. 31). In 1995 the retrospective pattern exhibited was irregular, and no correction was made.

It was noted in particular that recent regulatory changes may be causing commercial catch rates to underestimate present stock abundance, in which case the calculated catch at $F_{0.1}$ would be an underestimate. The Scientific Council agreed that this issue would be thoroughly evaluated at the 1997 June Meeting. The Council also agreed that the use of survey length-weight relationships for calculating commercial mean weights-at-age be investigated for potential effects of variation in spawning time.

Sources of Information: SCR Doc. 96/1, 3, 17, 78; SCS Doc. 96/3.

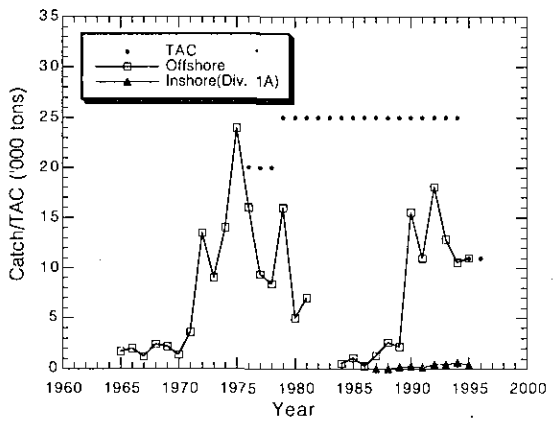
Greenland halibut in Subarea 0 + Divisions 1B-1F

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

	Catch[1]	TAC ('000 tons)	
	('000 tons)	Recommended	Autonomous
1993	13		
1994	11		
1995	11	11	11
1996	-	11	11

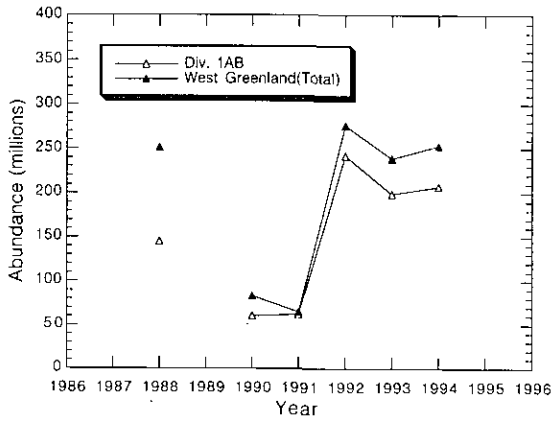
[1] Provisional



Data: Catch-at-age data were available for assessment. Standardized and unstandardized catch rates, biomass estimates and recruitment data were available from (1A) 1B-1D.

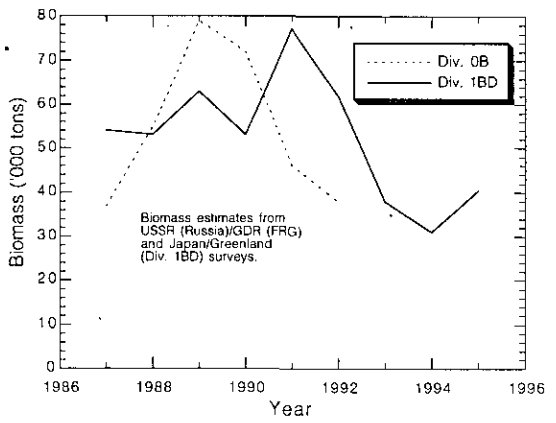
Assessment: No analytical assessment could be performed. Standardized catch rates increased to a level slightly below the average of the years 1988-94.

Fishing Mortality: Level not known.



Recruitment: Recruitment seems to be stable and it is anticipated that the good 1991 year-class will enter the trawl fishery in 1996 and 1997.

Biomass:



State of the Stock: The decline in the stock observed in the previous years has stopped and the stock seems to have stabilized at a lower level compared to the late-1980s and early-1990s.

Recommendation: TAC in 1997 should not exceed 11 000 tons for Subarea 0 + Divisions 1BCDEF.

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

Sources of Information: SCR Doc.96/14, 29, 36; SCS Doc. 96/3, 9, 11, 13.

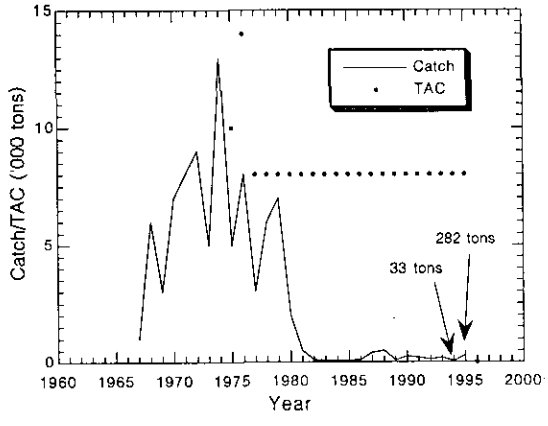
Roundnose Grenadier in Subareas 0 + 1

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 in the period 1977-1996. The advice for 1996 was that the catches should be restricted to by-catches in fisheries targeting other species. There has been no directed fishery for this stock since 1978.

	Catch[1] ('000 tons)	TAC Recommended	TAC Autonomous[2]
1993	0.2	8.0	
1994	0.0	8.0	
1995	0.3	8.0	5.5
1996		0	3.4

[1] Provisional
[2] Set by Greenland for SA 1

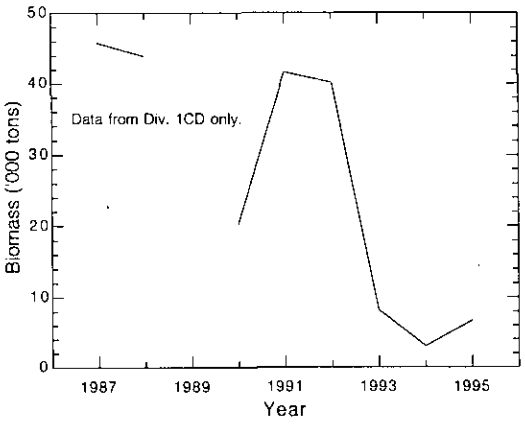


Data: Biomass estimates from surveys in Div. 1CD during the period 1987-95 were the only available time series. Estimated biomass has declined from 40 000 tons in 1992 to 3 000 tons in 1994, but increased to 7 000 tons in 1995.

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 directed fishing for roundnose grenadier in 1997. Catches should be restricted to by-catches in fisheries targeting other species.

Sources of Information: SCR Doc. 96/29; SCS Doc. 96/3, 95/9 95/13.

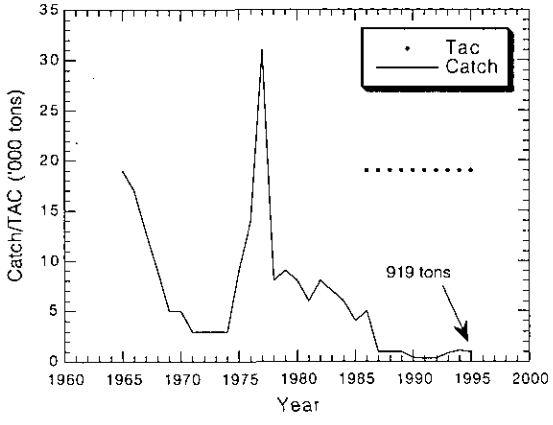
Redfish in Subarea 1

Background: There are two species of commercial importance in Subarea 1 golden redfish (*Sebastes marinus* L.) and deep sea 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: During the last decade, redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. No data to estimate the contributions of golden and deep sea redfish to the total catches are available. Catch figures do not include the weight of substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp and cod. The 1994 by-catch in the shrimp fishery was estimated to be 4 200 tons representing about 180 million redfish.

	Catch[1] ('000 tons)	TAC Recommended	TAC Autonomous
1993	0.8	+[2]	19
1994	1	+[2]	19
1995	0.9	0	19
1996	-	0	19

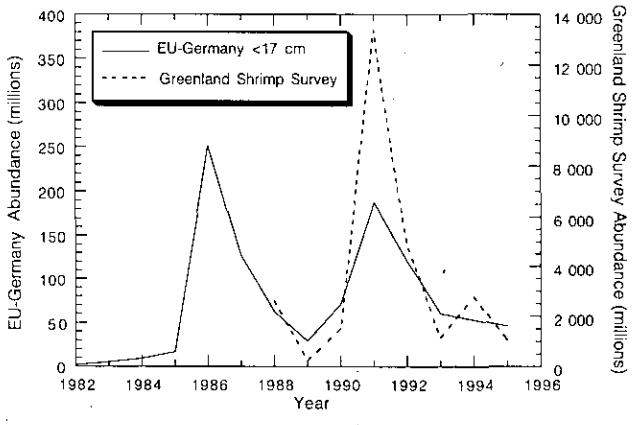
[1] Provisional.
[2] No TAC recommended, catches should be limited to by-catch and kept at lowest possible level.



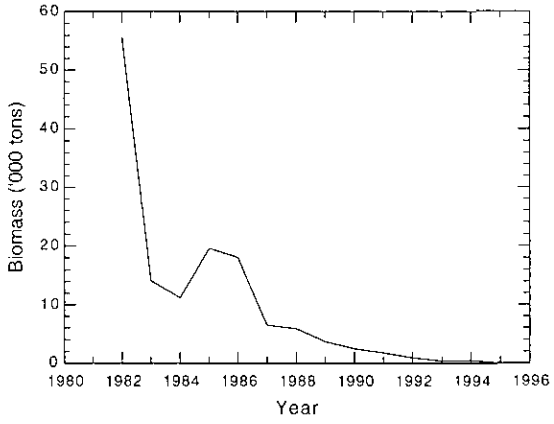
Data: Between 1962-90 the mean fish size in the commercial catches of golden redfish decreased by about 10 cm, the biggest reduction occurred in the late-1980s. Length frequencies derived from commercial by-catch revealed that the shrimp trawl selects all fish sizes <20 cm representing the present size composition of the stocks. Recent stock abundance, biomass and length structure were derived from annual groundfish surveys.

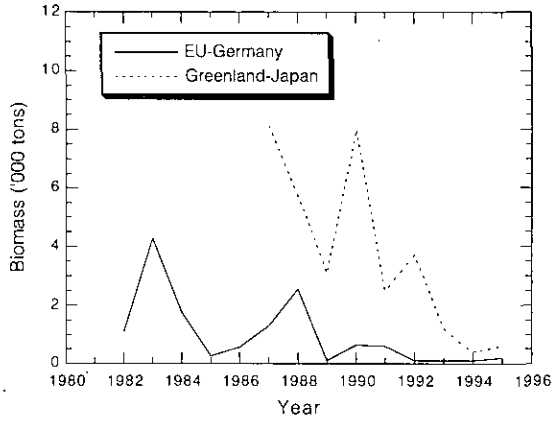
Assessment: No analytical assessment was possible.

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 deep sea redfish (≥17 cm) to an extremely low level.





State of the Stock: Both stocks are considered severely depleted. Short term recovery is very unlikely.

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

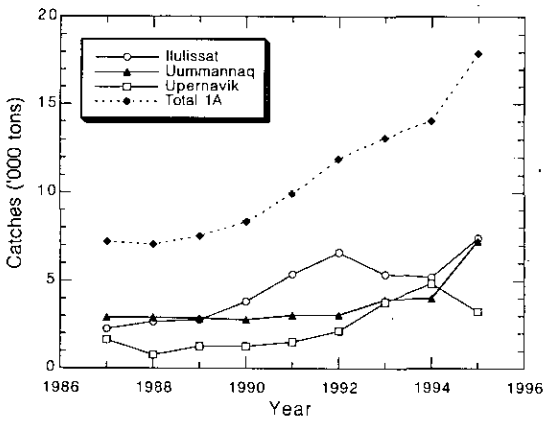
Special Comments: Long-term recovery of golden and deep sea redfish stocks in Subarea 1 from their severely depleted status depends on future recruitment. Any catches will reduce the probability of this event. Concern is expressed about the continuing recruitment failure. Considering the unknown impact of the estimated catches taken by the shrimp fishery, data collection on quantity and size composition of the Subarea 1 redfish by-catches taken by the shrimp fishery should be continued.

Sources of Information: SCR Doc. 96/4, 6, 29, 36; SCS Doc. 96/ 4, 9, 13.

Greenland Halibut in Division 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 this population.

Fishery and Catches: The fishery is mainly conducted with longlines and to a varying degree gillnets. Effort has increased in Ilulissat and Uummannaq, and decreased in Upernavik.



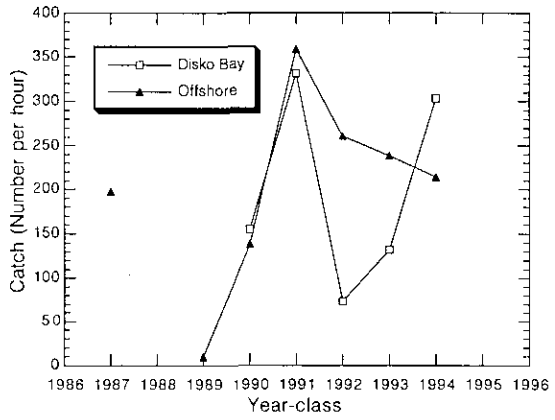
Catches[1] ('000 tons)	1993	1994	1995	TAC-96[2] Recomm.
Ilulissat	5.4	5.2	7.4	-
Uummannaq	3.9	4.0	7.2	-
Upernavik	3.8	4.8	3.3	-
Total 1A	13.1	14.0	17.9	-

[1] Provisional.
[2] No TAC advised.

Data: Catch-at-age data were available for years 1988-95 at Ilulissat, and for most years in this period at Uummannaq and Upernavik. Data on mean length in commercial catches, on weight categories in landings and by-catches in shrimp fishery were available. A recruitment index for age 1 were available from shrimp trawl survey. Catch rates and mean length were available from inshore longline survey.

Assessment: The recent level of fishing mortality could not be estimated. Indications of overfishing at Ilulissat and Uummannaq were suggested by analysis of mean length and weight categories in commercial fishery.

Recruitment: The level of recruits at age 1 offshore, has decreased since the large 1991 year-class, but is above the level in the late-1980s. In Disko Bay the level variates considerably.



State of the Stock: There were no signs of collapse of age-structure. However the stock at Ilulissat and Uummannaq appeared to be growth overfished.

Recommendation: Separate TACs should be considered for each of the three inshore areas.

Special Comments: Because the stock is dependent of recruitment from Davis Strait exploitation of the spawning stock and by-catches taken in shrimp fishery, should be taken into account managing the fishery in the fjords.

Sources of Information: SCR. Doc. 96/14, 36, 67, 68; SCS Doc. 96/9.

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.

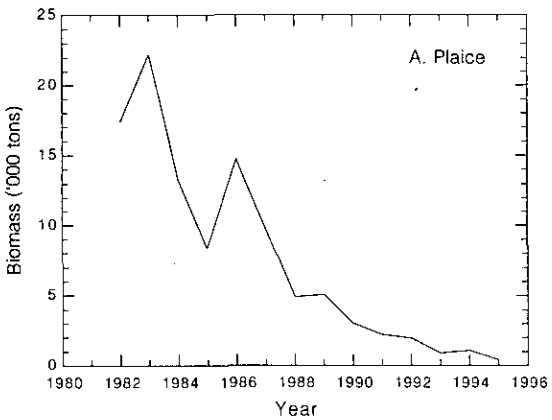
Fishery and Catches: Total combined annual catches of these species varied around 3 500 tons (mainly Green-land cod) during the last 10 years. They were taken by offshore trawl fisheries directed to shrimp, cod, redfish and Greenland halibut, by longliners operating both inshore and offshore and by pound net and gillnet fisheries in inshore areas only. The estimated by-catch from the shrimp fishery in 1994 was low.

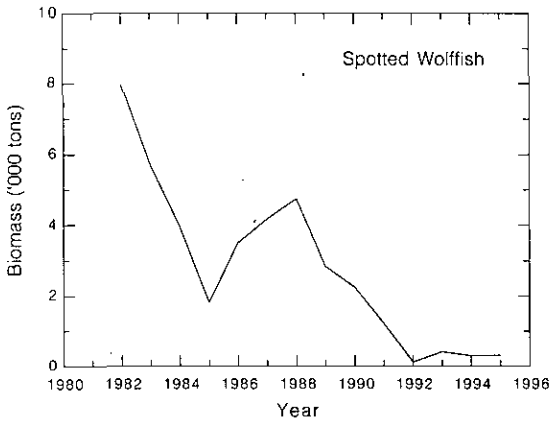
Data: Length frequencies for American plaice and Atlantic wolffish derived from by-catches in the shrimp fishery were available. These data indicated that the shrimp trawl is capable of catching all predominant fish sizes in the stocks of American plaice and Atlantic wolffish. Assessments of recent stock abundance, biomass, and length structure for American plaice, Atlantic and spotted wolffishes, and starry skate were based on annual groundfish surveys conducted by EU-Germany.

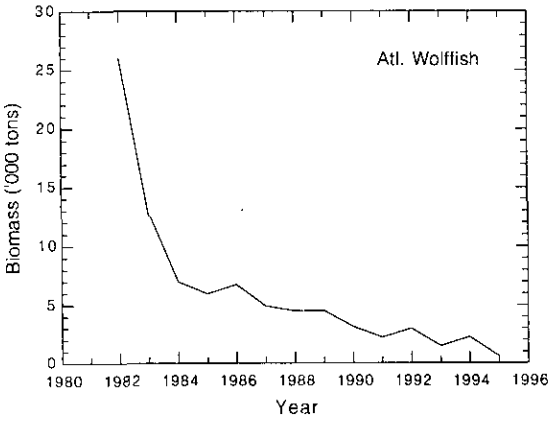
Assessment: No analytical assessment was possible for any of these stocks.

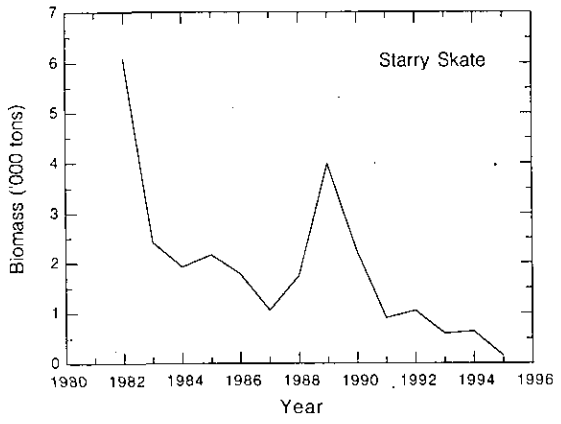
Recruitment: There are presently no indications of strong recruitment in the stocks of American plaice, Atlantic and spotted wolffishes and starry skate.

Biomass Indices: Incomplete survey coverage in 1995 (about 50%).









State of the Stock: The demersal stocks of American plaice, Atlantic and spotted wolffish and starry skates are severely depleted. Short-term recovery of these stocks is very unlikely.

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 Greenland cod, 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. Concern is expressed about the continuing recruitment failure. The possible impacts of the by-catches in the shrimp fishery are still unknown. Data collection on quantity and size composition of the by-catches by species including discards in the shrimp fishery in Subarea 1 should be continued.

Sources of Information: SCR Doc. 96/4, 5, 29, 36; SCS Doc. 96/4, 9, 13.

b) **Special Requests for Management Advice on Fish and Invertebrate Stocks** (note Annex 3, item 3)

i) **Responses to Request by Denmark (Greenland)**

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) Exchange program on Greenland halibut otoliths in order to calibrate the age reading methods between readers from the different countries involved in the fishery.

d) The impact on the stock composition of different exploitation patterns in terms of yield per recruit, long term sustainable yield and spawning stock biomass.

Concerning a), no new data were available since Div. 0B was not surveyed in 1995; see STACFIS report (Greenland halibut Subarea 0 + Div. 1B-1F) and *NAFO Scientific Council Reports*, 1994, page 110. The possibility of the existence of an isolated inshore population in Cumberland Sound (Div. 0B) is under investigation.

Concerning b), 99% of the inshore catches in Subarea 1 are taken in Div. 1A inshore areas. The Council recommended (report on Greenland halibut in Div. 1A), that separate TACs be considered for each inshore area (Ilulissat, Uummannaq and Upernavik) but could not calculate appropriate levels. The stocks in Ilulissat and Uummannaq appear growth overfished.

Concerning c), no new data were presented during the meeting, but at present there is an ongoing otolith exchange program involving most countries fishing Greenland halibut. The results of the exchange program will be evaluated at a meeting on Greenland halibut ageing in Iceland, November 1996 (See section on ICES/NAFO Greenland halibut Ageing Workshop in the STACFIS report).

Concerning d), no new data were presented during the meeting. An evaluation of different exploitation patterns is strongly dependent on precise ageing. At the present there is no consensus on the age reading method among laboratories involved in ageing of Greenland halibut, but progress on this problem is expected at the meeting in Iceland (see response to c above).

X. OTHER MATTERS

1. **Response to Special Request by Canada for Research Announcement Protocols**

Canada, acknowledging that such requests would normally come from the Fisheries Commission, requested the *Scientific Council to provide information on research program design and procedures for advance notification of planned research in the NAFO Regulatory Area.*

Scientific Council recognized the value of advance notification of planned research activities directed towards stocks and species of interest to Scientific Council but considered the information currently reported to STACREC or the Secretariat is adequate for Scientific Council purposes.

Scientific Council recognized that after completion of a survey, the amount of time required to process the collected data and prepare final reports will vary among surveys and Contracting Parties depending on the various priorities of the researchers involved. Nonetheless, Scientific Council encourages Contracting Parties to continue the past practice of reporting details of the research activities to the Scientific Council as soon as possible, preferably during the next June meeting.

2. **Participation in Symposium on Fish Otolith Research**

The Council was informed that the Institute of Marine Research of the Ministry of Fisheries, Norway, as the host of the 'Second International Symposium on Fish Otolith Research and Application', Bergen, Norway, 20-25 June 1998, had invited the Scientific Council to co-sponsor the event. The Council reviewed the meeting background and objectives received from Norway, and agreed to co-sponsor the Symposium. The Council requested the Secretariat to initiate contact with the organizers to proceed further.

3. **Review of STACPUB Membership**

Upon the request of the Executive Committee, the Council requested STACPUB to consider its membership taking into account the many recent new NAFO Contracting Parties and the additional workload on publications. The Council noted that STACPUB saw no reason to change its membership for the present.

XI. ADOPTION OF REPORTS AND RECOMMENDATIREONS

At its concluding session on 19 June 1996, the Council received summary presentations by the Chair of each Standing Committee. The Council then considered and **adopted** the reports of STACFEN, STACFIS, STACREC and STACPUB noting that minor editorial changes would be done as appropriate before the reports were issued as Appendices to the Council Report.

XII. ADOPTION OF SCIENTIFIC COUNCIL REPORT

At its concluding session on 19 June 1996, the Council considered the draft report of this meeting and this Report of the Scientific Council was **adopted** on the understanding that the Chairman of the Council will make the minor editorial changes as appropriate, with the Assistant Executive Secretary.

XIII. ADJOURNMENT

The Chairman thanked members of the Council for their hard work during the meetings especially the Designated Experts and the Chairmen of the Standing Committees (M. Stein, W. B. Brodie, D. Power and H. P. Cornus). He further thanked the Secretariat for continued help and effort and, in particular, the Assistant Executive Secretary who coordinated the Secretariat work and acted as rapporteur to the Scientific Council. He offered his congratulations to the newly elected STACFEN and STACFIS Chairmen who will take up their new duties at the end of the Annual Meeting in September 1996. There being no further business, he wished everyone a safe journey home and closed the meeting.

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

Chairman: M. Stein Rapporteur: K. Drinkwater

The Committee met at the Keddy's Dartmouth Inn at 9 Braemar Drive, Dartmouth, Nova Scotia, Canada, on 6 and 14 June 1996, to consider environment-related topics and report on various matters referred to it by the Scientific Council. Scientists attended from Canada, Denmark (in respect of Faroe Islands and Greenland), European Union, Japan, Russia and the United States.

The Committee reviewed the following documents: SCR Doc. 96/1, 4, 11, 13, 15, 16, 24, 25, 26; SCS Doc. 96/3 (Parts I and II), 4, 10 and 11 (Parts I and II).

1. Chairman's Introduction

The Chairman welcomed the members to the annual June Meeting of STACFEN.

2. Invited Lecture

The Chairman informed the Committee that a memo by the Executive Secretary of NAFO, Dr. L. Chepel, was sent to all Contracting Parties encouraging more environmentally-related and environment-fish interaction papers for STACFEN. The Chairman hoped that the members would heed the advice.

He then mentioned that the Russian/German Data Evaluation Project which began last year has resulted in three Workshops to date (further details are provided below), and that an article describing this work will appear in an upcoming issue of the NAFO newsletter.

The Chairman announced that the scheduled invited lecture by Dr. Mojib Latif from the Max-Planck Institut für Meteorologie, Hamburg, entitled "A mechanism for decadal climate variability" was cancelled. Dr. Latif was unable to attend due to health reasons.

3. Review of Environmental Conditions

a) Marine Environmental Data Service (MEDS) Report for 1995 (SCR Doc. 96/13)

The inventory of oceanographic data obtained by MEDS during 1995 was presented.

i) Hydrographic Data Collected in 1995

Data from 4 846 oceanographic stations collected in the NAFO area were sent directly to MEDS in 1995, of which 1 821 have been archived and the remainder are awaiting to be archived.

An additional 4 476 stations were received through IGOSS (Integrated Global Ocean Service System). Data known to have been collected during 1995, but which have not yet been received by MEDS, includes stations off West Greenland occupied by Danish scientists. The number of stations for which MEDS has received data directly was increased by over a factor of 5 from those obtained in 1994 but the number of stations obtained through IGOSS decreased by approximately 1 100.

ii) Historical Hydrographic Data Holdings

Data from 31 794 oceanographic stations collected prior to 1995 were obtained during the year, up by a factor of 6 over last year. The majority were due to a reprocessing and submission of the entire temperature and salinity dataset from the Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

iii) Drift-buoy Data

A total of 113 drift-buoy tracks were received by MEDS during 1995 representing over 320 buoy months. The total number of buoys was an increase of 25 over 1994 and the number of buoy months was more than twice that recorded.

iv) **Wave Data**

Over 116 700 wave spectra were processed in 1995, mostly from the permanent network of moored wave buoys in the area. This represented an increase of over 26 000 compared to 1994.

v) **Current Meter Data**

STACFEN was informed that MEDS does not at present archive current-meter data, but will help scientists, upon request, to obtain whatever data are presently available from the archives held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

vi) **Other Data Sources**

It was brought to attention of the Committee that extensive data within the NAFO region are being collected within the Joint Global Ocean Flux Study (JGOFS) and the U.S. GLOBEC Georges Bank Project. These data are available on the World Wide Web of the Internet.

b) **Review of Environmental Studies in 1995**

i) **Subareas 0 and 1** (SCR Doc 96/4, 15; SCS Doc. 96/4)

During the annual German (EU) groundfish survey (SCS Doc. 96/4), CTD measurements were taken at 35 fishing stations and along the NAFO standard sections off West Greenland (Cape Farewell and Cape Desolation). In addition, vertical temperature profiles to 750 m were taken in the eastern North Atlantic during trips to and from Greenland.

Monthly air temperature anomalies at three sites in Greenland and changes in the ice cover in the northern North Atlantic were described (SCR Doc. 96/15). Extremely cold air temperatures (monthly mean anomalies of up to -5K) were observed in winter off West Greenland, conditions similar to winters of the early-1990s.

The mean annual air temperatures were near normal, however, the cold winter temperatures were offset by the warm conditions through much of the remainder of the year. Above normal air temperatures began in April, persisted through most of the summer and reached a maximum in November. The author emphasized that, although 1995 showed relative warming compared to recent years, this did not yet signify a change in the longer-term negative trend in air temperatures that has persisted over the last 30 years. Ice conditions were near normal off East Greenland and along the Labrador coast during the first few months of 1995, although coverage was more extensive than normal in the northeastern Labrador Sea area in the early spring. During the autumn of 1995, ice extent off East Greenland and Baffin Island were near normal. Temperature and salinity measurements were observed during the autumn at standard sections off Cape Farewell, Cape Desolution and Frederikshaab but, due to ship difficulties, no data were obtained along the Fylla Bank Section. Colder-than-normal ocean temperatures were observed in the upper 200 m off Southwest Greenland, whereas in the Irminger layer (200-300 m) temperatures appeared to have declined slightly while salinities had increased. Based on previous studies which showed a negative relation between cod recruitment off West Greenland and salinity of the Irminger water layer during the previous autumn, the high salinities would suggest the likelihood of poor cod recruitment.

Variability in near-bottom temperatures collected during German groundfish surveys off West Greenland from 1982 to 1995 were compared to changes in demersal fish assemblages and distribution (SCR Doc. 96/4). Temperature data were averaged by geographic strata.

Trends in the near-bottom temperature in each of the strata were similar to the cold conditions in 1983-84, warm conditions during 1985-86, but it was observed to be decreasing during 1987-89 and warming since then. Absolute temperatures differed between strata, with deeper and southern strata generally being warmer. Correlation analyses failed to find a relationship between cod distribution and temperature, but the author did report that temperature did appear to influence growth rates and size of fish.

ii) **Subareas 2 and 3** (SCR Doc. 96/16, 24, 26; SCS Doc. 96/11 (Part II))

During the annual fisheries surveys in the Newfoundland region, CTD data were collected on the southern Labrador Shelf, the northern Newfoundland Shelf, the Grand Banks and off southern Newfoundland (SCS Doc. 96/11, Part II). In addition, transect information were collected over Hamilton Bank, off Bonavista Bay and along the Flemish Cap section. It was also noted that the Northern Cod Science Program, which concluded in March, 1995, resulted in approximately 250 publications, many containing information on the physical environment and its possible influence on fish stocks. The Committee was informed that the final report of the Northern Cod Science Program includes a list of these publications. This report was made available to STACFEN members by the Director of the Northern Cod Science Program.

Physical and biological data collected on the Labrador Shelf in September, 1985, were used to examine an hypothesis proposed earlier, that nutrient fluxes from Hudson Strait increase primary production on the northern Shelf and that a "conveyor-belt" food chain develops as the community is transported southward by the mean circulation (SCR Doc. 96/16). This hypothesis was proposed to account for the greater abundance of fish on the southern Labrador Shelf. It suggests that the relative importance of the larger plankton should increase southward along the Shelf. The field studies confirmed high nutrient levels on the northern Labrador Shelf in summer and suggest that they are advected from Hudson Strait. The high nutrient concentrations enhance local plankton production. However, nutrient, chlorophyll-a, plankton and biomass spectra distributions did not support the idea that a developing food chain is advected southward along the Shelf. A local zooplankton population was found to reside on the northern Labrador Shelf to feed upon the high phytoplankton biomass. High fish production on the southern Labrador Shelf may be more related to local prey production through upwelling processes near Hamilton Bank.

Climate variability of the deep waters in the Labrador Sea were described (SCR Doc. 96/24). This work was carried out as part of the Russian/German Data Evaluation Project.

Temperature variance (in the order of 1K) in the bottom water layer of the Labrador Sea (3 500 m) was larger than that in the overlying layer occupied by North Atlantic Deep water. The near bottom waters, which also showed an increasing trend in salinities from the 1960s to the mid-1970s, originated from the Denmark Strait Overflow. In the Irminger Atlantic Water (500-600 m) and the Labrador Sea water (1 200-1 500), strong coherence existed between events in those waters located on the slopes off West Greenland and Labrador. These depth layers also showed correlation maxima between temperature and salinity compared to other depth levels.

Sea ice and oceanographic conditions in the Newfoundland area during early-1996 were described (SCR Doc. 96/26). Moderate air temperatures during the late-autumn of 1995 and the winter of 1996 resulted in below normal ice cover extent and concentration off the east coast of Labrador and Newfoundland. The warming trend that began during the autumn of 1995 at Station 27, continued into the winter and spring of 1996. This represented the first time in almost a decade that the near bottom temperatures were above their long-term mean. Temperatures throughout much of the water column over the Grand Bank and along eastern Newfoundland were also above normal. The temperature increase was attributed, in part, to reduced ice cover, i.e. the heat in recent years was being used to melt ice and in 1995 it went into heating the water column.

There was less Cold Intermediate Layer (CIL) waters over the shelf and core temperatures had increased. Meteorological, sea ice and oceanographic data during early-1996 all point to moderating conditions relative to the cold conditions of the early-1990s.

iii) **Subareas 4, 5 and 6** (SCR Doc. 96/1, 11; SCS Doc. 96/3 (Parts I and II), 10, 11 (Part I))

Russian scientists reported that offshore of the Scotian Shelf, the SSTs were generally above normal in 1995 while over the shelf they tended to be below normal (SCS Doc. 96/3, Part I). They also noted that the boundary between the shelf and slope waters had shifted northward. The Russian Research Report also reported (SCS Doc. 96/3, Part II) that meteorological data and SSTs were obtained in Divisions 6G and 6H.

The Canadian Research Report (SCS Doc. 96/11, Part I) noted that a joint study between NOAA in the USA, Environment Canada and the Department of Fisheries and Oceans in Canada had assembled historical groundfish trawl survey data from Canada and the United States along with environmental information. The aim of the study is to evaluate the degree to which environmental variability and fishing effort have influenced changes in distributional patterns at the species and community levels. The data have been put into GIS format (Global Information System) and are presently being analyzed. This report led to a discussion on data analysis programs and procedures. The Chairman noted that access to large databases and techniques to process the data often limits the research potential and it would be beneficial if different laboratories shared their processing and analysis methods. It was suggested that a NAFO sponsored meeting or working group be convened to (1) inquire what programs the laboratories are using to analyze large data sets, (2) display and demonstrate their software and various products, and (3) consider the possibility of a special session of the Scientific Council on this subject.

The US Research Report (SCS Doc. 96/10) reported the continuation of temperature and salinity data collection along the Middle Atlantic Bight and Gulf of Maine transects. These data were also described in SCR Doc. 96/11 (see below).

Monthly monitoring of surface and bottom temperatures on transects across the Middle Atlantic Bight and the Gulf of Maine showed generally warmer-than-normal conditions during 1995, with an annual anomaly of upwards of 1.6K near-bottom over the shelf portion of the Middle Atlantic Bight (SCR Doc. 96/11). Surface salinities were above average for the year in the Middle Atlantic Bight. No salinity data were collected in the Gulf of Maine.

A comparison of recruitment of silver hake on the Scotian Shelf and cape hake off Namibia in southwestern Africa showed similarities in abundance and total biomass (SCR Doc. 96/1). Previous studies have shown a high positive correlation between silver hake abundance and SSTs. A similar relationship between temperature and abundance was found for the cape hake.

iv) **Comparison of Climatic Conditions in the Labrador and Barents Seas** (SCR Doc. 96/25)

A study of the relationship between atmospheric, sea ice and oceanic variability in the Labrador Sea area with those in the Barents Sea showed high negative correlations between two widely separated regions for several variables including air temperature, ice coverage, and water temperature. It was noted that while recent cooling has occurred in the Labrador Sea region, in the Barents Sea conditions have been very mild. The cause of the negative relationship is suggested to be related to the large-scale atmospheric wind patterns, i.e. the North Atlantic Oscillation (NAO) or fluctuation. It was noted when the NAO index is strongly positive, the Icelandic Low strengthens and the northwest winds over the Labrador Sea intensify, carrying cold air farther south. This produces more ice and colder ocean temperatures. At the same time over northern Europe the southwest winds intensify carrying warm air masses farther north causing warm conditions to develop in the Barents Sea. This leads to less ice and warmer ocean temperatures. The contrast between the high cod abundance in the warm Barents Sea with the low abundance in the cold Labrador Sea during recent years was highlighted.

c) **Overview of Environmental Conditions in 1995** (SCR Doc. 96/41)

A review paper was presented based on several long-term oceanographic and meteorological data sets. The highlights follow:

i) Cold winter air temperatures in 1995 were again observed in the Labrador Sea region but they were generally not as low as in previous years. For the remainder of the year they were generally warmer than or near normal. At the southern boundary of NAFO Convention Area, air temperatures were generally warmer than normal throughout the year, except for November and December when temperatures dropped below normal.

ii) The North Atlantic Oscillation (NAO) index was strongly positive but a strong eastward shift in the Icelandic Low and Bermuda-Azores High resulted in their exerting less influence in the Northwest Atlantic than in other high NAO index years.

iii) Similar to 1994, ice formed early, spread more rapidly, was of greater concentration and lasted longer than normal off southern Labrador, Newfoundland and in the Gulf of St. Lawrence. However, ice conditions were not as severe as 1994 nor as the early-1990s.

iv) The number of icebergs to reach south of 48°N during 1995 decreased slightly compared to 1994 but was still the third highest number detected since the introduction of side-looking airborne radar 13 years ago.

v) Below normal temperatures were observed throughout most of the water column at Station 27, continuing the pattern established over ten years ago, but conditions were not as cold as the early-1990s.

vi) The volume extent of the CIL water off Newfoundland during the summer decreased in 1995 to below the long-term mean and was at its lowest value since the early-1980s. This was due to a decline in the amount of CIL water off southern Labrador and northern Newfoundland, in contrast to the Grand Bank where the amount of CIL water increased slightly relative to 1994.

vii) The CIL waters in the Gulf of St. Lawrence remained very cold and their horizontal extent over the bottom of the Magdalen Shallows increased, with a new record for the amount of ocean bottom covered by water temperatures <0°C.

viii) Annual coastal sea temperatures at Boothbay Harbor and St. Andrews were above average while those at Halifax were colder-than-normal, a pattern similar to 1994.

ix) Deepwater temperatures on the Scotian Shelf (Emerald Basin) and in the Gulf of Maine remained high during 1995, while in Cabot Strait they decreased to near normal values. The high temperatures on the Scotian Shelf and in the Gulf of Maine were believed to be due to the influence of warm slope waters penetrating into the deep basins.

x) Cold waters were observed near-bottom and at intermediate waters over the northeastern Scotian Shelf and off southwestern Nova Scotia continuing a trend that began in the mid- to late-1980s. In the latter region, temperatures appeared to be increasing although they remained below normal. No evidence of warming was observed in the northeastern Scotian Shelf.

Discussion after the presentation centred on what environmental information is most useful for stock assessment purposes. While time series of oceanographic and meteorological variables allow description of the general climate, they are not always helpful for assessments. The overview is, however, meant to provide a general view of climate conditions within the NAFO region. The important environmental variable for each stock, and its appropriate scale in both time and space, vary for each species and sometimes for each stock within a species. In most cases we do not know what these variables and their scales are. It was felt by the Committee that directly relevant indices for assessment purposes should be sought through interdisciplinary research investigating linkages between fish and environment. It was recognized that this will not occur quickly.

4. Formulation of Recommendations Based on Environmental Conditions in 1995

STACFEN Chairman will prepare an SCR Doc. for the September 1996 Fishery Commission Meeting, which will highlight the essential results from the Environmental Studies in 1995. Some selected figures from papers presented to STACFEN will be incorporated in this SCR Doc.

5. 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). Representatives for Japan, Portugal, Spain and the United Kingdom are still to be designated.

6. Russian/German Data Evaluation (ICNAF/NAFO Data, Status Report)

At the June 1995 meeting it was noted that a cooperative program had been funded to allow German and Russian scientists and technicians to obtain and evaluate the historical hydrographic data collected by the former USSR. STACFEN Chairman reported on the three Workshops held; in Hamburg, 25-29 September 1995, Murmansk, 19-24 February 1996 and Hamburg, 22-26 April 1996. Written reports will be made available to the Committee at the September 1996 Scientific Council Meeting.

7. Acknowledgements

The Chairman closed the meeting by thanking the Secretariat and the participants 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 5-19 June 1996, 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, Denmark (in respect of the Faroe Islands and Greenland), European Union (France, Germany, Portugal, Spain and United Kingdom), Japan, Russian Federation and 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. The Chairman noted there was some new material on comparative trawl survey experiments and suggested this matter be considered under 'Other Matters'.

II. GENERAL REVIEW

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

As was done at the June 1995 Meeting, STACFIS agreed to have a general review of catches in the NAFO Regulatory Area of Subarea 3 in 1995. Estimates of catches from various sources were considered and combined with catches reported in STATLANT 21A forms to derive the most appropriate catches for the various stocks in Subarea 3. STACFIS was pleased to note that this review in 1996 was not as difficult as it had been in many recent years. The catches derived were then used in the assessments of the relevant stocks.

III. STOCK ASSESSMENTS

1. **Cod in Divisions 2J, 3K, and 3L** (SCR Doc. 96/2, 18, 19, 20, 21, 22, 23, 40, 42, 43, 44, 45, 46, 47, 48, 52, 56, 57, 59, 62)

a) **Introduction**

In the 1995 assessment of the stock, STACFIS was unable to determine the absolute stock level from an analytical assessment, but based on available data it was considered to be 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 decreased and in 1992 only 44 000 tons were landed as a result of closure of the fishery in mid-1992. A Canadian food and subsistence fishery was permitted in 1993 and part of 1994 but not in 1995. This fishery was generally considered a failure with catch rates being low and cod generally small. In 1995 a limited fishery was conducted for scientific purposes (Sentinel Survey) yielding approximately 163 tons. The Sentinel Survey catch together with by-catch gave a total catch of 331 tons in 1995 (Fig. 2).

No catch was reported in the Regulatory Area in Div. 3L in 1995.

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Fixed Gear Catch	72	79	101	103	113	60	12	9[1]	1.3[1]	0.3[1,2]	
Offshore Catch	179	156	168	151	106	90[2]	32[2,3]	2[1,2]	0.5[1,2]	0[1]	
Total Catch	252	235	269	253	219	150	44	11[1]	1.8[1]	0.3[1]	
TAC	266	256	266	235	199	190	120[4]	[4]	[4]	[4]	[4]

[1] Provisional.
[2] Includes reported landings and Canadian surveillance estimates.
[3] Fishery closed by EU in June 1992.
[4] Moratorium on Canadian fishing became effective in July 1992.

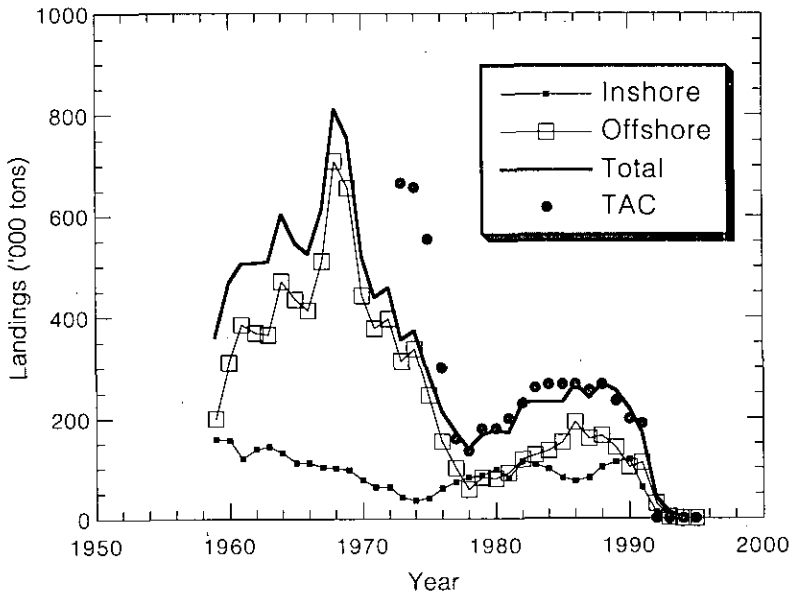


Fig. 1. Cod in Div. 2J+3KL: inshore and offshore landings and TACs.

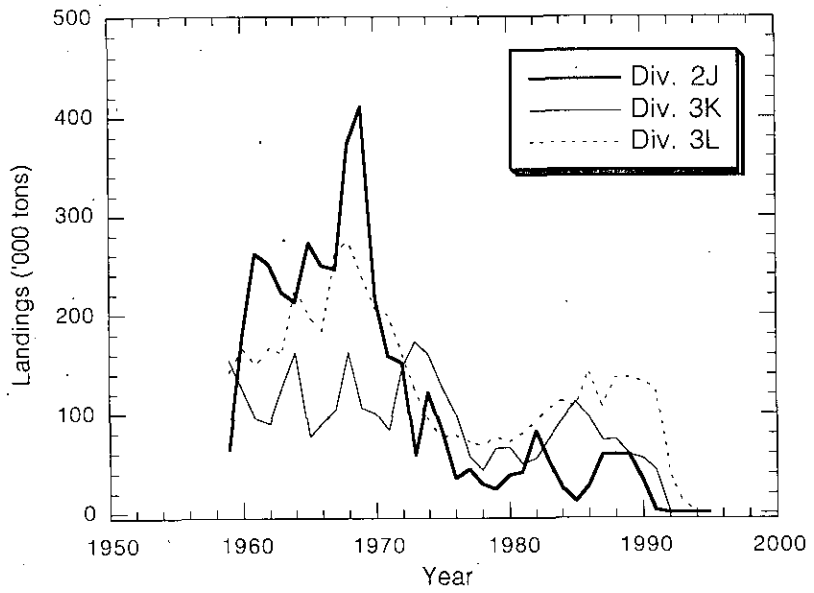


Fig. 2. Cod in Div. 2J+3KL: landings by Division.

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.

In 1995 cold air temperatures and strong NW winds resulted in early ice formation, greater areal extent of ice and a longer presence of ice on the Labrador/Newfoundland shelf. Air temperatures were not as severe, however, as in recent years and appear to be moderating. Ocean temperatures off Newfoundland at Station 27 were below normal during most of 1995 but they have warmed relative to the extreme cold period of the early-1990s. The volume of the CIL water off Newfoundland during summer decreased in 1995 to below the long-term mean to the lowest level since the early-1980s. This was due to a decline in the volume of the CIL off southern Labrador and northern Newfoundland, in contrast to the Grand Bank where the CIL increased slightly relative to 1994.

Ocean conditions in Div. 2J+3KL in 1995 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**

The stock structure of northern cod was studied utilizing polymorphic microsatellite markers. Samples were obtained from cod aggregations at 300-500 m in January-February 1992-93 and combined into a North group (Hamilton Bank to Funk Island Bank) and a South group (northeastern and eastern slopes of Grand Bank). Genetic differences were found, supporting earlier studies which indicated a subdivision between cod on the Northeast Newfoundland Shelf and cod on northern Grand Bank. It is argued that these results are not consistent with the hypothesis that cod shifted southward in the 1990s.

Seasonal migration patterns were discerned from analysis of reported recapture dates and locations from tagging experiments on Hamilton Bank, Belle Isle Bank and the North Cape of Grand Bank. Cod from all three areas tended to move southward and westward in the spring. After arriving inshore, they moved northward along the coast before moving offshore in mid-autumn. The cod tagged on Hamilton Bank can overlap in their winter distribution with cod tagged on Belle Isle Bank, but neither group overlaps with those tagged on the North Cape. This is consistent with genetic studies which indicated that cod sampled from Hamilton Bank and Belle Isle Bank were distinct from cod sampled on the northeastern and eastern slopes of Grand Bank.

Interviews with fishers in the Bonavista Peninsula area described the presence of several groups of cod, based on time of appearance; including "herring fish" which are caught early and mainly toward the inner regions of Bonavista and Trinity Bays, and "capelin fish" which arrive later at the time when capelin arrive in inshore waters to spawn. These two groups of cod correspond well to patterns seen in the landings from cod traps in both Bays.

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

i) **Offshore**

Bottom-trawl surveys in Div. 3L in spring 1995 and in Div. 2J3KL in autumn 1995 located no significant aggregations of cod. The autumn survey cannot be compared directly with estimates from preceding years because of a change in survey gear and vessel. However, the mean catch-per-tow remained low. Cod older than age 7 have been virtually absent in these surveys since 1993.

Acoustic data were collected in June 1995 in two areas. In the southern part of the Northeast Newfoundland Shelf near the Div. 3K/3L boundary, cod were located only at the

outer edge of the shelf at low densities. In the Hawke Channel in Div. 2J, cod were widely distributed at very low densities at depths of 350-450 m over an area spanning 50 naut. miles. These fish were mostly juveniles with a portion of spent adults.

ii) **Inshore**

In April 1995, a dense aggregation of spawning cod was located in Smith Sound, Trinity Bay. Subsequently three fjord-like inlets on the western side of Trinity Bay have been studied frequently. An acoustic study in early May 1995 provided an estimate of about 17 000 tons. Acoustic studies in mid-May and late June revealed that the cod had moved out of Smith Sound. Aggregations of cod mainly aged 3 to 8 were again found in the more northerly two arms in December. An acoustic survey in April 1996 revealed cod in all three arms. The densest aggregation of spawning fish was found in deep water in the outer reaches of Smith Sound. In other areas studied within Trinity Bay cod were mostly mature but not yet ready to spawn.

The presence of cod in the inlets of Trinity Bay and unverified reports of cod in shallow water contrast with the low abundance of cod offshore. The affinity of these fish is uncertain. They may belong to "bay stocks", they may be fish that overwinter inshore but are genetically indistinct from the historically greater body of fish which overwintered offshore, or they may represent some of the fish which formerly migrated inshore- offshore but have remained inshore since the summer-autumn of 1994. The inshore aggregations may be very important for the recovery of the stock.

iii) **Juvenile cod**

Studies conducted by submersible of age 1-4 year juvenile cod have demonstrated age-specific associations with substrate in the inshore. From the patterns of activity of cod in relation to cover, these fish appeared likely to be using specific substrate characteristics for protection from predators. Results suggest that the substrate which is ideal for one age group of cod may be completely inappropriate for another. Acoustic bottom classification was confirmed by the use of a submersible. The information on substrate preferences by juvenile cod might be useful in refining inshore survey design and evaluation.

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

Mean weights-at-age for cod caught in the commercial fishery declined during the 1980s and early-1990s after peaking in the late-1970s and early-1980s. Sampling during autumn research surveys illustrates that the changes varied with Division. Average lengths and weights-at-age declined most strongly in Div. 2J, to a lesser extent in Div. 3K, and least in Div. 3L. In recent years there appears to have been an improvement from the very low values observed in 1991-93, but sample sizes have been very small for some ages.

Annual weight increments were related to water temperature as reflected by the cross-sectional area of the cold intermediate layer (CIL) of the Labrador Current. There was evidence that cod growth in Div. 2J and Div. 3K is limited by food supply more than by temperature, and that growth may be limited by the size attained by age 3.

The somatic condition of cod sampled in Div. 2J and Div. 3K during the autumn research surveys recovered from low levels in 1991-92 to moderate levels in 1993-95. Liver index, which had declined in Div. 2J, remained at a relatively low level. When liver index data were aggregated into groups defined by aggregations of cod rather than by NAFO Divisions, the contrast between patterns in the north and patterns in the south became more apparent. Of considerable interest was an increase in liver index in cod on the plateau of Grand Bank at the time that liver index declined rapidly in Div. 2J. Condition of cod sampled from the Sentinel Survey inshore in 1995 increased considerably over time at one site which was monitored during July-August. Condition at other sites was variable, but generally good. Cod sampled from the inlets in western Trinity Bay in December 1995 and spring 1996 were in good condition. Fisheries inshore in the Sentinel Survey Program also reported cod to be in good condition.

Interannual changes in condition of cod in Div. 2J and Div. 3K was shown to vary with temperature and capelin biomass. However, this relationship makes use of the estimates from Canadian acoustic surveys, and may depend on the coincidence of low biomass values with very low condition in the early-1990s. There was evidence that the surveys greatly underestimated capelin biomass during these years.

Observations from autumn surveys indicated that the proportion of mature female cod-at-age had been increasing in all Divisions, with the increase being greatest since the early-1990s. The estimated age at 50% maturity in the stock as a whole had decreased from over 6 years to a low of 4.86 years in the most recent two years. There was some indication in the maturity data that cod may skip spawning altogether in some years. In autumn 1995, the proportion mature-at-age and at-length did not differ significantly between cod sampled offshore and cod sampled in the fjords of western Trinity Bay.

g) **Fishing Gear Selectivity, Fishing Mortality and Discarding**

Selectivity of the various fishing gears used to catch cod can be estimated from tagging data. The shape of the selectivity curve varies among gears and for some gears has changed significantly over the time period 1954 to 1990. It was suggested that the estimation of selectivity can lead to improvements in stock assessments.

As part of the Sentinel Survey in 1995 the catch from a variety of inshore gear was subject to very intensive length frequency sampling. These length frequencies indicated relative differences in the selectivity among gears in keeping with the results from the tagging studies in that interpretation of both tagging data and Sentinel Survey data were sensitive to assumptions regarding availability, especially at current low stock sizes.

Multiplicative model analysis of the autumn Canadian groundfish survey numbers at age data indicated that total mortality reached a peak value of over 1.5 on the 1987 cohort. Subsequent cohorts have benefitted from the imposition of the moratorium, although estimates for more recent cohorts was confounded by the introduction of the new survey gear in 1995.

In an attempt to account for a greater proportion of the deaths attributable to fishing, discards of cod in the Canadian cod- and shrimp-directed fisheries have been estimated from observer records for the period 1990-94. Observer estimates of discards rose from less than 0.5% of the landings in 1980 to about 6.5% in 1986, and subsequently declined to around 2% in the early-1990s. These estimates did not include discarding by the inshore and non-Canadian offshore vessels. Also prior to 1986 not all Canadian vessels had observers on board. Estimates of the numbers of discarded cod-at-age will be added to the catch-at-age for future assessments of this stock.

h) **Recruitment Trends**

Multiplicative model analyses of the Canadian autumn survey catch-at-age did not indicate even moderately strong year-classes after 1987. The relative strength of the 1986 and 1987 year-classes remained uncertain. Fish from these year-classes initially appeared to be abundant in the surveys but subsequently almost disappeared. The early information on these cohorts came from a period (1989 to 1992) when survey numbers-at-age appeared elevated across several ages relative to earlier and later years.

A variety of indices have been developed to assess the relative abundance of pre-recruit cod (ages 0 to 3). These include pelagic juvenile surveys, coastal bottom seine surveys and demersal juvenile surveys. The 1994 year-class, which appeared strong at age 0 now appears no stronger than the previous three year-classes. The 1993-year class also now appears weaker than previously thought. The ability of these indices to distinguish between strong and weak year-classes has not yet been established.

i) **Biomass Trends**

Autumn research vessel survey estimates of biomass in Div. 2J+3KL had declined significantly in recent years and the 1995 estimate remained extremely low (13 344 tons) (Fig. 3), although this

estimate was not directly comparable with those of previous years because of the change in trawl gear in 1995 compared to the old survey gear. Compared to the old survey gear, the new gear had a higher catchability for small cod and a somewhat lower catchability for large cod. Comparative fishing exercises have been carried out and an attempt will be made to convert the time series to be compatible to the catchability of the new gear. The only significant aggregation of cod that was observed in 1995 occurred inshore of the trawl survey and was estimated to be 17 000 tons. The estimate from the Canadian spring trawl survey in Div. 3L was only 343 tons whereas for the autumn survey it was 5 275 tons.

Sequential population analysis was applied to the catch-at-age and Canadian autumn trawl survey index-at-age data in an attempt to reconstruct the time series of fishing mortalities and numbers-at-age for this stock. However, as in recent years this analysis was rejected because of severe patterning in the residuals between observed and predicted survey estimates over the last decade. This could result from errors in catch, survey or incorrectly assumed natural mortality.

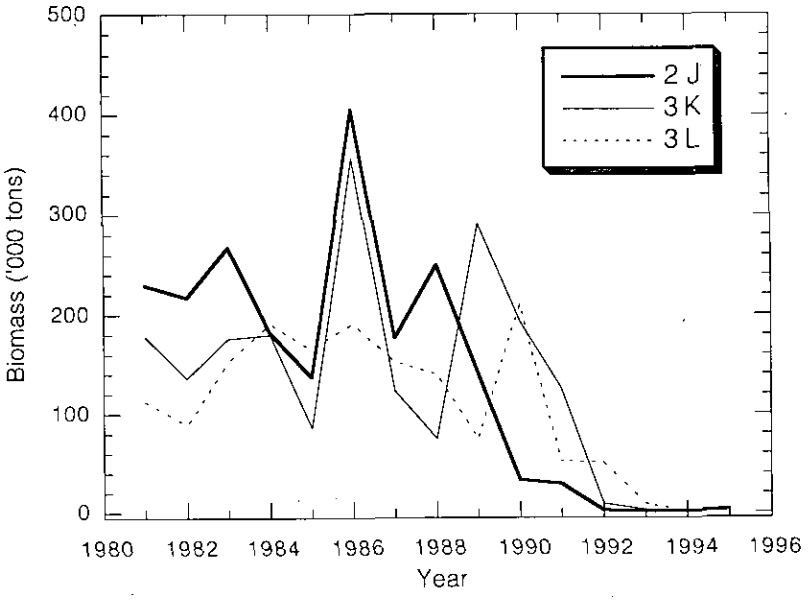


Fig. 3. Cod in Div. 2J+3KL: biomass estimates from surveys.

A Sentinel Survey conducted by fishers at 58 sites in Div. 2J and 3KL in summer-autumn 1995 suggested that catch rates were lower than the last year of the commercial fishery in Div. 2J and northern Div. 3K, had improved in southern Div. 3K and were variable in Div. 3L. Fishers participating in the survey cautioned that high catch rates in some areas may have been a consequence of the lack of competition among gear because of the low levels of effort involved.

j) **Summary**

The Div. 2J and Div. 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 strength of the 1986 and 1987 year-classes at young ages remains uncertain. There is no indication in survey data of any strong year-classes after 1987. Analyses of cod population growth rates across several stocks indicate that the annual growth rate of the Div. 2J and Div. 3KL cod population at low abundance should average 18%. However, absence of any strong year-classes precludes recovery in the near future.

The reasons for the drastic decline in this stock remain unresolved. Hypotheses suggest a variety of potential causes, such as, adverse environmental conditions, high fishing mortality, and increased predation. Although water temperatures were anomalously low during the early-1990s, there were indications of a return to more normal conditions in 1995 with a concomitant slight improvement in weights-at-age and fish condition.

2. **Cod in Division 3M** (SCR Doc. 96/7, 30, 32, 54, 64, 81; SCS Doc. 96/12)

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 is also taken as by-catch in the directed redfish fishery by Portuguese trawlers. Small amounts of cod were taken as by-catch in the shrimp fishery by Canada and Norway, based on observer data from these fleets in 1993-95, and in the past the by-catch of cod in the Russian pelagic fishery for redfish was also low. The fleet currently operating in Div. 3M includes vessels from non-Contracting Parties, most of them stern-trawlers.

ii) **Nominal catches**

From 1963 to 1979, the mean reported catch was 32 000 tons, with high variations between years. Reported catches declined after 1980, when a TAC of 13 000 tons was established, but Scientific Council regularly expressed its concern about the reliability of some catches in the period since 1963, particularly those since 1980. New estimates of the annual total catch since 1988 were made available in 1995 (Fig. 4), including non-reported catches and catches from non-Contracting Parties.

Most of the catch in 1995 was taken by trawlers from EU-Portugal and non-Contracting Parties.

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	13	13	0	0	0	13	13	13	11	11	11
Catch	15	11	29[1]	48[1]	41[1]	16[1]	25[1]	16[1,2]	30[1,2]	10[1,2]	

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

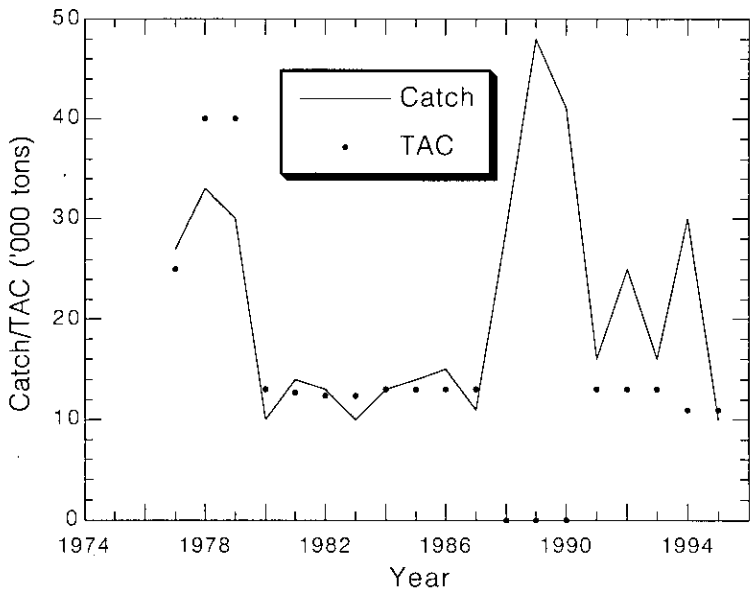


Fig. 4. Cod in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Length and age composition for 1995 catches were available for Portuguese trawlers and gillnetters.

ii) **Catch rates**

Portuguese trawl CPUE, derived from catch and effort data from a sample of the fleet, increased since 1990 to a peak in 1994, then declined in 1995.

iii) **Research survey data**

Biomass and abundance estimates were available from research vessel bottom trawl surveys conducted by USSR/Russia from 1977 to 1995, with the exception of 1994 (Fig. 5), with a concurrent acoustic survey from 1985 to 1993. The estimates of bottom trawlable biomass in most recent period showed a maximum level of 37 000 tons in 1989, a minimum of 2 400 tons in 1992, and a value of 8 000 tons in 1995, among the lowest observed in this survey series.

Stratified-random bottom trawl surveys were conducted by the EU from 1988 to 1995. These 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 to 9 000 tons in 1995 (Fig. 5).

The maximum stock biomass in 1989 indicated by both surveys was produced by the relatively abundant 1985 and 1986 year-classes when aged 4 and 3 years, respectively. The increase of biomass from 1992 to 1993 was attributed to the contribution of the also abundant 1990 and 1991 year-classes.

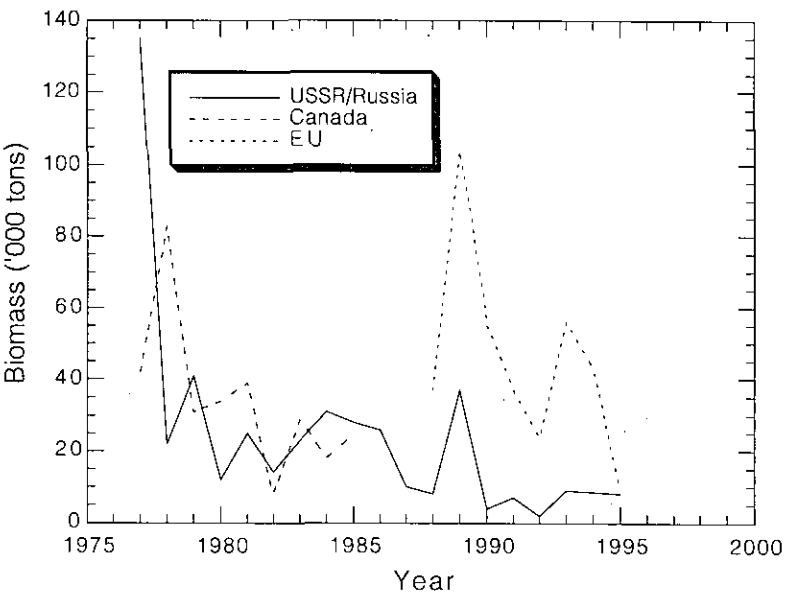


Fig. 5. Cod in Div. 3M: total biomass estimates from surveys.

c) **Estimation of Parameters**

A sequential population analysis (XSA) was carried out for ages 1 to 8+ and years 1988 to 1995.

Catch-in-number data corresponded to the estimates of total annual catch revised in 1995. Natural mortality was set at 0.2. The analysis was tuned with the results of the EU survey from 1988 to 1995.

d) **Assessment Results**

The apparent contradiction between the increase of CPUE from 1990 to 1994 and the decreasing trend of stock size, either from the assessment and the EU survey results, was related with the concentration of the majority of the population in dense shoals. This was observed in the analysis of cod catch distribution in the EU surveys. This observation could induce an increase in catchability, and therefore the stock was able to support a fishery with high yield level at the expense of high fishing mortality.

STACFIS stressed that because of uncertainties associated with the fit of the XSA 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 throughout the age range of the exploited population in 1992 and 1993. From 1994 onwards, the exploited population has been mainly restricted to the survivors of the 1991 and 1990 cohorts, but fishing mortalities of these cohorts remained at a relatively high level in 1994 and 1995 (Fig. 6).

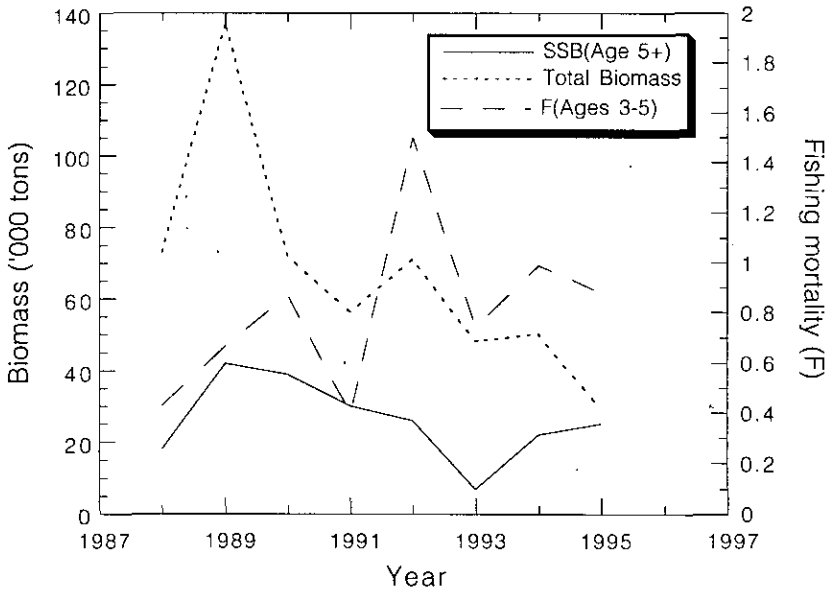


Fig. 6. Cod in Div. 3M: results from Sequential Population Analysis, believed by STACFIS only to reflect trends. SSB is ages 5+ from 1988-93, and ages 4+ from 1994-95.

Total biomass decreased along the period from a peak value in 1989 and reached a minimum in 1995 in accordance with EU survey results. The XSA also confirms the relative abundance of the 1985 and 1990 to 1991 year-classes and the weakness of the 1992 to 1994 year-classes.

Limited data from the shrimp fisheries in Division 3M indicate only low by-catch of cod. The low levels estimated from the observed fishery may be due, at least in part, to the low stock size. Furthermore, by-catch data from several fleets fishing shrimp are unavailable.

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 record peak in 1990. New studies on cod maturation

indicated that cod age 4 were mature in 1994 and 1995. The decrease in the age at maturity of the stock is interpreted as a reaction of the population to the decline of the stock.

3. Cod in Divisions 3N and 3O (SCR Doc. 96/49, 80; SCS Doc. 96/12)

a) Introduction

Nominal catches increased during the late-1950s and early-1960s, reaching a peak of about 227 000 tons in 1967. During the period from 1979 to 1991, catches ranged from 20 000 to 50 000 tons. The continued reduction in recommended TAC levels contributed to reduced catches in recent years to a level of about 10 000 tons in 1993 (Fig. 7). Directed fisheries on this stock ceased about mid-year in 1994. This suspension continued through 1996.

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Recommended TAC					Same as agreed						
Agreed TAC	33	33	40	25	18.6	13.6	13.6	10.2	6	0	0
Reported Catches	51	42	43	33	18	17	10.1	9[1]	1.9[1]	0.17	
Non-reported Catches	-	-	-	-	11	12	2.5	0.7	0.8	0	
Total Landings	51	42	43	33	29	29	12.6	9.7[1]	2.7[1]	0.17	

[1] Provisional.

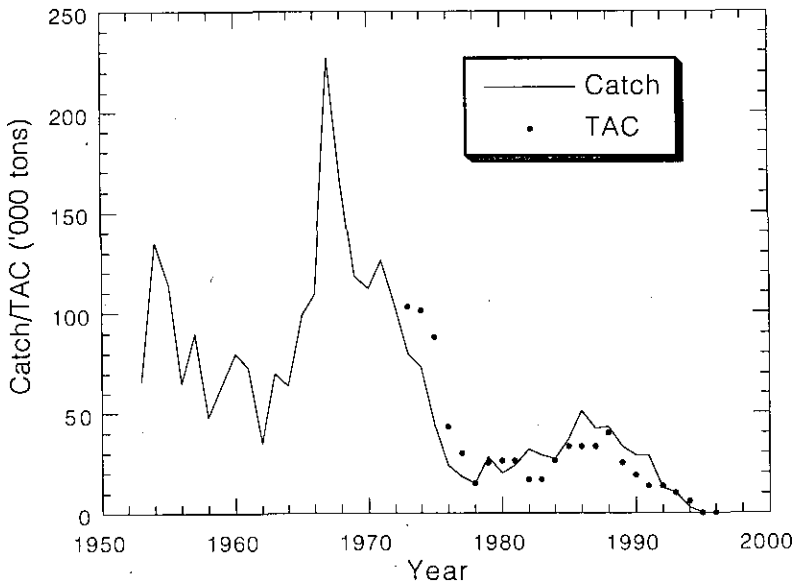


Fig. 7. Cod in Div. 3NO: catches and TACs.

Catches during 1995 totalled approximately 172 tons, mainly from the Regulatory Area by the EU and non-Contracting Parties (108 tons) while Canada reported approximately 64 tons.

b) Input Data

i) Commercial fishery data

Catch rates. There was no 1995 catch rate information since there were no directed fisheries for cod.

Catch-at-age. Biological sampling data were available as gillnet and otter trawl by-catch. An estimate of the total removals-at-age were derived from this information. The estimates should be treated with some caution since the 1995 sample numbers were very low. The 1989-91 year-classes (ages 4-6) were the most numerous in the catch in 1995. The 1989 and 1990 year-classes dominated the catches from 1991 to 1994.

Mean weights-at-age in the commercial catch for most ages declined between 1993 and 1994 but increased somewhat in 1995. These changes may have been an artifact from the data being available from a small area (only from the Regulatory Area) and the small sample size in recent years. STACFIS **recommended** that *data for by-catch of cod in the Canadian longline fishery in Div. 3NO be presented to the Scientific Council Meeting in June 1997.*

ii) **Research survey data**

Stratified-random research vessel surveys have been conducted in spring by Canada in Div. 3N for the 1971-96 period, with the exception of 1983, and in Div. 3O for the years 1973-96 with the exception of 1974 and 1983.

A new survey trawl (Campelen 1800) was introduced to the Canadian survey starting with the autumn 1995 survey. Extensive comparative fishing with the old survey trawl (Engel 145) and Campelen trawl had recently been completed but the data were not fully analyzed. Therefore it was not yet possible to make comparisons of surveys using the two different trawls.

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 increased in 1993. However, the 1994 and 1995 estimates declined to the lowest values in the time series. Abundance estimates for Div. 3NO suggested similar trends to those observed for biomass (Fig. 8).

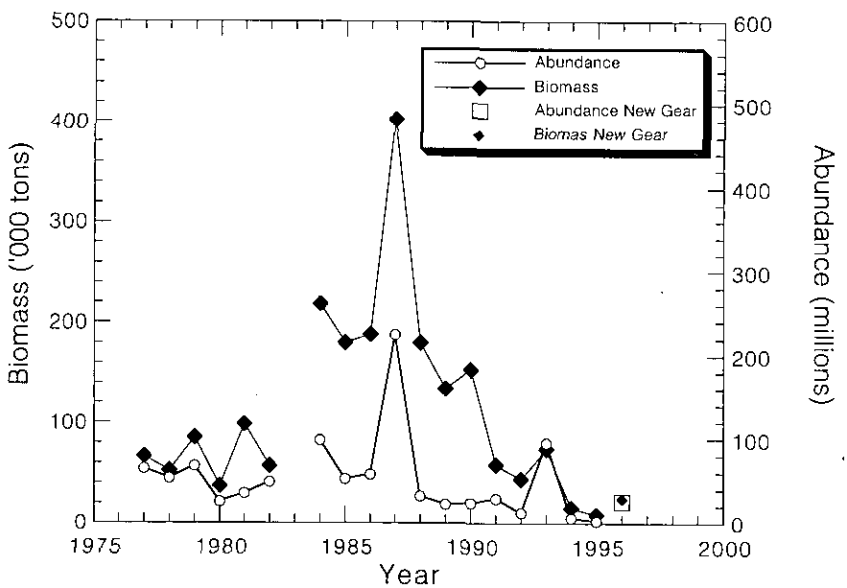


Fig. 8. Cod in Div. 3NO: abundance and biomass estimates from Canadian spring surveys.

Estimates-at-age indicated that the year-classes after 1983 have all been low relative to the year-classes that supported the fishery in the early-1980s. The dominant ages in the 1995

survey were age 5 and 6 (the 1990 and 1989 year-classes).

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

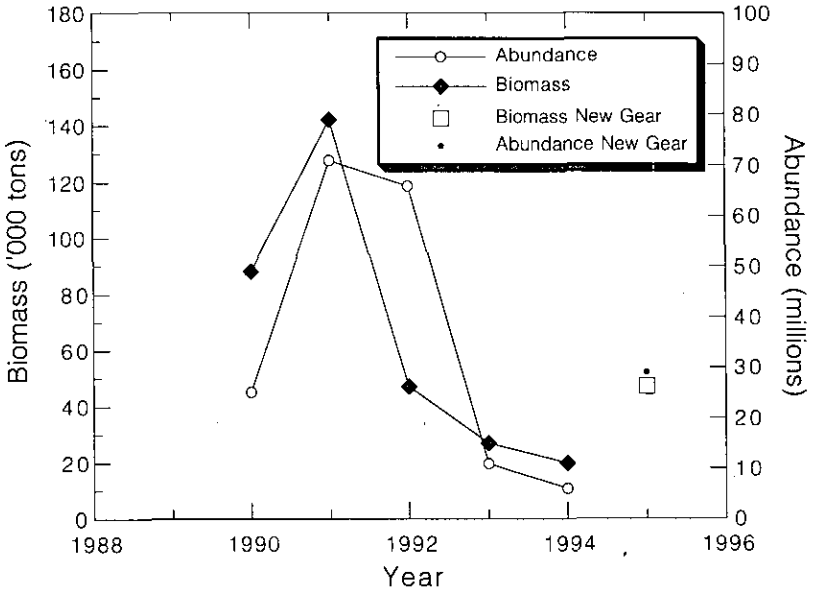


Fig. 9. Cod in Div. 3NO: abundance and biomass estimates from Canadian autumn surveys

Stratified random surveys by EU-Spain were conducted in May 1995 and 1996 in the Regulatory Area of Div. 3NO. Cod biomass estimates for comparable strata were approximately 7 200 tons in 1995 and 5 700 tons in 1996. An increase in abundance at younger ages was observed in the survey in 1996. Fish appeared more widely distributed in comparable strata between the two surveys and a number of additional strata were surveyed in 1996. The length composition for cod in the 1996 Spanish and Canadian spring surveys were similar.

Canadian autumn juvenile survey data were available for the period 1989-94 (Fig. 10). Russian survey data were available for the period 1977 to 1993 but no new data have been available since that time.

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 1995. Since the Canadian survey trawl was changed in 1995, the autumn 1995 and spring 1996 survey data were excluded. As in 1995, the 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 are considered to be outliers in their respective time series as both estimates were very high relative to previous and more recent surveys and had large variances associated with their estimates. Consequently, an ADAPT analysis was conducted using survey data with the 1993 data omitted.

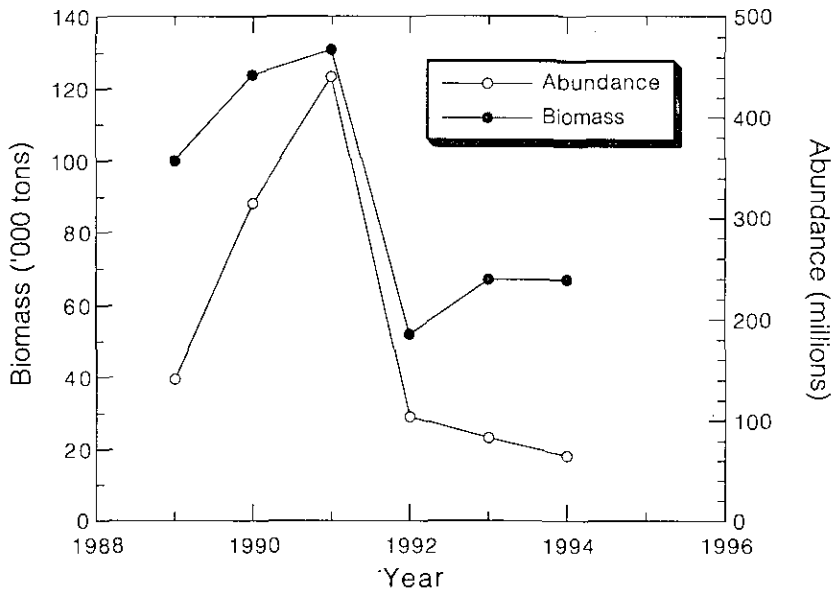


Fig. 10. Cod in Div. 3NO: abundance and biomass estimates from Canadian autumn juvenile surveys.

Regardless of the ADAPT analysis considered, CVs were high on most abundance estimates and the patterns observed in the residuals suggested some uncertainty with the results of the analysis.

d) **Assessment Results**

Because of the uncertainty with the SPA, the results were not considered useful for catch projections. However, they do give an indication of historical trends in the size of the stock. Population numbers (age 3+) have been declining for most years since the mid-1980s. The spawning stock biomass has also declined substantially since the relatively high levels in the mid-1980s and remains low (Fig. 11).

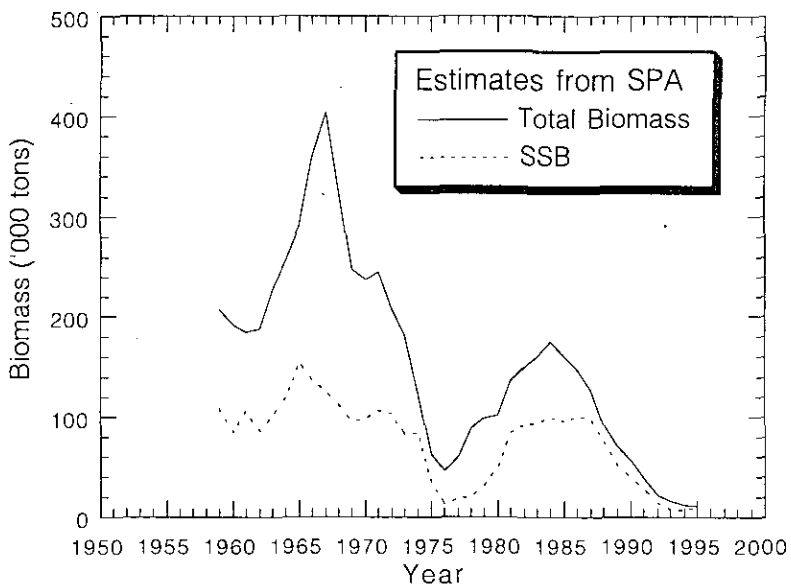


Fig. 11. Cod in Div 3NO: biomass estimates from ADAPT.

All available data indicate that the present stock for ages 3+ is made up primarily of the 1989 and 1990 year-classes. These year-classes have been in commercial catches since age 2 years and have dominated the catch numbers-at-age since 1991. Survey data suggest that there have been no strong year-classes since 1982.

4. Redfish in Subarea 1 (SCR Doc. 96/4, 6, 29, 36; SCS Doc. 96/ 4, 9, 13)

a) Introduction

Historically, redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. Landings were composed almost exclusively of golden redfish (*Sebastes marinus* L.) until 1986. Subsequently, the proportion of beaked redfish (*Sebastes mentella* Travin) represented in the catches increased, and since 1991, the majority of redfish catches were beaked redfish. In 1977, total reported catches peaked at 31 000 tons (Fig. 12). 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 during this period, a directed fishery on redfish was observed for this fleet. At 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 has been directed to shrimp or Greenland halibut only.

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

Recent catches ('000 tons) are as follows:

	1986	1987	19881	989	1990	1991	1992	1993	1994	1995
Catch	5	1	1	1	0.4	0.3	0.3	0.8[1]	1[1]	1[1]

[1] Provisional.

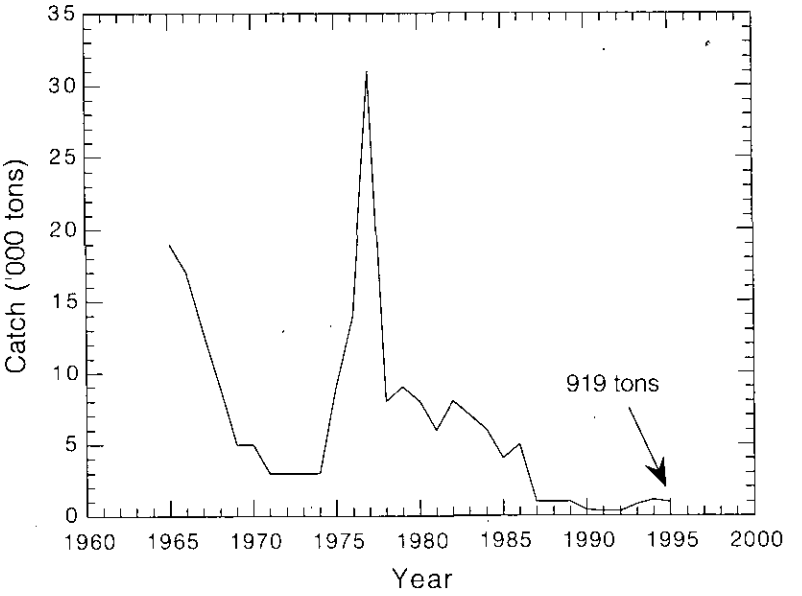


Fig. 12. Redfish in Subarea 1: catches.

b) **Input Data**

i) **Commercial fishery data**

Length measurements of commercial catches of golden redfish taken off West Greenland and landed at Cuxhaven or Bremerhaven, together with measurements obtained directly on board commercial or research vessels fishing on aggregations, were presented for the period 1962-90. These data revealed significant reductions in mean size of fish caught by about 10 cm, with the biggest reductions occurring in the late-1980s, when mean fish length remained under 35 cm.

By-catch information of the shrimp fishery was presented based on two sources; the Greenland shrimp survey catches taken within the areas of commercial fishery activities and 20 trawl hauls taken by a commercial trawler in 1996. The research vessel was found to catch redfish at similar rates as the commercial vessel but caught shrimp less effectively. Length frequencies derived from commercial catches revealed that the shrimp trawl selected all fish sizes <20 cm reflecting the present size composition of the stocks. However, the 1994 by-catch in Subarea 1 was estimated to be 4 234 tons representing about 180 million redfish. Given the likely spacial and seasonal patterns, the reliability of the by-catch estimate was difficult to assess. Lacking further information on age composition and natural mortality of the pre-recruiting redfish, no proper method to assess the impact of the by-catches on survival rates was available.

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 boundary 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 the pelagic occurrence of redfish. The survey results indicated that both abundance and biomass estimates of golden redfish (≥17 cm) decreased by 99% over the period of the survey (Fig. 13).

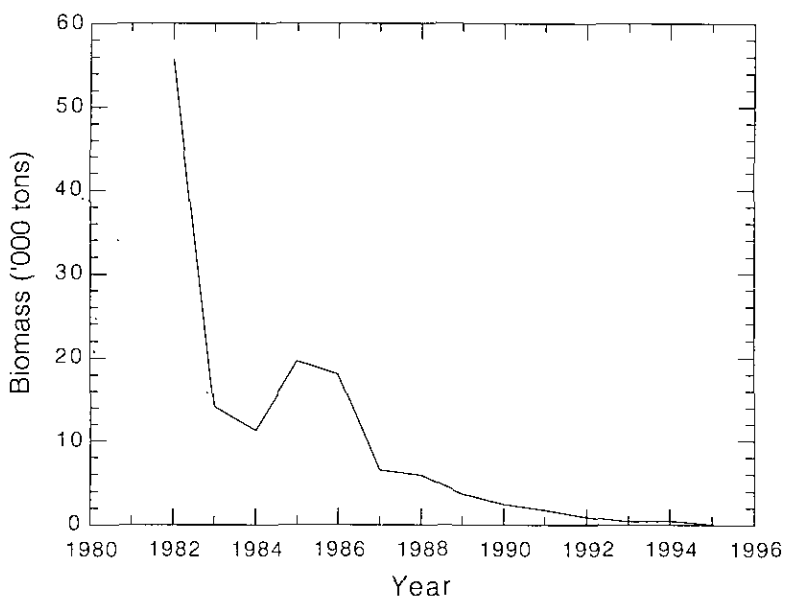


Fig. 13. Redfish in Subarea 1: golden redfish survey biomass index, EU-Germany.

Estimates for beaked redfish (≥17 cm) varied without a clear trend but have been extremely low since 1989 (Fig. 14). Despite of the incomplete survey coverage (50%), the estimates for 1995 did not indicated significant changes from this assessment. Golden and beaked redfish showed abrupt changes in their size structure from a regular modal length at 30 cm

to significantly smaller individuals in 1992 and 1995, respectively. Juvenile redfish (<17 cm) were found to be very abundant, especially in 1986 and 1991. Species and stock identification of these juvenile redfish remained unclear, but the reappearing peaks at 6, 10-12 and 15-16 cm might indicated annual growth increments and represented the age groups 0, 1 and 2 years.

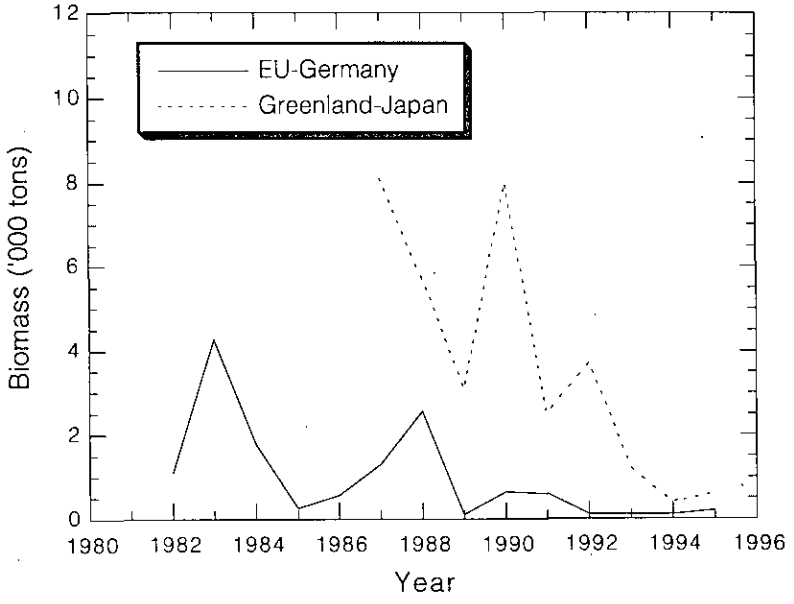


Fig. 14. Redfish in Subarea 1: beaked redfish survey biomass indices.

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 1995, one stratified random bottom trawl survey was carried out. As usual, beaked redfish were caught mainly at depths less than 600 m. During 1994-95, an increase of the biomass index from 400 to 600 tons was observed. However, both estimates represent record low values for the time series and a reduction by more than 90% compared to the maximum of 8 100 tons observed in 1987 (Fig. 14). Length measurements revealed that the size structure of the stock was presently dominated by individuals <20 cm.

Greenland shrimp survey. Abundance indices of redfish were derived from stratified random shrimp surveys covering the offshore areas in Div. 1A to 1F between 59°N and 72°30'N from the 3-mile boundary to the 600 m depth contour line. In this area redfish less than 20 cm predominated. The surveys commenced in 1988 and were carried out during summer time (July-September). Extensions of the area surveyed were not taken into account due to the low abundance of redfish observed in strata added subsequently. During 1988-92, the mesh size of the cod end was 40 mm. In 1993, a mesh size of 20 mm was introduced. Estimates for 1988-92 were therefore converted to take into account this change in cod end mesh size. Abundance estimates vary enormously but peaked in 1991 indicating that juveniles were very abundant (Fig. 15).

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 the stocks of golden and beaked redfish in Subarea 1 remain severely depleted.

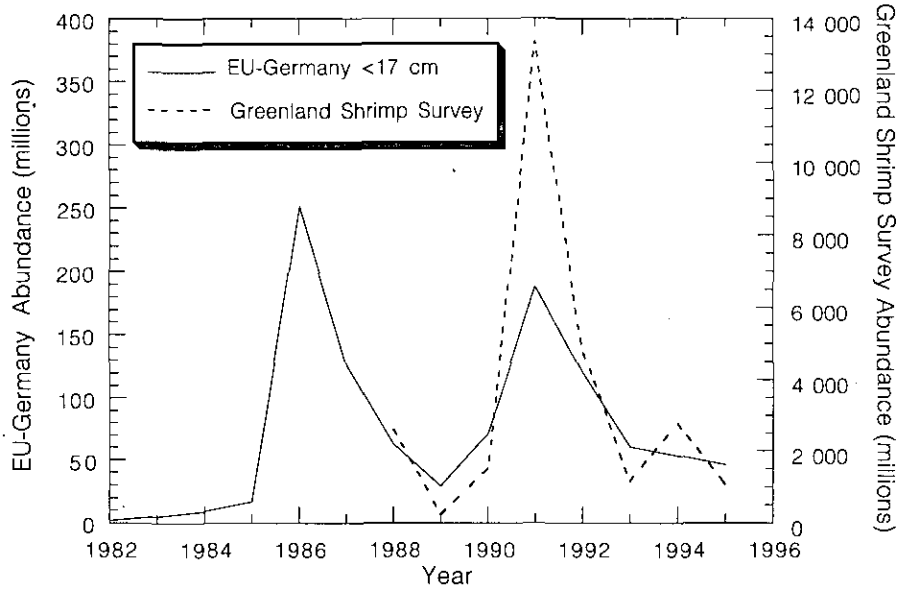


Fig. 15. Redfish in Subarea 1: juvenile redfish survey abundance indices.

Pre-recruits (<17 cm) were found to be very abundant, especially in 1986 and 1991 as indicated by the surveys. Their origin and recruitment potential to the stocks under consideration is unclear. Considering the unknown impact of the catches taken by the shrimp fishery, concern must be expressed about the continuous recruitment failure.

5. Redfish Division 3M (SCR Doc. 96/9, 12, 54, 64, 82; SCS Doc. 95/3, 12, 13, 14)

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 on Div. 3M in 1994 was mainly conducted by non-Contracting Parties, Russia and EU-Portugal. Redfish by-catches by South Korea as well as the Baltic States Latvia, Lithuania and Estonia were greatly reduced in 1994. This was a change in comparison to 1993 and is reflected in the amount of the total estimated catch of about 11 000 tons in 1994 in comparison to 29 000 tons in 1993. The reduction was also caused by the re-direction of effort from redfish to cod by the remaining fleets. The situation was the same in the fishery in 1995 with similar levels of effort as in 1994.

The Russian redfish fishery with pelagic trawl started in March on the southern slopes. The fishing activity was reduced in May because of low catch rates. The fishery recovered during July and August again on the southern parts of the bank and produced the best catch rates of 1995. The fishery ceased in late September.

The Portuguese redfish fishery on Flemish Cap started in March and ceased in December. It was conducted with bottom trawls and gillnets and 30% of the catches were taken by the gillnetters. The trawlers operated from March to December in the depth range from 140 to 1 000 m. During March and April the trawl fishery was more an opportunistic fishery on cod or redfish. The gillnetters were active from April to October/November in the depth range from 260 to 1 100 m. The main by-catch in this component of the fishery was Greenland halibut. The gillnetters partly directed fishing on Greenland halibut.

The Japanese redfish directed fishery was conducted during February to April and October/November with bottom trawls.

There was no directed Spanish redfish fishery on Flemish Cap and catches of redfish were exclusively by-catch.

ii) **Catches**

From 1987 to 1992 (excluding 1988) annual catches were greater than 40 000 tons. Catches have since declined to 11 000 tons in 1994 and 13 500 tons in 1995.

Recent catches ('000 tons) and TACs are as follows (Fig. 16):

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	20	20	20	20	50	50	43	30	26	26	26
Catch	29	44	23	58[1]	81[1]	48[1]	43[1]	29[1,2]	11[1,2]	13[1,2]	

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

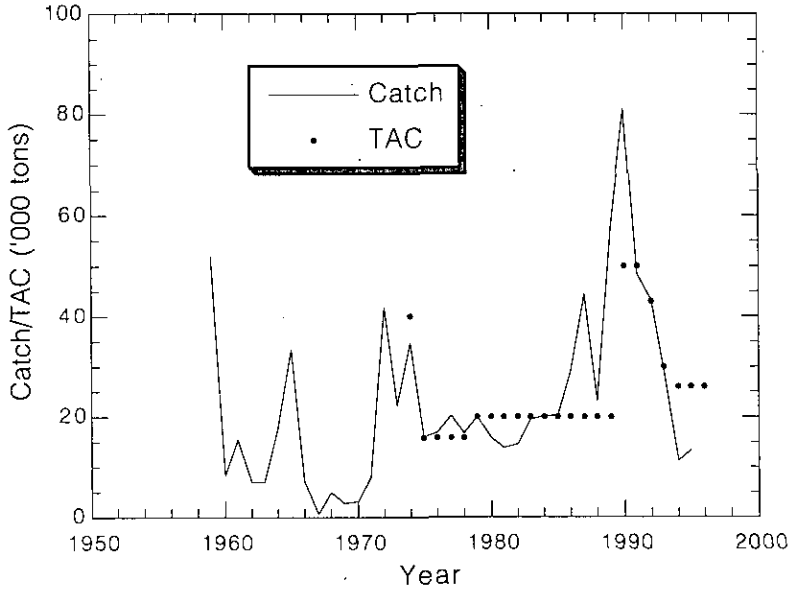


Fig. 16. Redfish in Division 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Sampling data. The available length distribution of Russian catches showed a peak at 20 to 21 cm in total, as well as for males and females.

The Portuguese sampling data on *S. mentella* from trawl catches were dominated by the length-classes 25 to 41 cm with two modes at about 29 and 36 cm for males and 30 and 37 cm for females.

Gillnet catches of *S. mentella* were dominated by lengths between 28 and 43 cm for males and 30 to 44 cm for females. For both males and females there was a peak at 37 cm.

The mean lengths from the 1995 Portuguese commercial samples indicated that fish were about 5 cm longer in 1995 than 1994. The reasons for this are unknown.

Redfish by-catch in the shrimp fishery. Sampling data of by-catches in the shrimp fishery of Canada and Norway were available. Redfish (*Sebastes* spp.) was the largest component in the by-catch in terms of weight for the period 1993 to 1995. The percentage of total redfish by-catch declined from 28.4% in 1993 to 1.1% in 1995. In terms of numbers the estimates were 89 million fish (all between 12 and 22 cm) in 1994 and 4.8 million fish (more than 95% of lengths less than or equal to 22 cm) in 1995. There was no sampling in 1993 but extrapolation based on 1994 sampling resulted in an estimated 138 million redfish caught as by-catch in the shrimp fishery. The available data suggested that the introduction of the Nordmore grate in 1994 and a subsequent reduction in the bar spacing of the grate in 1995 was effective in reducing the amount of redfish by-catch in the shrimp fishery. However, the impact of changes in redfish abundance cannot be determined. It was also noted that the sampling intensity was low and only a small portion of the fleets fishing for shrimp was covered. Preliminary data from the Icelandic shrimp fishery during the first half of 1996 indicated length groups 7 to 20 cm comprised the redfish by-catch.

CPUE data. Standardized CPUE series of the Portuguese trawler fleet from 1988 onwards was available for consideration. This fishery is well known and sampled (3 of 12 trawlers). This fleet started fishing for cod and occasionally for redfish until April. Thereafter cod catches became poor and the fleet concentrated on redfish and Greenland halibut. CPUE data were taken only from sampled vessels and only from hauls directed on redfish. In contrast to the combined STATLANT 21B based CPUE data the direct observed data are considered as more appropriate as an indicator of trends in the stock. As the gillnet fleet targeted on cod and later on Greenland halibut, the data of this fishery were not used.

The 1995 CPUE declined from the high value in 1994 to a level even below that of 1993. This can be explained by a fishery of more opportunistic type in 1995. Therefore CPUE data from the 1995 Portuguese trawl fishery may not be considered as stock indicator, proving the concern that CPUE data are not appropriate as an indicator of the state of redfish stocks on Flemish Cap on a year to year basis *(NAFO Sci. Coun. Rep.*, 1995, page 75). However, the trends in the time series of the Portuguese CPUE and the EU bottom trawl survey generally agree.

ii) **Research survey data**

There are two survey series which give information on the state of the redfish stocks on Flemish Cap. Russian bottom trawl surveys were conducted annually in the period 1983 to 1993 and in 1995. Unfortunately this survey was interrupted in 1994. Acoustic estimates were available from 1988 to 1993. Since 1988 the EU conducted annual bottom trawl surveys providing estimates of all three redfish species which were combined in the following table:

	Biomass in tons			
Year	EU	Russia (bottom)	Russia (acoustic)	Russia (bottom + pelagic)
1983		154 900		
1984		132 300		
1985		51 900		
1986		309 500		
1987		106 400		
1988	158 222	47 000	332 000	379000
1989	136 633	83 300	282 600	365900
1990	104 193	17 700	228 700	246400
1991	63 846	45 400	62 300	107700
1992	104 477	18 200	81 300	99500
1993	62 589	69 800	77 300	147100
1994	126 011			
1995	73 641	20 702		

EU survey. The increase in total biomass from 1993 to 1994 was mainly due to a drastic increase of *S. marinus* biomass and juvenile redfish biomass. In comparison to 1993, in 1994 *S. marinus* biomass was at the same level as *S. mentella* biomass. Fish of lengths from 30 to 45 cm dominated the survey catches of golden redfish, and length groups 18 to 20 cm the catches of beaked redfish. In 1995 fish of length groups 19 to 23 cm were dominant in all three species. The biomass of *S. marinus* declined again to a slightly higher level than in the period from 1991 to 1993. The biomass of *S. mentella*, however, increased further in 1995 due to growth of unspecified juveniles in 1994 to fish identifiable as *S. mentella* in 1995, whereas that of *S. fasciatus* remained constant at a level seen from 1991 to 1994. In total the biomass decreased to the level of 1993 (Fig. 17). The high value of golden redfish biomass in 1994 was due to concentration of older fish in strata 6 and 7. These concentrations were not found before 1994 and also not in 1995.

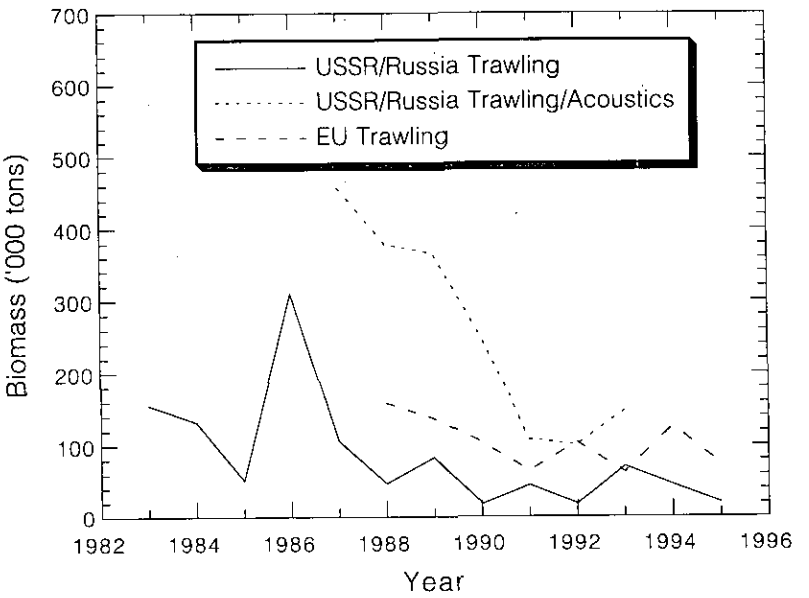


Fig. 17. Redfish in Div. 3M: biomass.

Russian survey. The Russian trawl survey series fortunately was continued in 1995 after a break in 1994. From 1988 to 1994, the total redfish biomass (trawl and acoustic) declined from about 370 000 to 100 000 tons. During the same period, the trawlable biomass varied between about 18 000-70 000 tons. The 1995 trawlable estimate was about 20 000 tons. Length groups 19 to 21 cm were dominant. The 1995 estimate was for beaked redfish only whereas the earlier estimates were for all 3 species combined.

In both surveys (EU and Russia) similar length frequencies with a peak at lengths 19 to 21 cm could be observed.

iii) **Age determinations**

Age determinations were available from the Russian research survey (scales), EU research survey (otoliths), EU-Spain/EU-Portugal commercial catches (otoliths) and shrimp by-catches (otoliths). Because of differences in age interpretations of data from the different sources, age-length information was not used to describe the fishery or the resource.

c) **State of the Stock**

The EU survey estimated the trawlable biomass of the redfish stocks on Flemish Cap at about 126 000 tons in 1994. The biomass estimated for 1995 at 74 000 tons is back at a level slightly higher than 1993 (63 000 tons). The increase in biomass in 1994 can be explained by a concentration of older golden redfish which was not seen again during the 1995 survey and an increase in *S. mentella* biomass probably due to growth.

The Russian trawl survey based on the same stratification as the EU-survey resulted in a trawlable redfish biomass of about 20 000 tons, a level also seen in the years 1990 and 1992.

In both surveys fish of length groups 19 to 21 cm were dominant, and these are already recruiting to the fishery.

Although there was no information on the absolute biomass of the redfish stocks, estimates of the two survey series indicated stabilisation of the trawlable parts of the redfish stocks since 1991. It was noted that some commercial catches of redfish came from areas outside the survey area. There was expectation of good recruitment indicated by the 1992-94 surveys. These fish will not mature for another few years. There are no indications of any subsequent strong recruitment. It was not clear if this was an effect of by-catch of juvenile redfish in the shrimp fishery on Flemish Cap which started in 1993 or the end of a pulse of good recruitment.

Fishing mortality was expected to have been reduced due to the reduction of effort from 1993 to 1994 and 1995. If present reduced levels of effort are maintained and by-catch in the shrimp fishery is kept low in future years, the probability of recovery of the redfish stocks on Flemish Cap will increase.

Based on calculations which indicate a yield of 0.110 kg per recruit at $F_{0.1}$, it is estimated that the loss of commercial yield of redfish due to the 1993-95 by-catches in the shrimp fishery would be about 25 000 tons.

6. **Redfish in Divisions 3L and 3N** (SCR Doc. 95/76; SCS Doc. 96/12)

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. 18). Catches increased rapidly from about 21 000 tons in 1985, peaked at a historical high of 79 000 tons in 1987 and declined to about 27 000 tons in 1992. Catches in 1993 and 1994 at about 23 000 tons and 6 000 tons respectively could not be estimated precisely because of discrepancies in the available sources of information, however, the likely amount is between 20 000 tons and 26 000 tons for 1993 and 3 800 tons to 7 600 tons for 1994. The 1995 catch, estimated at 2 000 tons, is the lowest historically for this fishery.

In the early-1980s the former USSR, Cuba and Canada were the primary fleets directing for redfish. The rapid expansion of the fishery in 1986 was due primarily to the entry of EU-Portugal, taking about 21 000 tons. In 1987 various non-Contracting Parties, most notably South Korea, Panama and Caymen Islands began to fish in the Regulatory Area accounting for a catch of about 24 000 tons. From 1987 to 1994 non-Contracting Parties had taken between 1 000 tons and 10 000 tons annually, however, in 1995 they did not fish in Div. 3LN.

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, primarily by fleets from the Baltic countries, has occurred in the 'Beothuk Knoll' area which is located southwest of the Flemish Cap at the Div. 3M, Div. 3L and Div. 3N border. In 1994 fleets from the Baltic countries returned home early in the year because of a relatively poor fishery on the Beothuk Knoll. These countries did not direct for redfish in 1995. In addition, Cuba has not fished since 1993 and EU-Portugal has directed to other species or fisheries in the NAFO Regulatory Area. The fishery from 1994 to 1995 was concentrated in Div. 3N.

From 1980 to 1990 the TAC each year for this stock has been 25 000 tons. The TAC was reduced to 14 000 tons for 1991, maintained at that level to 1995. The agreed TAC for 1996 is 11 000 tons. TACs were exceeded each year from 1986 to 1993. In some years 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:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	25	25	25	25	25	14	14	14	14	14	11
Catch	43	79[1]	53[1]	34[1]	29[1]	26[1]	27[1]	23[1,2,3]	6[1,2,3]	2[1,2]	

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

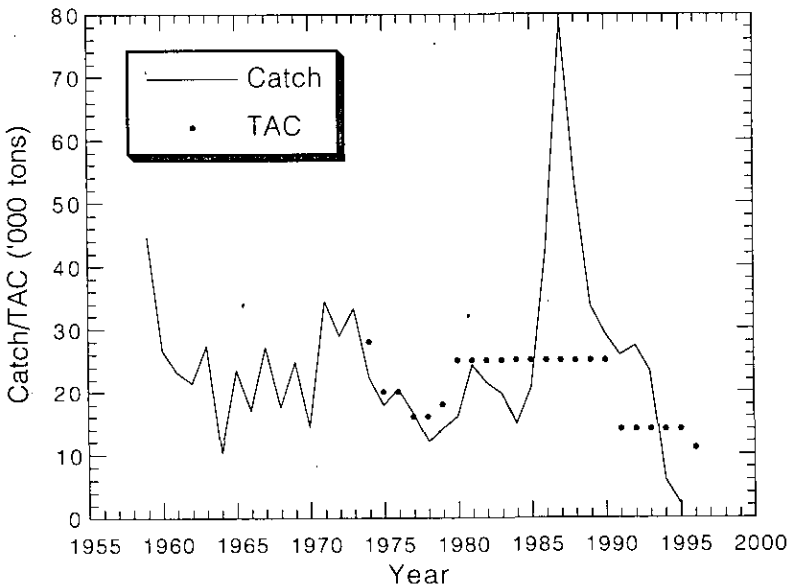


Fig. 18. Redfish in Div. 3LN: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

An updated 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.

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.

A standardized CPUE series based on Portuguese observed data (SCS Doc. 96/12) 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 or 1995. An analysis of Portuguese CPUE observed data for Div. 3NO combined indicated an increasing trend from 1991 to 1994 and stability in the rate between 1994 and 1995. STACFIS was uncertain whether these indices were reflective of the trends in the population or simply reflect the experience of the Portuguese fleet. The Committee noted that the CPUE data were not presented separately for Div. 3N and Div. 3O as recommended in June 1995. The possibility of a relationship between redfish in Div. 3O and Div. 3LN was revisited. It was noted that the Portuguese fleet conducts a fishery in the area of the border of Div. 3N and Div. 3O suggesting they are related. The Committee considered that it would be very useful

to provide information relative to the distribution of the Portuguese fleet in the area, and therefore, STACFIS **recommended** that *the Portuguese observed data be analyzed and distribution maps provided relative to effort directed towards redfish in Div. 3LN.*

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.*

Redfish sampling for 1995 available as by-catch from a Portuguese trawl fishery in Div. 3L (SCS Doc. 96/12) suggested males 22-30 cm and females 23-30 cm dominated the catch based on a sample obtained in February. The mean lengths of the samples were 27.5 cm for males and 28.8 cm for females. Sampling of the 1995 Div. 3N Portuguese trawl fishery from February to August suggested males 26-32 cm and females 26-35 cm dominated the catch. The mean lengths of these samples were 32.1 cm for males and 32.7 cm for females. It was noted that the mean length and mean weight in the catch increased by 4-5 cm and 150 grams respectively, compared to 1994. Given the relatively slow growth rate of redfish it is possible that the fishery was conducted on a different body of fish than in 1994.

ii) **Research survey data**

Stratified-random surveys have been conducted by Canada in Div. 3L in various years and seasons from 1978 to 1995 in which strata up to a maximum of 732 m were sampled. Up until the autumn of 1995 these surveys were conducted with an Engels 145 high lift otter trawl utilizing a small mesh codend liner (29 mm) and tows conducted for 30 minute duration. Beginning in autumn 1995, the survey was conducted with a Campelen 1800 survey gear with a 12 mm codend liner and 15 minute tows. Data from comparative fishing trials between the Engels trawl and protocol, and, the Campelen trawl and protocol were not available prior to this meeting to convert the pre-autumn 1995 Engels data into Campelen equivalents.

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. Mean number and mean weight (kg) per standard tow showed large fluctuations between some adjacent years. Although it was difficult to interpret year to year changes in the estimates, in general, the data suggested that the survey biomass index (Fig. 19) from 1991 up to spring 1995 was at its lowest level (average 4 500 tons) relative to the time period prior to 1986 (average 103 000 tons). The autumn 1995 index at 50 000 tons was not directly comparable, however, 90% of this estimate is influenced by one relatively large catch. Regardless of this caveat, the 1995 estimate was still lower than the unconverted estimates prior to the mid-1980s.

Canadian surveys have also been conducted in spring (1991-96) and autumn (1991-95) in Div 3N. These surveys also utilized the Campelen survey trawl beginning in autumn 1995 as described above. 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 availability to the trawl gear or migrations to and from Div. 3N rather than real changes in population abundance, and therefore were not considered reflective of year to year changes in population abundance. The average survey biomass index for the 1991 to spring 1995 period was about 14 000 tons. Surveys in the autumn 1995 and spring 1996 resulted in a biomass index of 41 000 tons and 6 000 tons respectively. About 28 000 tons of the autumn 1995 estimate occurred in a single stratum due to a large catch. The Committee noted that these estimates were within the range of the unconverted estimates of the surveys prior to the Campelen surveys.

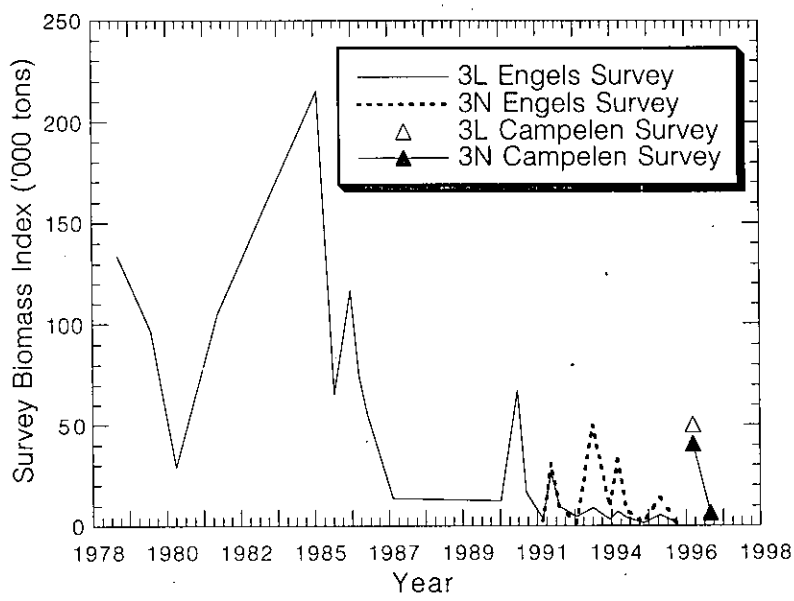


Fig. 19: Redfish in Div. 3LN: survey biomass indices from Canadian surveys in Div. 3L and Div. 3N.

A comparison of the Canadian and Russian bottom trawl surveys in Div. 3L indicated a similar trend of decline in density estimates from 1984 to 1990, and both indices have remained at this relatively low level to 1994. It was noted, however, that the 1994 Russian survey did not cover the entire Div. 3L area and there was no survey conducted in 1995. The Canadian index continued to be relatively low to the spring of 1995. The situation was unclear for Div. 3N. The Russian surveys indicated relatively low mean weight-per-tow from 1989 to 1991 with a dramatic rise in 1993. This large increase in 1993 relative to 1991 was highly influenced by the trawling conducted in one stratum, which accounted for 70% of the biomass but only represented about 9% of the area surveyed.

iii) **Recruitment**

Length distributions and age distributions in number per thousand from the regular spring and autumn Canadian surveys in Div. 3L indicated there has been relatively poor recruitment over the time period covered by the surveys. These also indicated the seasonal variability in years where seasons have been covered sufficiently. The 1994 autumn and 1995 spring surveys showed similar length distributions. The bulk of the lengths were within a range from 26 cm-29 cm which corresponds to fish born about 1984. The length distribution sampled by the Campelen trawl in autumn 1995 showed a much broader range but the bulk of the catches mostly consisted of fish in the range of 25 cm to 33 cm. There was no sign of any good recruitment in the recent surveys.

Length distributions and age distributions from spring and autumn Canadian surveys in Div. 3N from 1991-95 showed different size compositions compared with Div. 3L for each corresponding seasonal survey, generally 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 and 1987 year-classes) that could be tracked through to the 1995 spring survey at about 19 cm. This mode was also reflected in the 1995 autumn survey which had a peak at 20 cm. Given the variability in the survey estimates the magnitude of this recruitment cannot be determined. There was no sign of any good year-classes subsequent to this in the surveys.

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 suggest the survey biomass index has been low in Div. 3L since 1991 relative to the late-1970s to mid-1980s period. A direct comparison cannot be made at this time with recent surveys utilizing the Campelen trawl. Nonetheless, the estimates from the autumn 1995 survey in Div. 3L are within the lower range of the unconverted Engel surveys prior to 1987. The situation in Div. 3N based on the Canadian surveys is unclear because of large seasonal fluctuations, however, the survey biomass index has averaged 14 000 tons from 1991 to the spring of 1995, which is about three times the average biomass index based on Canadian surveys in Div. 3L since 1992 (4 500 tons). Surveys using the Campelen trawl since the autumn of 1995 cannot be compared directly at this time but are within the range of Engels estimates since 1991. Russian bottom trawl surveys have also indicated a decline in relative abundance to historically low values in recent years for Div. 3L and indicate a decline for Div. 3N from 1984 to 1991.

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

In summary, Div. 3L continues to be very low with no sign of good recruitment. Div. 3N has declined from 1984 to 1991 but the status since then is uncertain. The Div. 3N portion contains a recruiting component of unknown abundance that is already 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**

Noting that there was no new information available to address an outstanding recommendation relative to the integrity of Div. 3LN and Div. 3O as management units for redfish, the Committee was informed that work continues within Canada to address questions related to stock structure and migration of redfish. STACFIS regards this issue as important and necessary to resolve. STACFIS concluded that a further look at survey databases 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.*

7. **Silver Hake in Divisions 4V, 4W and 4X** (SCR Doc. 96/1, 3, 17, 78, SCS Doc. 96/3)

a) **Introduction**

The fishery historically 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 subjected to various seasonal, area, and gear restrictions. Since 1990, allocations have been made to Canadian companies which have entered into developmental arrangements with Cuban and Russian Federation fishing companies to harvest silver hake. Despite these realignments, the resultant composition of the fleet actively fishing silver hake has not changed with regard to vessel size and type, although Russian vessels have not participated since 1993. 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 decline. 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 trends continued in 1995 and resulted in only 18 000 tons being harvested from a TAC of 50 000 tons.

Recent catches and TACs ('000 tons) are as follows (Fig. 20):

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	100	100	120	135	135	100	105	86[1]	30	60	60
Catch	83	62	74	91	69	68	32	29[2]	8[2]	18[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.

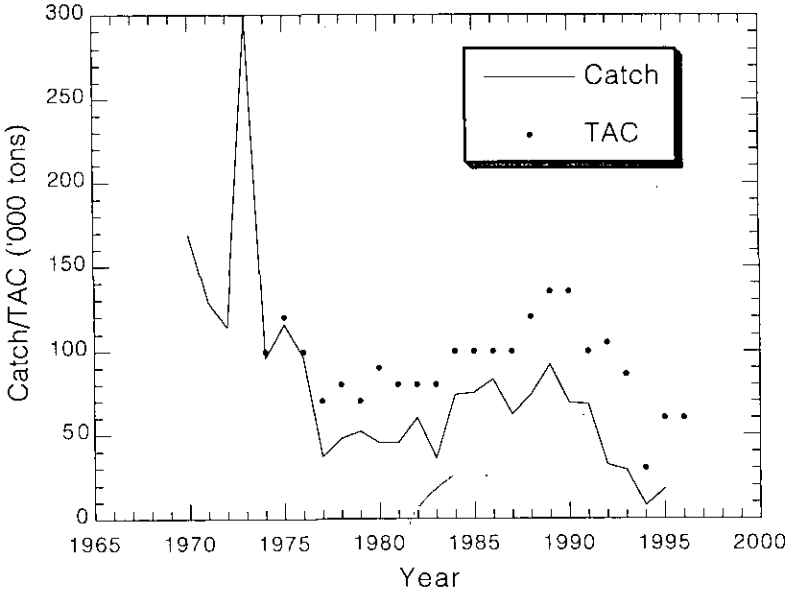


Fig. 20. Silver hake in Div. 4VWX: catches and TACs.

The 1995 fishery commenced in the last week of March, and finished in mid-July. In 1995 Canada continued the regulatory changes implemented in 1994 to minimize cod, haddock and pollock by-catches in this fishery - the Small Mesh Gear Line (SMGL) was repositioned to restrict fishing to water deeper than 190 m, and use of a separator grate in codends was mandatory. These measures were effective in reducing by-catches. STACFIS expressed concern that these restrictions on the fishery may be affecting silver hake catch rates, and **recommended** that *the effect of regulatory measures introduced in 1994 on Div. 4VWX silver hake catch rates be examined in more detail in future.*

An exploratory fishery inshore of the SMGL is being conducted by Canadian fishermen in 1996. Based on anecdotal information this venture appears to be operating successfully in Emerald and LaHave Basins.

b) **Input Data**

i) **Commercial fishery data**

Catch rates. In response to a Scientific Council recommendation of 1995 to examine the possibility of interaction terms in the catch-rate data, catch and effort data from the commercial fishery were analyzed using a multiplicative model fitted with a gamma distribution (SCR Doc. 96/17). Country, division, month and year were considered as factors. Using an all-subset model building approach, a model with year alone had as much explanatory power as a model with all factors included, and thus the interaction problem could be avoided. As a result of this analysis, a non-standardized catch-rate series was calculated, using Canadian observer data, and used as an index of stock abundance. The new analysis was generally in agreement with the standardized series

used in the previous assessment. Catch rates have dropped in recent years (Fig. 21), from a peak of 4 tons/hour in 1989 to approximately 1.4 tons/hr between 1992-95.

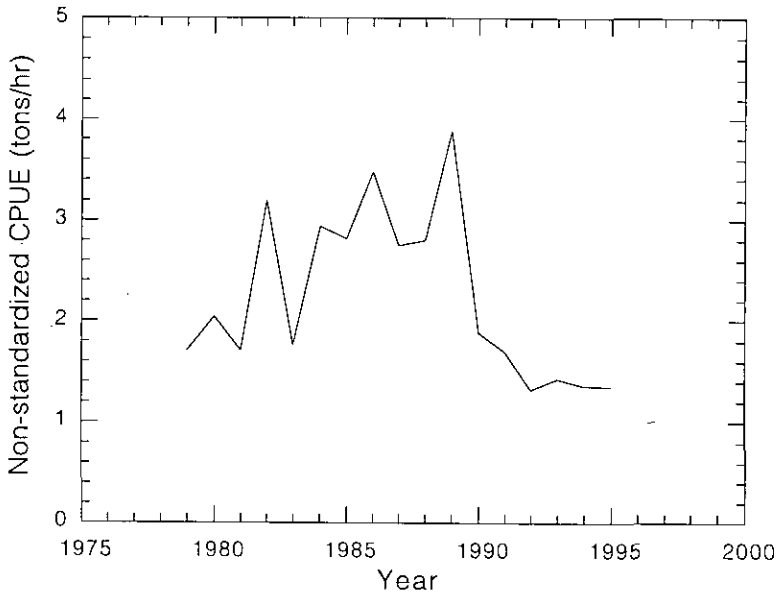


Fig. 21. Silver hake in Div. 4VWX: non-standardized catch rates.

Catch-at-age and weight-at-age data. The commercial removals-at-age for 1995 were calculated from Canadian length samples from the commercial fishery and monthly age-length keys constructed from Canadian ageing data. Length/weight data from Canadian July research vessel surveys were used in the calculation of weights-at-age. The removals-at-age and weight-at-age for 1977-1994 were taken from the previous assessment, to provide estimates for the period 1977-95 inclusive. Commercial mean weight-at-age has declined since 1992, but showed a small increase for most ages in 1995 over the 1994 levels. STACFIS expressed concern that commercial weight-at-age might be affected by the length/weight relationship derived from the July research vessel survey, and **recommended** that *for Div. 4VWX silver hake, the proportion of post-spawning fish in the Canadian July survey data be examined.* It was also **recommended** that *for Div. 4VWX silver hake, the distribution of fish in the Canadian July surveys be examined for interannual variations or temporal trends, and compared to fishery distributions, to investigate the hypothesis of variations in the timing of stock migrations.*

ii) **Research survey data**

The survey results indicated a decline in total numbers and biomass over the period 1986-92 (Fig. 22). However, since 1992 abundance and biomass have increased.

Based on the 0-group survey, the 1995 year-class appeared to be above average in size.

iii) **Biological studies**

The use of M = 0.4 as the natural mortality for silver hake was examined, in an analysis based on long term recruitment trends. The ratio of one year old fish to the total population abundance was assumed to be a proxy for natural mortality, where fishing mortality was low. Based on this assumption, M was calculated to be 0.6. STACFIS noted that the data set used to calculate the ratios included years of high exploitation in the mid-1980s, which might affect the results of the analysis.

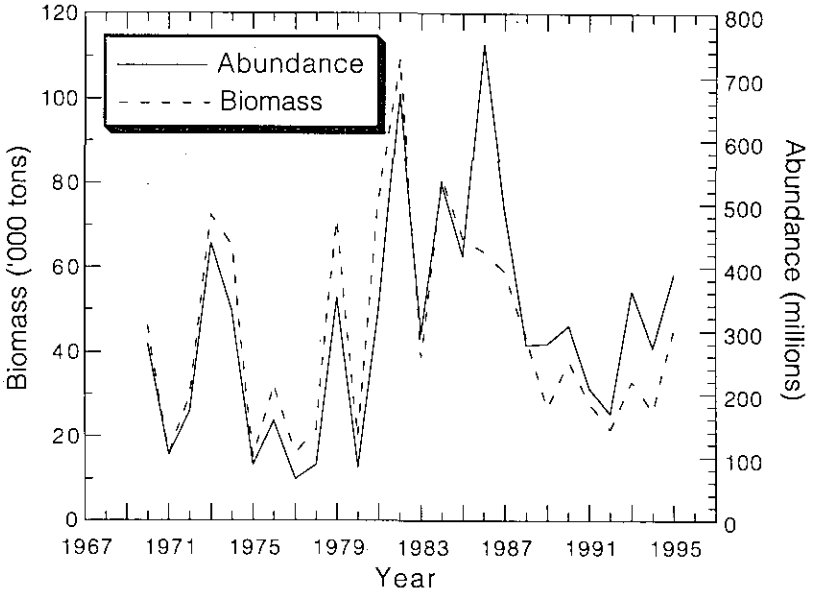


Fig. 22. Silver hake in Div. 4VWX: survey biomass.

Variability in silver hake abundance was compared to that of several other Northwest Atlantic gadoid stocks, and some similarities were found.

c) **Estimation of Parameters**

Sequential population analysis. Commercial catch-at-age (ages 1-9, 1979-95), age desegregated non-standardized CPUE (ages 1-9, 1979-95), Canadian July survey catch-at-age (ages 1-9, 1979-95) and a juvenile index (0-group, 1981-95 except 1992) were used for tuning in a VPA using a bias-adjusting Adaptive framework (ADAPT). A dome-shaped partial recruitment pattern was used in the analysis, with M set at 0.4. This analysis gave an estimate of F in 1995 of 0.2, on average, for ages 3-5 (Fig. 23).

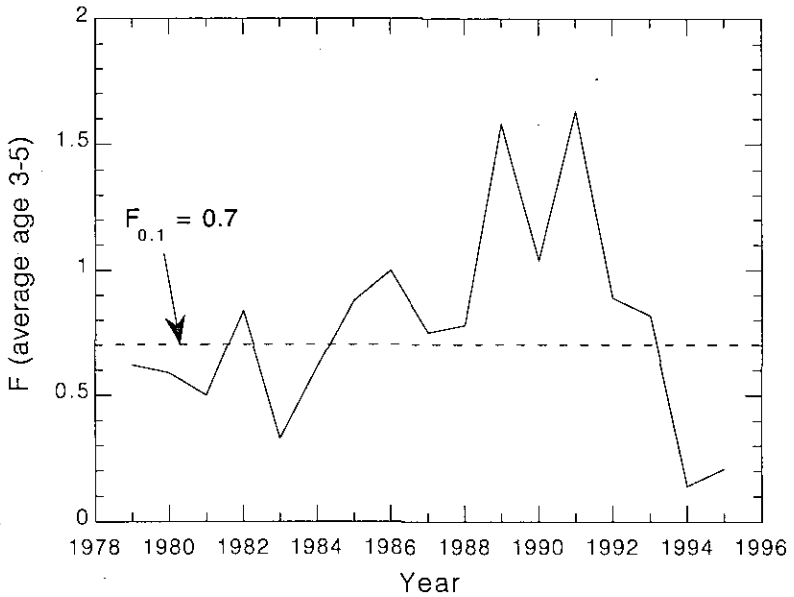


Fig. 23. Silver hake in Div. 4VWX: Average fishing mortality for age 3-5.

A retrospective analysis using the results of the ADAPT formulation showed a tendency for F to be underestimated, and population numbers overestimated, as a longer time series of data was introduced. This pattern has been noted in previous assessments of this and other North Atlantic stocks, but the underlying cause remained obscure. An analysis of the retrospective pattern on an age-by-age basis showed the degree of over estimation of the population numbers to range between 10 and 30%, with a tendency to increase with age. Thus, numbers from the population analysis were adjusted, on an age-by-age basis for catch projection purposes.

A similar adjustment for a retrospective pattern was made in the 1993 and 1994 assessments, but this was not done in 1995 as the retrospective pattern exhibited was irregular, and under and over-estimates, although substantial, cancelled each other out.

The appropriateness of the severely dome-shaped partial recruitment pattern imposed in the VPA was raised and STACFIS **recommended** that *the effect of the dome-shaped partial recruitment pattern be thoroughly investigated for Div. 4VWX silver hake.*

d) **Prognosis**

The 1995 year-class will make a significant contribution to the catch in 1997 at age 2. Size of this year-class (1 280 million) was calculated from a linear relationship between the 0-group survey and SPA numbers at age 1 (1983-91 year-classes). The size of the 1994 year-class at age 1 is poorly estimated in the SPA, as the estimate is based on a single occurrence in the catch matrix. The strength of the 1994 year-class was estimated from both the July survey data and the 0-group survey. Year-class estimates from the July research vessel survey were regressed against estimates from the SPA for the 1982-92 year-classes at age 1. The prediction from this relationship for the strength of the 1994 year-class was 1 100 million fish, while the estimate from the 0-group survey relationship was 720 million. Since the amount of variation explained by the two relationships was approximately the same, the size of the 1994 year-class was taken as an average of the two estimates, at 910 million fish. A geometric mean of age 1 numbers from the VPA (1984-93 year-classes) was used for the 1997 year-class (800 million). For projection, an $F_{0.1}$ value of 0.70 was used, based on the yield-per-recruit analysis conducted during the 1994 assessment. As was the case for the previous assessment, mean weights-at-age for projection were taken as the average of the three most recent years (1993-95), while the partial recruitment pattern was an average of the five most recent years (1991-95). Weight-at-age, partial recruitment and numbers were:

Age	Avg weight (kg)	PR	numbers[1]
1	0.057	0.02	910 000
2	0.103	0.25	381 011
3	0.140	0.73	320 731
4	0.177	1.00	107 890
5	0.210	0.75	37 411
6	0.287	0.66	6 829
7	0.390	0.44	1 194
8	0.393	0.54	331
9	0.766	0.08	156

[1] January 1995 numbers, age 2+ adjusted for retrospective pattern.

The 1996 silver hake fishery is still in progress, and the exact total catch cannot be determined at this time. Based on preliminary catch rates, level of participation, and historical trends in resource availability, the final catch was predicted to be 18 000 tons. A catch of this size will result in a mean F at ages 3-5 (the main age groups in the fishery), similar to the level of 1995. The catch at a target fishing level of $F_{0.1}$ in 1997 is estimated to be 49 000 tons.

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 the size of incoming year-classes for this stock.

8. American Plaice in Divisions 3L, 3N and 3O (SCR Doc. 96/49, 51, 61, 75; SCS Doc. 96/12)

a) Introduction

This fishery was under moratorium in 1995. Total catch in 1995 was 637 tons, mainly taken in the Regulatory Area (Fig. 24). Canadian catch in 1995 was about 59 tons, taken as by-catch, mainly by inshore gears.

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	55	48	40[1]	30.3	24.9	25.8	25.8	10.5	4.8[2]	0	0
Catch	65[3,4]	55[3,4]	41[3,4]	44[3,4]	32[3,4]	34[4]	11[4]	17[5,6]	7[5]	0.6[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.

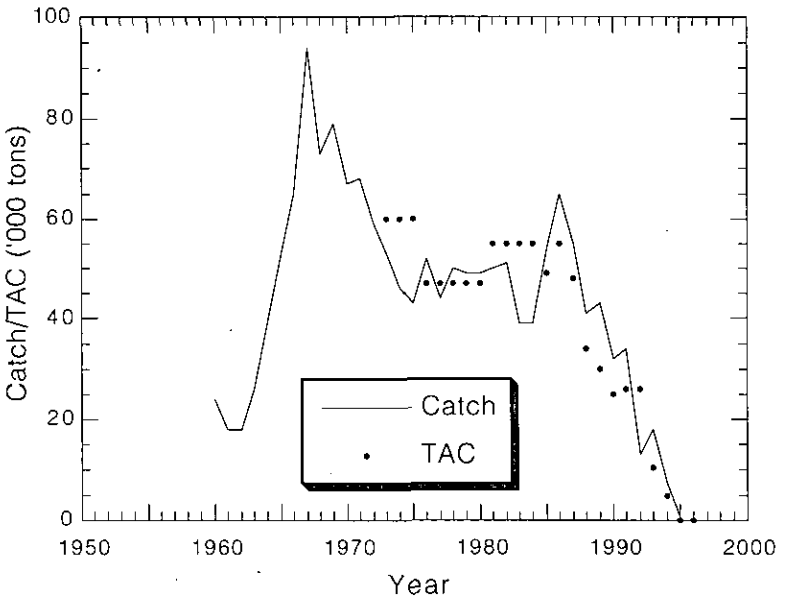


Fig. 24. American plaice in Div. 3LNO: catches and TACs.

b) Input Data

i) Commercial fishery data

Catch and effort. There were no catch and effort data available.

Catch-at-age. There were no catch-at-age data available. There was limited sampling of by-catch in the Portuguese fishery. These data indicated that the main length range from the trawler by-catch in Div. 3N and 3O was 26-38 cm and from gillnets in Div. 3O there were 3 modes at 32, 42 and 48 cm.

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. 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 (4 600 tons) which is only about 3% of the 1985-88 mean value. 52% of the remaining biomass in Div. 3L was found in strata with a depth range of 366-731 m in 1995, as compared to 5% in 1991.

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. 25) as the strong year-classes of the early-1970s dominated survey catches. The total abundance index for 1995 was the lowest estimate in the series having declined by 85% from the value of 1990. In the late-1970s, fish aged 9 years and older made up 35 to 45% of the abundance index. By 1995, fish in these age groups made up only 25% of the index, and the estimates of abundance at these ages had declined by more than 95% during this period. Also, the proportion of the stock north of 45°N has decreased substantially in recent years.

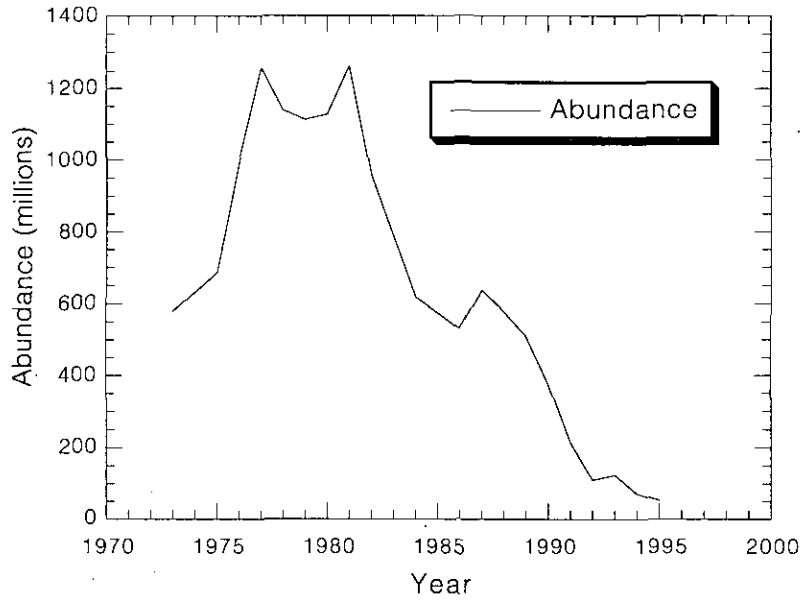


Fig. 25. American plaice in Div. 3LNO: abundance from Canadian spring surveys.

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 1994 abundance estimates at almost 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 were 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 declined by 30% or more in each of the last 4 years, while there was no trend in either Div. 3N and 3O. For Div. 3LNO in total, the autumn surveys indicated a decline in abundance of 75% from 1990 to 1994 (Fig. 26), compared to a decrease of 80% during this period in the spring surveys (Fig. 25).

Campelen surveys. Starting in autumn 1995, Canadian surveys have been conducted using a Campelen 1800 trawl. Until a conversion factor is calculated and applied; the biomass estimates from the autumn 1995 survey and preliminary spring 1996 estimates are not comparable to the earlier spring and autumn surveys. As with the previous series in recent years, the biomass estimate in Div 3N and 3O declined somewhat between autumn and spring.

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.

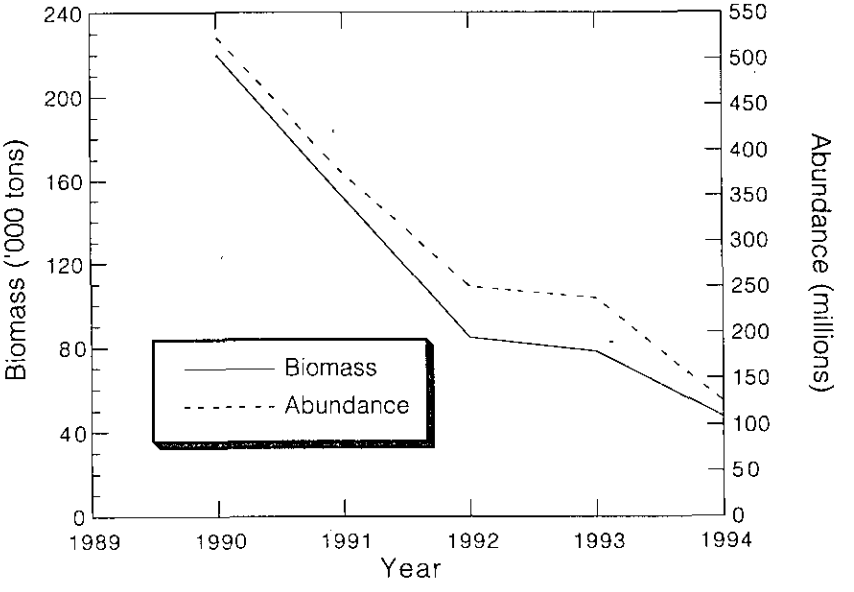


Fig. 26. American plaice in Div. 3LNO: biomass and abundance from autumn surveys.

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. The abundance of juveniles has been relatively stable over the time series. The 1988 and 1989 year-classes showed some promise in the 1994 survey, but the 1991 and 1992 year-classes were average at best.

STACFIS noted that the abundance and biomass estimates from the juvenile surveys (Fig. 27) were much higher in all years than those in the comparable spring and autumn groundfish surveys. This is 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 comprised of young fish.

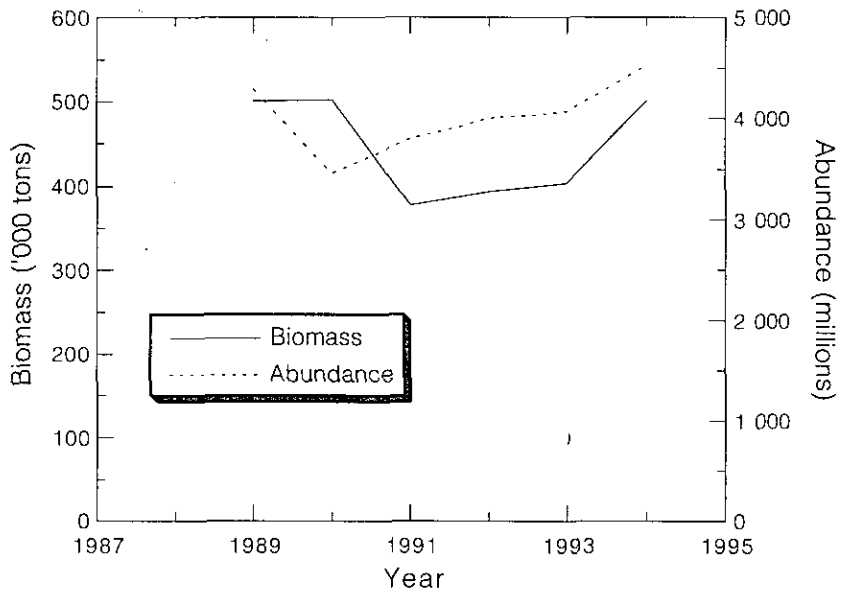


Fig. 27. American plaice in Div. 3LNO: biomass and abundance from juvenile surveys.

USSR/Russian surveys. Results from USSR/Russian surveys in Div. 3LNO were available for 1972-91. The results agree with those of the Canadian spring surveys indicating an increase in stock size in the late-1970s and early-1980s followed by an almost continuous decline from 1984. No comparable survey was done in 1992 or 1995, 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 this stock and **recommended** that *the estimates for Div. 3LNO American plaice from the 1993 and 1994 Russian spring surveys be made available in June 1997 if possible.*

EU-Spain survey. Results from a survey conducted in 1996 in the Regulatory Area in Div. 3NO to a maximum depth of 1 100 m were available. The biomass index of American plaice in strata surveyed in both the 1996 and 1995 surveys was 99 500 tons in 1996, an increase of 84% over 1995. In both years, half the biomass was estimated to be in a known nursery area for American plaice (stratum 360, depth range 57-91 m). The peak catch was from 26 to 38 cm for males and 30 to 32 cm for females and much of the biomass was composed of small fish. STACFIS noted that the abundance of every length group increased between 1995 and 1996.

Canadian deep water surveys. As discussed in 1995, 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.

iii) **Biological studies**

Age at 50% maturity (A_{50}) for females in Div. 3LNO was estimated for each year from 1960 to 1995. 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.

An index of female spawning stock biomass was calculated from the Canadian spring groundfish surveys from 1975 to 1995. This index was relatively stable until the late-1980s when it began a precipitous decline (Fig. 28). The current estimate of 6 000 tons is 95% less than the estimates of the mid-1980s.

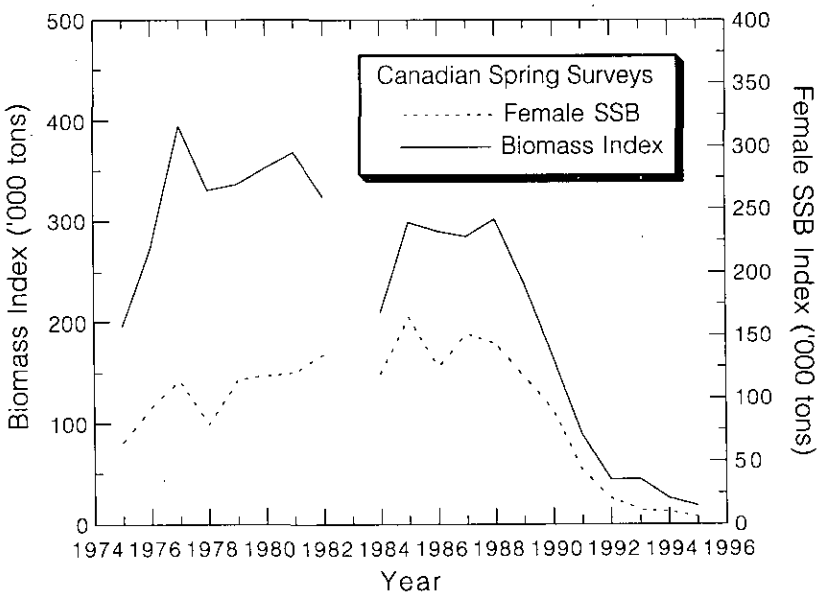


Fig. 28. American plaice in Div. 3LNO: estimates of biomass and SSB from Canadian spring surveys.

The results of two tagging experiments were presented. The first examined movements of juvenile American plaice near the tail of the Grand Bank in Div. 3N and 3O while the second reported on movements of adults mainly released on the top of the Grand Bank in Div. 3L. A total of 9 715 juvenile and 3 154 adult American plaice were released. The results indicate that both juveniles and adults are rather sedentary with little indication of movements beyond 30-50 naut. miles. STACFIS **recommended** that *the data on American plaice tagging in Div. 3LNO be examined in relation to distribution of fishing effort.*

c) **Assessment Results**

The Canadian spring and autumn and the Russian surveys all show a large decline in abundance and biomass since the mid to late-1980s. This agrees with the decline in CPUE and the collapse of the fishery. The indices from Canadian juvenile surveys have been relatively stable from 1989 to 1994 and show no better than average recruitment since the 1989 year-class. The EU-Spain survey in the Regulatory Area of Div. 3NO showed a large increase in biomass and abundance between 1995 and 1996. There was also some indication of an increase in biomass in the Canadian deep-water surveys in Div. 3L between 1994 and 1995 while Div. 3N was stable.

STACFIS noted that it could not resolve the differences in these survey trends at this time. The research recommendations listed below may help to resolve this.

d) **Research Recommendations**

STACFIS noted that set positions from surveys would be helpful in comparing the results between surveys and across years and **recommended** that *set locations be mapped and presented wherever possible for surveys of Div. 3LNO American plaice.*

STACFIS **recommended** that *error bars be presented with estimates of biomass and abundance from surveys for Div. 3LNO American plaice to aid in the interpretation of interannual changes.*

STACFIS noted that the abundance-at-age estimated from many of the survey series presented could be analyzed together and **recommended** that *for Div. 3LNO American plaice, multiplicative models be used to estimate relative year-class strength from the 3 main Canadian survey series.*

STACFIS noted that there have been a number of changes in the depth range covered in the Canadian juvenile survey series and **recommended** that *abundance from the juvenile surveys for Div. 3LNO American plaice be examined incorporating only the strata common to every year.*

9. **American Plaice in Division 3M** (SCR Doc. 96/54, 64, 72, 79; SCS Doc. 96/12)

a) **Introduction**

Since 1974, when this stock started to be regulated, catches ranged from 600 tons in 1981 to 5 600 tons in 1987. After that catches declined to 275 tons by 1993, caused in part by a reduction in directed effort by the Spanish fleet, which took place in 1992. Since then, catches increased to the level of early-1990s. Catches for 1995 increased by 85% compared with 1994 and was estimated to be around 1 300 tons. In 1995, estimated catch for non-Contracting Parties exceeded by more than three times the catches of NAFO members. By-catches in the shrimp fishery were not included in the catches but were estimated to be low (see SCR Doc. 96/64).

From 1979 to 1993 a TAC of 2 000 tons has been in place for this stock. A reduction to 1 000 tons was decided for 1994 and 1995, and a moratorium was agreed for 1996 (Fig. 29).

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	2	2	2	2	2	2	2	2	1[1]	1[1]	0
Catch	3.8	5.6	2.8	3.5	0.8	1.6	0.8	0.3[2]	0.7[2]	1.3[2]	

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

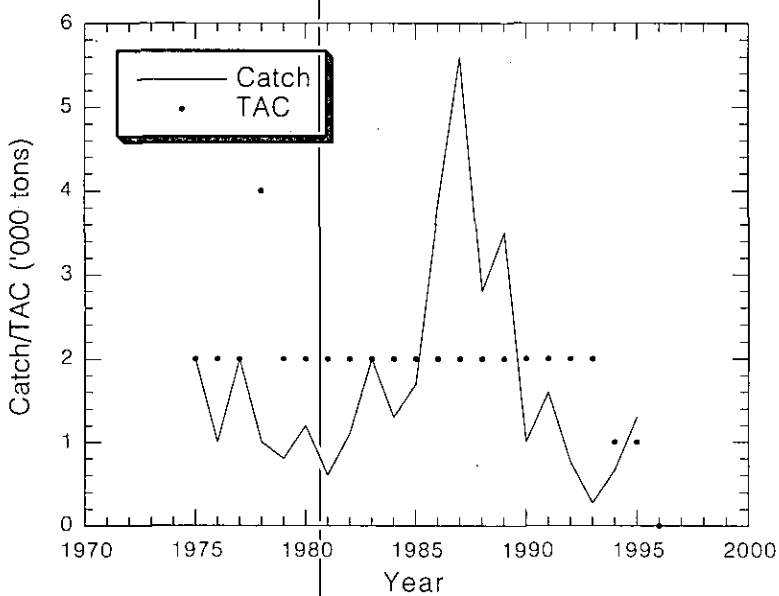


Fig. 29. American plaice in Div. 3M: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Commercial data were insufficient to derive length and age composition. As in 1995, length and age composition of the catches were derived from the survey which took place in July 1995. This was considered to be adequate taking into account that more than 77 % of the

total catch was estimated to come from non-Contracting Parties, which are not regulated by NAFO enforcement measures. These catches were thought to have a similar length composition to the survey.

Mean weight-at-age in the catches did not indicate any trend.

ii) **Research survey data**

The series of research surveys conducted by the EU since 1988 was continued in July 1995. The Russian survey series, started in 1983 was interrupted in 1994, but continued in 1995. However no data on American plaice were available. STACFIS **recommended** that *the 1995 data, and data on American plaice from future Russian surveys in Div. 3M, be made available as soon as possible*. A continuous decreasing trend in both the indices of abundance and biomass was observed since the beginning of the EU series. The Russian series, although showing a higher variability, also indicated a decreasing trend starting in 1986 (Fig. 30).

During the survey series the age reader was changed three times, and age compositions of the survey may reflect different criteria. Although these may produce some variability in age interpretation between readers, the 1986 and 1990 year-classes nevertheless appeared to be the strongest of the series. Since 1991 a series of very poor year-classes were indicated by the survey data.

The spawning stock biomass (50% age 5 plus age 6+), as estimated from the EU surveys, increased in 1993 to a value close to 1991, but decreased again in 1995. This decreasing trend is expected to be continued as no strong year-classes will recruit to the SSB in the near future:

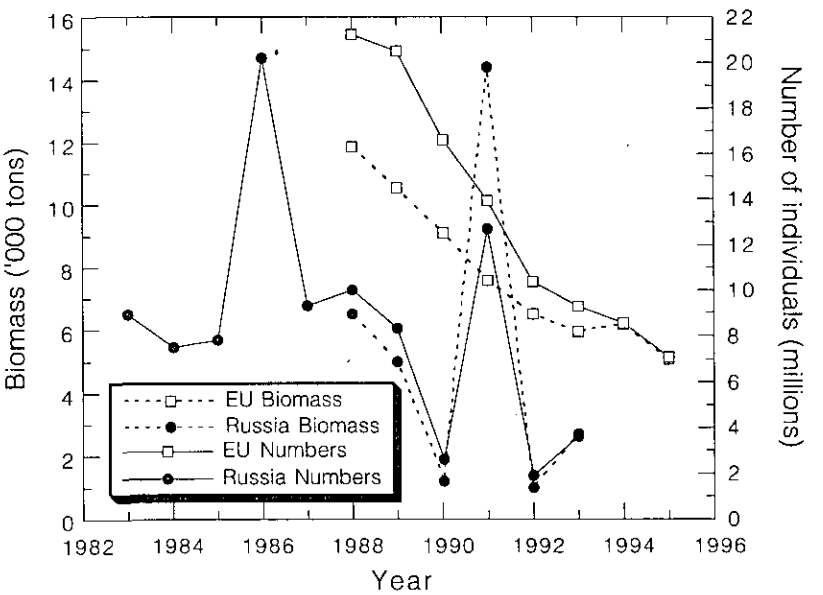


Fig. 30. American plaice in Div. 3M: abundance and biomass trends in the surveys.

Year	1988	1989	1990	1991	1992	1993	1994	1995
SSB	8.5	5.8	5.3	5.7	3.6[1]	5.0	5.0	4.3

[1] 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 of the trend in fishing mortality could be obtained, by comparing the catch and survey biomass ratio, for ages fully recruited to the fishery. For 1995 it was 0.27, which was an increase of 136% compared to the 1994 level (Table 1, Fig. 31).

Table 1. American plaice in Div. 3M: trend in F index as estimated by the catch to survey biomass, ratio for ages fully recruited to the fishery (8 to 11).

Year	Catch	Survey	C/B
1988	1298	6066	0.21
1989	1470	2573	0.57
1990	497	3262	0.15
1991	768	2481	0.31
1992	435	2141	0.20
1993	111	1075	0.10
1994	309	2666	0.12
1995	429	1580	0.27

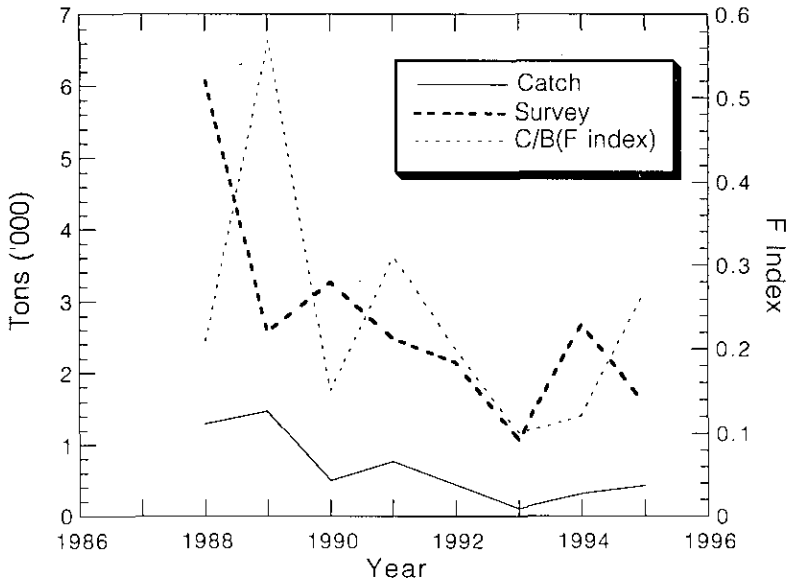


Fig. 31. American plaice in Div. 3M: trends in the catch, EU-survey biomass and F index for ages fully recruited to the fishery.

d) **Assessment Results**

STACFIS noted that this stock appears to be in a very poor condition, with no good recruitment to SSB expected for at least the next five years.

10. **Witch Flounder in Divisions 3N and 3O** (SCR Doc. 96/49, 70; SCS Doc. 96/12)

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. 32). 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 (Contracting Party as of November 1995) also contributed to the increased catches.

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

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	5	5	5	5	5	5	5	3[1]	0	0
Catch	8	7	4	4	5	5	4[2]	1[2]	0.4[2]	

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

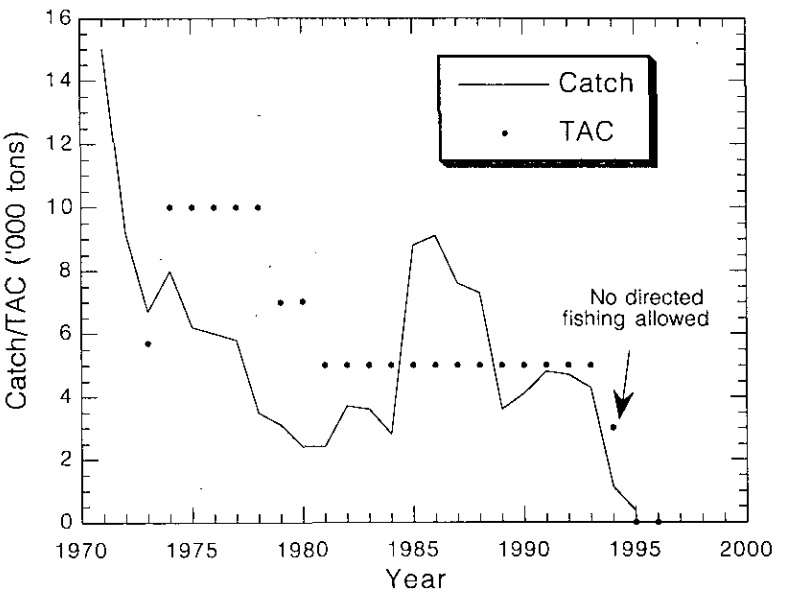


Fig. 32. Witch flounder in Div. 3NO: catches and TACs.

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 estimates of catch for 1994 and 1995 were 1 100 tons and 400 tons, respectively.

Catches by Canada ranged from 1 200 tons to 4 300 tons from 1985 to 1993 (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) and zero catch in 1995. 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 zero 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 and have been only estimated from other sources, for example greater than 30% for 1991 and 1992. There were also catches in some instances which must be estimated from breakdowns of large catches of unspecified flounder in the early years of the fishery.

b) **Input Data**

i) **Commercial fishery data**

Very little information was available due to a moratorium on directed fishing. Some length frequency data from by-catch in the Portuguese gillnet fishery during 1995 in Div. 3O indicated catches in the range of 28-58 cm with modes at 38-40 cm and 46 cm (SCS Doc. 96/12).

ii) **Research survey data**

Biomass estimates. Estimated biomasses from Canadian surveys in Div. 3N have been at very low levels during 1971-95 and in most years were 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 in Div. 3NO during 1991-95 has been the most complete in the time series, including much deeper water, there was a declining trend since 1989. The 1993 and 1995 values were among the lowest observed in Div. 3O (Fig. 33). Although surveys were conducted in the autumn of 1995 and spring of 1996, they were carried out with a modified shrimp trawl compared to a groundfish trawl in previous years. The indices were higher from these surveys, however, they were not comparable to previous years to allow for evaluation of trends in population size to the present.

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.

A similar survey in 1996 estimated biomass to be 2 300 tons for similar strata mainly in a length range of 26-50 cm. The survey was extended from a maximum depth of 730 m in 1995 to 1 100 m in 1996. About 76% of the estimated biomass from the survey in 1996 was accounted for by strata not surveyed in 1995.

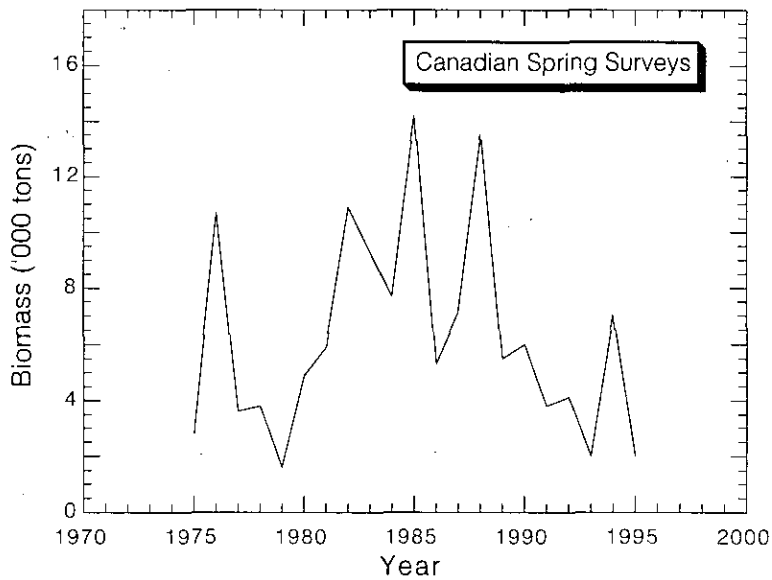


Fig. 33. Witch flounder in Div. 3NO: estimates of biomass.

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 since 1993, 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 for witch flounder from the surveys in Div. 3NO be made available for the June 1997 Meeting.*

11. Yellowtail Flounder in Divisions 3L, 3N and 3O (SCR Doc. 96/49, 66, 74)

a) Introduction

Catches decreased from around 2 069 tons in 1994 to about 67 tons in 1995 (Fig. 34). Catches by EU vessels were at relatively low levels from 1992 to 1993. 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 1995 ranged from 65 to 100 tons.

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	15	15	15	5	5	7	7	7	7[1]	0[1]	0[1]
Catch	30[2]	16	16[2]	10[2]	14[2]	16[2]	11[2]	14[2,3]	2[1,3]	0.1[2,3]	

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

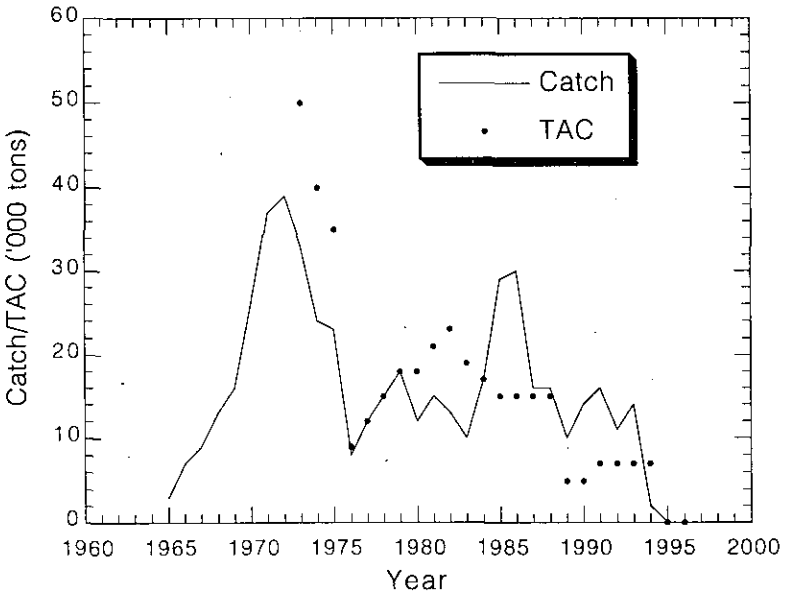


Fig. 34. Yellowtail flounder in Div. 3LNO: catches and TACs.

b) Input Data

i) Commercial fishery data

There were no catch-rate or sampling data from the commercial catch in 1995. 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 (1971-95). Surveys have been carried out by Canadian research vessels in Div. 3LNO each year, with some exceptions, from 1971

to 1995, with the results based upon Engel 145 Hi-Lift otter trawl equivalents. 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. In 1995, 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 1988-95 (Fig. 35). In Div. 3L the index of trawlable biomass declined steadily from about 15 000 tons in 1984-85 to zero in 1995. In Div. 3O, the biomass index was relatively stable around 15 000 tons from 1988 to 1991, however, the 1992, 1994 and 1995 values were around 6 000-8 000 tons, compared to 27 000 tons in 1993. There was a high degree of variability associated with the 1993 biomass estimate in Div. 3O, and the 1994 and 1995 surveys suggest that this 1993 estimate may have been anomalously high. The Canadian groundfish survey catches have been usually dominated by yellowtail flounder aged 5-8 years, however, in 1994 and 1995 the catches were dominated by ages 6-7. The length composition of the catches ranged in size between 16 cm and 52 cm, with a modal length of 24 cm.

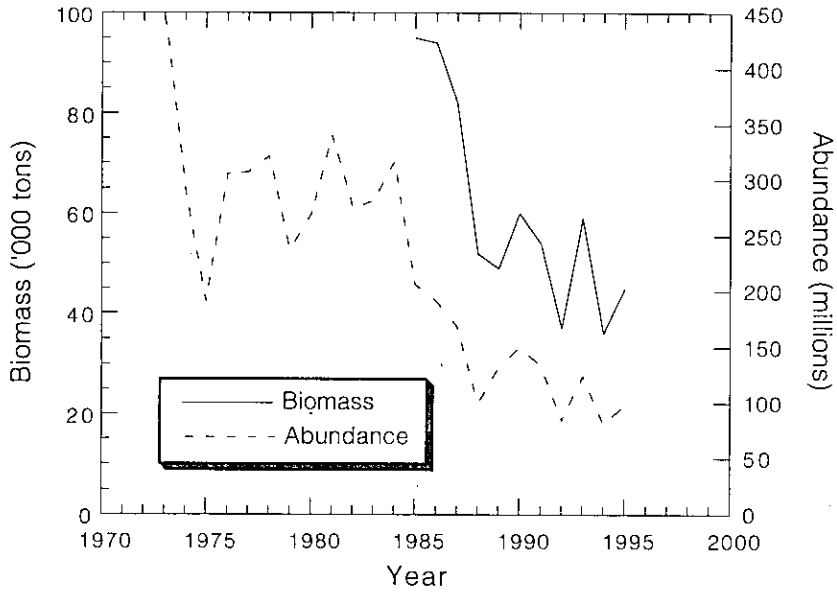


Fig. 35. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian spring surveys.

EU-Spain stratified-random spring surveys in the NAFO Regulatory Area of Div. 3NO (1995-96). These surveys which were carried out with a Pedreira otter trawl and covered a depth range of 45 to 1 000 m, produced a trawlable biomass estimate of 129 000 tons compared to 28 000 tons in 1995. Similar to the 1995 survey, the majority (94%) of the biomass was found in strata 360 and 376, the traditional nursery area in Div. 3N. STACFIS noted that it was difficult to put this survey in the context with the Canadian spring 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 10 cm and 54 cm, with a modal length of 24 cm.

Canadian stratified-random autumn surveys (1990-94). These surveys covered depths to 731 m and were carried out using the Engel 145 Hi-Lift otter trawl during the period 1990-94. 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. 36).

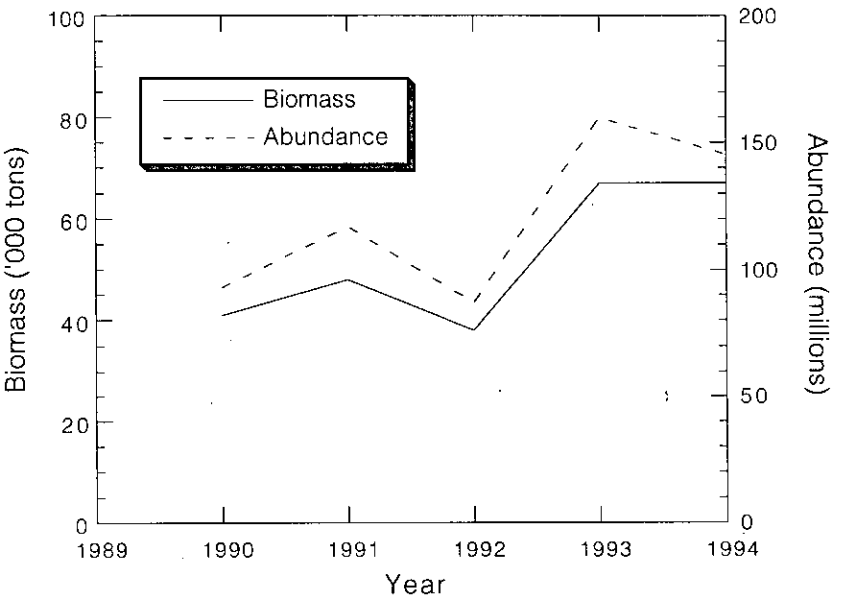


Fig. 36. Yellowtail founder in Div. 3LNO: estimates of biomass and abundance from Canadian autumn surveys.

Canadian stratified-random juvenile groundfish surveys (1985-94). From 1985 to 1994, annual surveys have been conducted in Div. 3LNO using a Yankee 41 shrimp trawl. These surveys covered the areas of juvenile and adult yellowtail flounder distribution. In Div. 3L, the biomass 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 was almost twice the size of the 1993 estimate (Fig. 37). 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"

Canadian stratified-random Campelen trawl surveys (1995-96). Beginning in the autumn of 1995, Canadian autumn and spring surveys were carried out using a Campelen 1800 shrimp trawl. The "new" standard trawl will replace the "old" standard trawls, the Engel 145 Hi-Lift otter trawl and the Yankee 41 shrimp trawl used in the spring and autumn groundfish surveys. Because the conversion factors have not been derived to convert the old standard time series, the autumn 1995 and the spring 1996 estimates are not directly comparable to any of the other time series. The 1996 spring abundance and biomass estimates were the same in Div. 3N and higher in Div. 3O, compared to the autumn 1995 estimates.

Stock distribution. Tagging returns from four juvenile tagging experiments carried out in 1990-93 in the nursery area of Div. 3N showed that juveniles were relatively sedentary with little indication of long distance movements and generally showed a persistence in the area of release. Changes in stock distribution on the Grand Bank, Div. 3LNO, were examined using the indices from the 1994-96 Canadian spring groundfish surveys, the 1994 juvenile survey and the autumn 1994-95 groundfish surveys. All three indices showed a near absence of yellowtail flounder in Div. 3L, confirming the decline in the northern range, since the late-1980s, to the area on and to the west of the Southeast Shoal, (Div. 3NO). STACFIS expressed some concerns about this range contraction from the northern

part of the Bank (Div. 3L). However, the 1996 Campelen trawl survey showed that the stock may have increased its range further north and west in Div. 3NO in comparison to 1994-95 distribution. The expansion seen in the 1995 autumn and the 1996 spring surveys was difficult to interpret given the change in the standard survey gear.

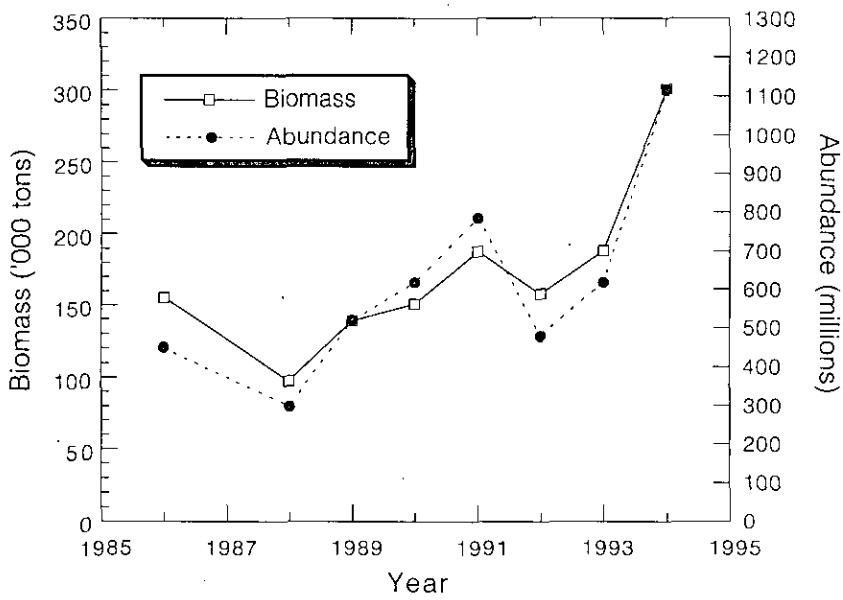


Fig. 37. Yellowtail flounder in Div. 3LNO: estimates of biomass and abundance from Canadian juvenile surveys.

c) **Assessment Results**

Estimates of exploitation rate, expressed as a catch/survey biomass ratio using the spring research vessel index were calculated. The ratio remained high during the late-1980s and early-1990s, as biomass declined, and has declined substantially in 1994 and 1995. This may be the result of the catches in 1994 and 1995 decreasing by 85% and 99%, respectively, from the mean catch level in 1988 to 1993. Nevertheless, the stock may be increasing in size as a result of the decrease in fishing mortality since 1994, possibly aided by the relatively fast growth rates of yellowtail flounder.

Preliminary investigations of a stock-recruitment relationship using the Canadian spring survey data series indicated that because the SSB index was low from 1989-95 the probability of obtaining good year-classes from spawning during this period is low. It was noted that the stock recruitment relationship was preliminary and used age 7+ abundance as a proxy for SSB. STACFIS **recommended** that *a more detailed investigation of the stock-recruitment relationship for yellowtail flounder in Div. 3LNO be completed for the 1997 assessment.* STACFIS also noted a stock-recruitment relationship could be used to investigate some of the guidelines, for example minimum acceptable biological limits, for re-opening the fishery.

An analysis of survey indices at age using the three Canadian time series in a general linear model showed that recent year-classes have been poor relative to year-classes in the 1960s and 1970s. This analysis also showed that an average estimate of total mortality (Zs) from the 1975-85 cohorts was about 1.0. STACFIS expressed interest in the use of general linear models to investigate cohort strengths and totality mortality using multi-survey indices and encouraged further work in this area.

There were four indices used to evaluate this stock: the Canadian spring and autumn groundfish surveys, the Canadian juvenile groundfish surveys and the EU-Spanish spring surveys. Canadian spring survey estimates showed some stability at a lower level since 1988, while recent Canadian juvenile and autumn surveys, the EU-Spanish surveys and the recent Canadian trawl surveys with the new standard trawl (Campelen) showed an increase in indices of abundance. STACFIS noted that the interpretation of these recent increases in some indices is confounded by the lack of converted indices for the Canadian spring, autumn and juvenile indices to 'new' standard survey trawl indices, the short time series in the EU-Spanish surveys, and the effect of the range contraction

of the stock on survey estimates and their variances. Stock size has been relatively stable, since the late-1980s, at a level lower than the early- to mid-1980s.

12. **Greenland Halibut in Subarea 0 and Divisions 1B-1F** (SCR Doc. 96/14, 29, 36 67; SCS Doc. 96/3, 9, 11, 13)

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 18 100 tons in 1992. Since then catches have gradually decreased to 10 598 tons in 1994, but increased to 11 054 tons in 1995. In Subarea 0 catches peaked in 1990 with 14 513 tons, declined from 12 358 tons in 1992 to 4 722 tons in 1994 and increased to 5 880 tons in 1995. 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. 38).

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

	1986	1987	1988	1989	1990	1991	1992	1993[1]	1994[1]	1995[1]	1996
Recommended TAC[2]	25	25	25	25	25	25	25	25	25	11	11
SA 0	+	+	1	1	15	8	12	7	5	6	
Div. 1BCDEF	+	1	2	1	1	2	5	5	6	5	
Total	+	1	3	2	16	10	18	13	11	11[3]	

[1] Provisional.
[2] In the period 1986-1994 the TAC included Div. 1A.
[3] Including 3308 tons non-reported.

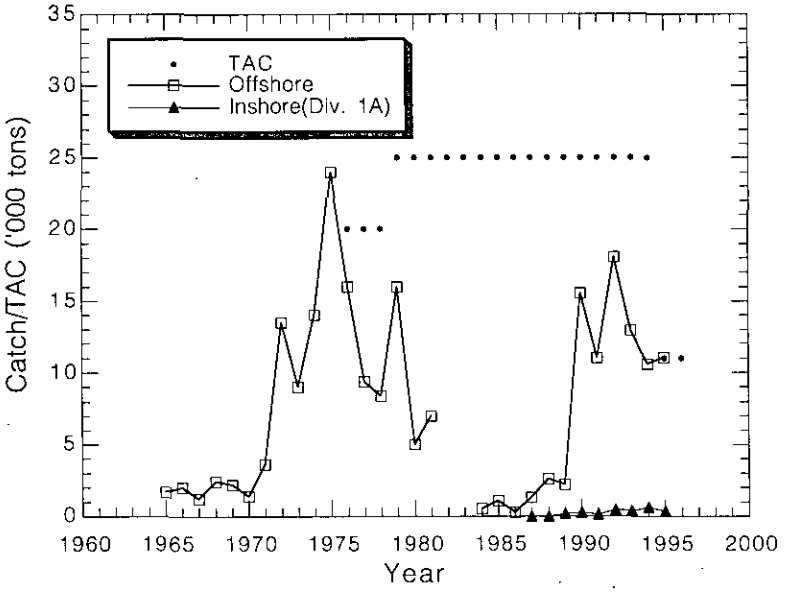


Fig. 38. Greenland halibut in Subarea 0 + Div. 1B-1F: catches and TACs.

The fishery in Subarea 0. Prior to 1984, USSR and GDR conducted trawl fisheries 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. Catches were about 14 500 tons in 1990 but have gradually decreased to 5 880 tons in 1995 of which 4 072 tons were taken by Canadian trawlers or trawlers chartered by Canada. In 1995 an offshore Russian longline fishery and a Canadian gillnet fishery was introduced in Div. 0B and yielded catches of 274 tons and 1 249 tons, respectively. Most of the fishery takes place in the second half of the year.

In 1987 a longline fishery started inshore in Cumberland Sound. The catches gradually increased to 400 tons in 1992 where it has remained until 1994. In 1995 a gillnet fishery was introduced in the area and the total gillnet and longline catches were 285 tons.

No catches were reported from Div. 0A.

The fishery 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 1995. Offshore, 4 593 tons were taken by mainly Norwegian and Greenlandic trawlers while 529 tons were taken by a Greenlandic longliner. Inshore catches amounted to 79 tons taken by gillnet. Almost all the fishery takes place in Div. 1CD in the second half of the year.

b) **Input Data**

i) **Commercial fishery data**

For 1995 catch-at-age and weight-at-age data were available from the offshore fishery in Subarea 1 and length frequency data from the offshore fishery in Div. 0B. As in the previous two years fish at age 7, taken in the trawl fishery, was the dominant age group in the overall catches. The introduction of a gillnet fishery in Div. 0B and an increase in the longline fishery, together with a tendency towards more large fish in the trawl fishery have, however, given a shift towards larger fish in the overall catches compared to previous years.

Maturity data were available only from the gillnet fishery in Div. 0B, where almost all of the fish sampled were mature.

Standardized catch-rate series were calculated from available logbook data from the offshore trawl fishery in Div. 1CD during 1988-95. The standardized catch rates fluctuated, but have shown a decreasing trend in the period 1988-94. The catch rate increased in 1995 to a level a little below the average of the time series. Catch rates for one Japanese trawler fishing in Subarea 1 in the period 1987-95 showed a drop in 1991 but the 1992 value was similar to the average of the years 1987-90. In 1994 the catch rate decreased about 37% compared to 1992 but increased again in 1995 to a level a little below the average for the time series. Average catch rates from the Norwegian trawl fishery in Div. 1CD showed a decrease from 1991 to 1993, stabilized between 1993 and 1994, but decreased further in 1995 to about half of the level in 1991 (Fig. 39). Catches rates for a longliner in Subarea 1 were available for 1994 and 1995 and showed an increase of 36%.

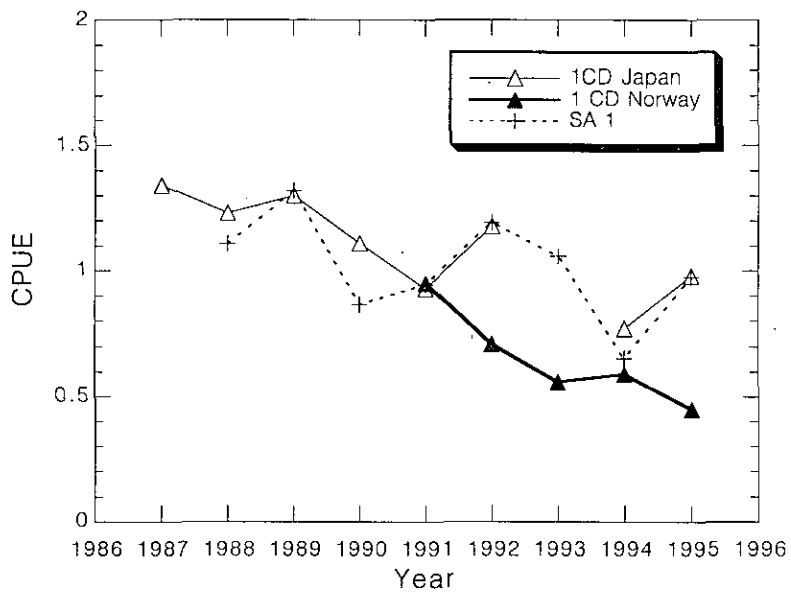


Fig. 39. Greenland halibut in Subarea 0 + Div. 1B-1F: CPUE.

Based on the Greenland shrimp trawl survey and catches from a commercial trawler, the by-catch of Greenland halibut in the shrimp fishery at West Greenland in 1994 was estimated to be 1 467 tons and 21 million specimens. The bulk of the by-catch consisted of 1 and 2 year old fish and was taken mainly in Div. 1A and 1B.

ii) **Research survey data**

Since 1987 bottom-trawl surveys have been conducted in Subarea 1 jointly by Japan and Greenland. In 1995 a survey was conducted in August and covered Div. 1A to 1D at depths between 400 and 1 500 m. The trawlable biomass was estimated to be 40 800 tons, which was not a statistically significant increase compared to 31 300 tons in 1994. The 1995 estimate included 400 tons from Div. 1A, which was not covered in 1994. The estimated biomass in 1995 was, however, still below the level in the late-1980s and early-1990s (Fig. 40). The increase in biomass between 1994 and 1995 was seen in all Divisions, but was mainly due to an increase in the estimated biomass in Div. 1CD depth stratum 600-1 000 m. Abundance estimates for Div. 1CD for the period 1988-92 fluctuated in the range 35-53 million but had gradually declined to 25 million in 1994. In 1995 the abundance increased again to 31 million. The increase was seen in most age groups, but was most pronounced in age group 4 - the presumably good 1991 year-class.

Biomass estimates ('000 tons) from USSR(Russia)/GDR(FRG) surveys and Japan/Greenland surveys for the years 1987-95 in Subareas 0+1 area as follows:

Year	USSR(Russia)/GDR(FRG) 0B	USSR(Russia)/GDR(FRG) 1BCD	Japan/Greenland 1BCD	Japan/Greenland 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	-	-
1995	-	-	40	41	-

[1] Div. 1A south of 70°N.
[2] USSR(Russia)/GDR(FRG) Survey Div. 0B + Japan/Greenland 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

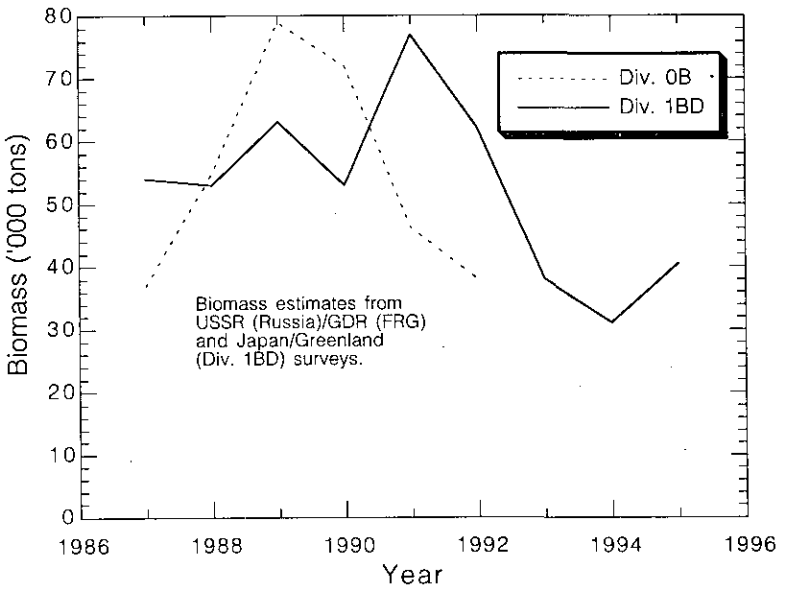


Fig. 40. Greenland halibut in Subarea 0 + Div. 1B-1F: biomass estimates from surveys.

Since 1988 annual surveys have been conducted with a shrimp trawl off West Greenland between 59°N and 72°30'N from the 3-mile boundary to the 600 m depth contour line. The abundance in 1995 was estimated at 184 million, which was somewhat below the level in 1992-94 (about 250 million) but above the 60-80 million recorded for 1990-91. In the nursery area (Div. 1AB), which is a subset of the survey area, the abundance was estimated to 145 million. This was below the level in 1992-94 (200 million), but above the level in 1990-91 (60 million) (Fig. 41). The catches were composed almost exclusively of 1 and 2 year old fish.

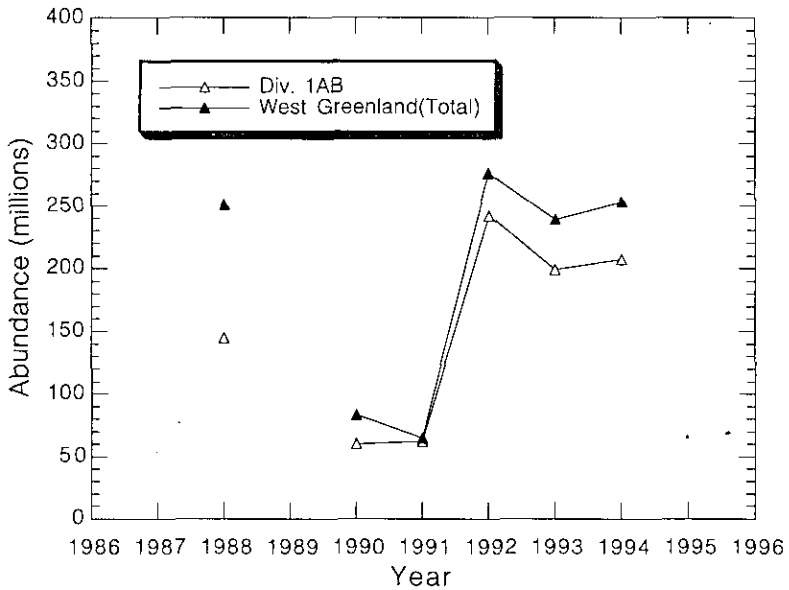


Fig. 41. Greenland halibut in Subarea 0 + Div. 1B-1F: abundance from shrimp trawl surveys.

c) **Estimation of Parameters**

VPA and yield-per-recruit analysis could not be used due to uncertainties in the input parameters.

d) **Assessment**

Catches peaked at 18 000 tons in 1992 but have been stable around 11 000 tons since then. Survey trawlable biomass in Div. 1B-1D showed an increase from 31 000 tons in 1994 to 40 000 tons in 1995 and seems to have stabilized, however, at a lower level compared to the late-1980s and early-1990s. Population estimates at age 1 of the 1992-94 year-classes have declined in recent years compared to the presumably good 1991 year-class, but are still considered to be at or above average for the last decade. The 1991 year-class is still considered to be good at age 4 and will gradually contribute to the trawl catches in 1996 and 1997. Although incomplete, three out of four available CPUE indices showed an increase in 1995 compared to 1994.

e) **Research Recommendations**

Neither catch numbers-at-age, weights-at-age data nor CPUE data were available for Div. 0B offshore for 1995, and STACFIS **recommended** that *these data should be presented at the Scientific Council Meeting in June 1997, in order to continue the time series already established.*

The question of whether the Cumberland Sound Greenland halibut stock contributes to the Subareas 0+1 stock needs to be resolved. STACFIS **recommended** that *the tagging program initiated in Cumberland Sound in 1995 to ascertain whether adult Greenland halibut fish move into Davis Strait should be continued.* The degree of spawning activity should be examined at the same time.

The joint Greenland/Japan survey was conducted for the last time in 1995. The survey will be continued with another vessel by Greenland. STACFIS **recommended** that *parallel trawling between the Japanese and Greenlandic vessels should be carried out in order to make it possible to extend the already established time series* for Greenland halibut in Subareas 0 and 1.

STACFIS **recommended** that *the investigations of the by-catch of Greenland halibut in the shrimp fishery in Subareas 0 and 1 should be continued.*

13. **Greenland Halibut in Division 1A** (SCR. Doc. 96/14, 36, 67, 68; SCS Doc. 96/9)

a) **Introduction**

The main fishing grounds for Greenland halibut in Div. 1A are located inshore. The annual inshore catches in Div. 1A were around 7 000 tons in the period 1984 to 1989, but have been steadily increasing to 17 911 tons in 1995 (Fig. 42). In recent years the inshore catches have been rather evenly distributed throughout the year.

Catches ('000 tons) in Div. 1A are as follows:

	1987	1988	1989	1990	1991	1992	1993[1]	1994[1]	1995[1]
Ilulissat	2.3	2.7	2.8	3.8	5.4	6.6	5.4	5.2	7.4
Uummannaq	2.8	2.9	2.9	2.8	3.0	3.1	3.9	4.0	7.2
Upernavik	1.6	0.8	1.3	1.2	1.5	2.2	3.8	4.8	3.3
Offshore	-	-	-	-	-	-	+	+	+
Unknown [2]	0.4	0.6	0.6	0.5	+	0.1	-	-	-
Total	7.2	7.0	7.5	8.3	9.9	11.9	13.1	14.0	17.9
Officially reported	8.4	7.0	7.5	7.5	9.2	11.9	-	-	-

[1] Provisional.
[2] Catches from unknown areas within Div. 1A.

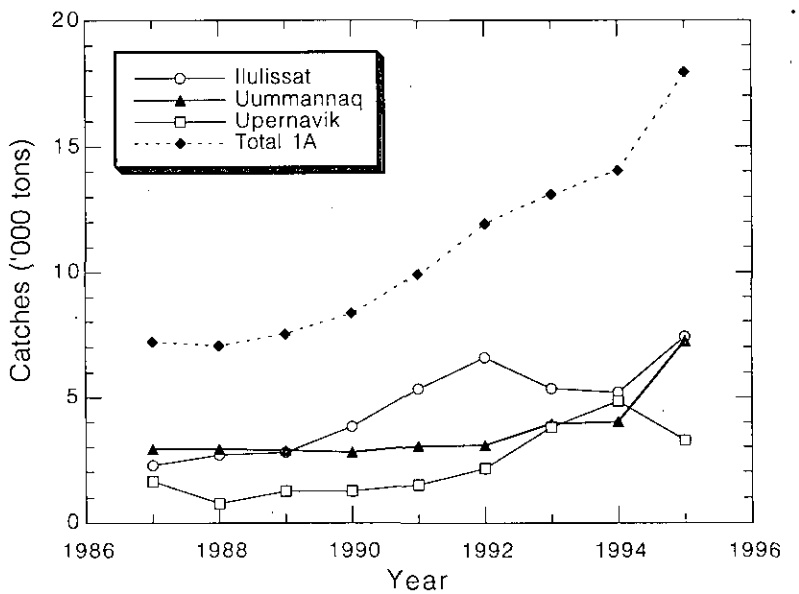


Fig. 42. Greenland halibut in Div. 1A: catches by area.

The offshore fisheries in Div. 1A. There has been practically no offshore fishing for Greenland halibut in Div. 1A. In 1993, 34 tons were taken by a Japanese trawler, in 1994, 18 tons by a Greenlandic longliner and in 1995, 13 tons by a Japanese trawler.

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. Gillnet fishery is regulated by a minimum mesh-size of 110 mm (half mesh). There are no regulations on longline fishery. Longline catches comprised 73% in 1994 and 76 % of the total catches in 1995. There are no quotas on the fishery.

The inshore fishery in Div. 1A is mainly located in three areas: Ilulissat (69°N), Uummannaq (71°N) and Upernavik (73°N). Landings in Greenland northernmost settlement, Qaanaq (77°) accounted for 8 tons in 1995.

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.

The catches at Ilulissat increased from about 2 000 tons in 1987 to 6 600 tons in 1992. In 1993 and 1994 the catches decreased to 5 200 tons, but increased again in 1995 to 7 400 tons . Longline catches comprised 67% in 1994 and 66% of the total catches in 1995.

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 and 1994 the catches increased to 4 000 tons, and again in 1995 catches increased to 7 234 tons. In 1994 longline catches comprised 57% of the landings at Uummannaq, but increased to 76% in 1995.

Upernavik. The northernmost area consists of a large number of ice fjords. The main fishing grounds are 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 1 600 tons in 1987 to 4 800 tons in 1994. A substantial increase from 1993 to 1994 was due to relocation of effort from southern areas in 1994. However, this relocation was not repeated in 1995, and catches decreased to 3 269 tons.

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 and Upernavik in 1991-92. Catch-at-age data for Upernavik 1993 were obtained by using an age-length key from 1995. In 1994 and 1995 age-length keys were obtained for all three areas. The otolith samples from 1994 were re-read and 1994 catch-at-age data were recalculated with new age-length keys. The 1994 catch-at-age data appeared to be consistent with 1995 data.

An analysis of the mean length in commercial samples from the period 1988 to 1995 was presented. There was a significant decrease in mean length since the late-1980s at Ilulissat. Catch-at-age data also showed a tendency towards younger fish in the catches during this period. In Uummannaq there was a significant decrease of mean length in catches since 1988, which corresponded to a shift towards younger fish in the catches. In Upernavik there was no trend in the data.

Results from an analysis of weight categories in landings concluded that the proportion of fish between 1.0 and 3.5 kg ('small fish') in catches had increased at Ilulissat from 70% in 1990 to 85% in 1995. In Uummannaq the proportion has been stable around 55% since 1991. In Upernavik the proportion of 'small fish' in landings has been stable between 30 and 35% since 1990.

Catch-curve analysis was used in an attempt to determine the F-level during the period 1987 to 1995. Because of fluctuations in recruitment and migrations in and out of the limited fishing grounds, the results were considered unreliable. Measures of effort should be provided, to make it possible to obtain estimates of Z from catch-rate-at-age in the commercial catches, and furthermore should trends in effort be compared to trends in F.

An analysis of by-catches of Greenland halibut in the commercial shrimp fishery in Div. 1A to 1F, estimated the total by-catch to be 1 500 tons in 1994, corresponding to approximately 21 million individuals, mainly ages 1 and 2. The analysis conducted was based on 20 tows from a commercial trawler in 1996.

ii) **Research survey data**

Before 1993 various longline exploratory fisheries with research vessels were conducted. Due to different 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, with approximately 30 fixed stations in each area. In July-August 1995 the research longline vessel 'Adolf Jensen' covered the fjord areas of Upernavik and Uummannaq. A total of 52 longline settings with 54 000 hooks were made. CPUE and mean-length values at Uummannaq, increased since the last survey in 1993, but were still below the values obtained in mid-1980s (see text tables). CPUE and mean length values from Upernavik decreased from 1994 to 1995.

CPUE values (kg/100 hooks) from longline surveys conducted in Div. 1A inshore areas.

Area	1962	1985	1986	1987	1993	1994	1995
Ilulissat	-	-	8.3	16.5	3.1	3.1	-
Uummannaq	4.6	13.7	-	8.6	2.8	-	6.6
Upernavik	-	-	-	-	-	5.2	3.9

Mean length (cm) from catches taken in Div. 1A inshore longline surveys.

Area	1962	1985	1986	1987	1993	1994	1995
Ilulissat	-	62.4	53.5	62.2	55.9	56.5	-
Uummannaq	67.8	70.5	-	61.8	57.5	-	57.8
Upernavik	-	-	-	-	-	64.6	60.8

Some of the juveniles at the nursery areas south-southwest of Disko Island and Disko Bay were considered to recruit to the inshore areas in Div. 1A, although the proportion was unknown. 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 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. Standardized recruitment indices were presented as catch-in-numbers per hour, for both the offshore and inshore nursery areas (Fig. 43). In the offshore area the recruitment level of age 1 has decreased since the large 1991 year-class, but was still above the level of year-classes 1987, 1989 and 1990. Recruitment of age 1 in Disko Bay revealed considerable variation during the years, which makes an interpretation of the recruitment level difficult.

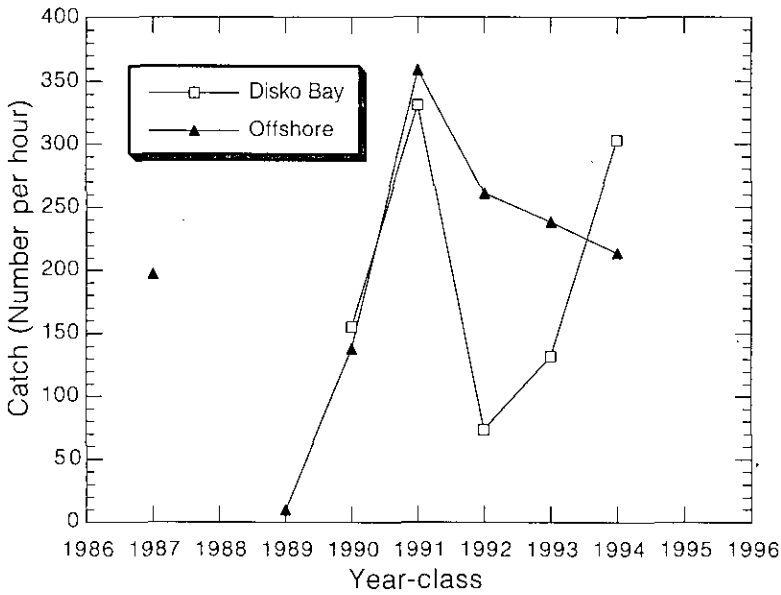


Fig. 43. Greenland halibut in Div. 1A: recruitment of age 1 on nursery grounds.

iii) **Biological studies**

A meristic study was presented, concluding that Greenland halibut from fjords in Div. 1A, Baffin Bay and Davis Strait derived from the same spawning area, or from spawning areas with the same environmental conditions. The between-year effect on the number of vertebrae was larger than the between-area effect.

c) **Assessment Results**

The recent level of fishing mortality could not be estimated.

The stock in all three areas consist of a large number of age groups, and the age structure of the stock does not show signs of collapse.

In Ilulissat the mean length in commercial catches has decreased significantly since the late-1980s, and the proportion of 'small fish' in catches continued to increase in 1995 indicating growth overfishing. The mean length and CPUE values from the longline survey were stable in 1993 and 1994, but below values obtained in 1980s.

In Uummannaq the mean length in commercial catches has decreased significantly since 1990 indicating growth overfishing. The proportion of 'small fish' in the catches has, however, been stable since 1991. The mean length from the longline survey is at the same level as in 1993 and CPUE values have increased, but are still below values obtained in the 1980s.

In Upernavik the mean length in commercial catches varies during the years, and there are no clear trends. The proportion of 'small fish' in the catches has been stable since 1990. Mean length and CPUE values from survey data decreased slightly from 1994 to 1995.

The level of recruits at age 1 has decreased since the large 1991 year-class, but is still above the level of year-classes 1987, 1989 and 1990.

The inshore stock is exclusively dependent on recruitment from the offshore nursery grounds and the spawning stock in Davis Strait. Only sporadic spawning occurs in the fjords, hence the stock is not self-sustainable. The fish remain in the fjords, and do not contribute back to the spawning stock.

d) **Research Recommendations**

STACFIS **recommended** that *measures of effort from the commercial fishery be analyzed to obtain estimates of total mortality for Greenland halibut in Div. 1A.*

14. **Greenland Halibut in Subarea 2 and Divisions 3KLMNO** (SCR Doc. 96/8, 33, 34, 35, 54, 73; SCS Doc. 96/12, 13)

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. 44). 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. The total catch estimated by STACFIS for 1990-93 was 47 000 tons in 1990, 55 000-75 000 tons in 1991, about 63 000 tons in 1992 and 42 000-62 000 tons in 1993. STACFIS accepted an estimated catch of 48 000 tons for 1994 although the estimates reviewed ranged as high as 53 000 tons. The accepted catch for 1995 was 15 000 tons, a reduction of about 75% compared to the average annual catch of the previous 5 years due to new management measures introduced in 1995. The major participants in the fishery in the Regulatory Area were EU-Spain and EU-Portugal using mainly otter trawls.

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 annually since then to 2 300 tons in 1995.

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 using 140-152 mm mesh, while catches since then have been taken mainly in offshore areas at the edge of the Continental Shelf using 190 mm mesh.

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. Since then, the otter trawl catch declined steadily to less than 600 tons in 1995.

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC[1]	75	100	100	100	50	50	50	50	25	27	27
Catch[2]	16	31	19	19	47	55-75	63	42-62[3]	48[3]	15[3]	

[1] Set autonomously by Canada 1985-94 and by NAFO Fisheries Commission in 1995 and 1996.
[2] Includes estimated unreported catches in 1990-95.
[3] Provisional.

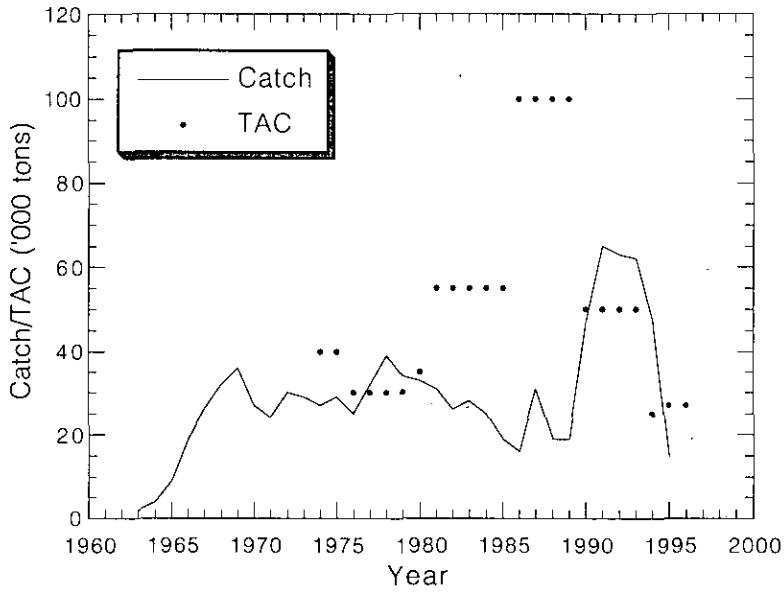


Fig. 44. Greenland halibut in Subarea 2 + Div. 3KLMNO: catches and TACs.

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 presented at the Scientific Council Meeting of June 1995 (SCR Doc. 95/78). 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. Mainly as a result of declining catch rates 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. No new data were available for this meeting on Canadian gillnet catch rates.

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 (SCR Doc. 96/73).

A catch-rate analysis of Portuguese otter trawlers fishing in the NAFO Regulatory Area of Div. 3L from 1988-95 was also reviewed. The CPUE declined sharply from 1989 to 1991, recovered somewhat in 1993 then declined again to the lowest level observed during the period by 1995 (SCR Doc. 96/33). Although directed effort on Greenland halibut in Div. 3N accounted for only 30% of the observed effort from the Portuguese trawl fishery, no trend in catch rates for this Division could be detected despite an isolated peak in 1992.

Size and age data were not available from the 1995 Canadian fishery in time for this meeting. However, new data from the 1994 fishery were presented. The catch was comprised mainly of ages 7-13. There were relatively more older fish (age 10+) in the catches in recent years due to the increase in the use of large mesh (>190 mm) gillnets in deep water since about 1992, accompanied by a reduction in trawler effort which usually catches smaller (younger) fish (SCR Doc. 96/73).

Length compositions from the Japanese fishery in Div. 3LM indicated that most fish caught were in the length range of 40-65 cm in November and 35-50 cm during December. It was noted that almost all fish caught were immature (SCS Doc. 96/13).

The commercial catch-at-age data for 1995 from EU-Portugal indicated low numbers of fish older than age 7 in the trawler catches, which comprised most of the Portuguese fishery, with the peak of the catches at ages 4 to 6. Nevertheless, the catch did contain fish up to ages 15+ (SCS Doc. 96/12).

No commercial fishery data were available from EU-Spain for 1995 although EU-Spain accounted for most of the catch in 1995. Data are being collected from this fishery in 1996.

ii) **Research survey data**

STACFIS noted once again 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. This concern was more apparent in the current assessment considering that areal survey coverage of the management area was much reduced compared to similar data used in the 1994 and 1995 assessments.

Canadian stratified-random autumn surveys in Div. 2J and 3K. During 1995, a new survey trawl was introduced to this survey series. A Campelen 1800 shrimp trawl with rock hopper footgear replaced the previously used 'Engel 145' groundfish trawl with large steel bobbin footgear. Based upon the results of comparative fishing experiments between the two gears (SCR Doc. 96/28) length based conversion factors were developed and accepted to convert the historic time series of biomass and abundance of Greenland halibut to equivalent estimates had the Campelen 1800 shrimp trawl been used throughout (Fig. 45). While the actual index values changed from those in past reports, due to variable conversion factors by length, the overall trends from 1977-95 for Div. 2J and 1978-95 for Div. 3K were directly comparable. No data were available for conversion of the Div. 3L time series. However, this time series accounted for little of the Greenland halibut distributed in Div. 3L due to limited depth coverage.

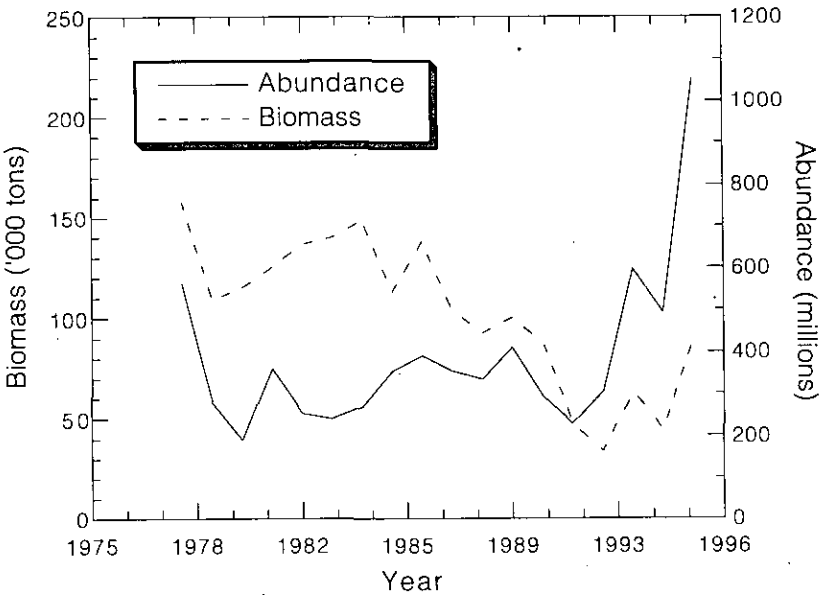


Fig. 45. Greenland halibut in Div. 2J and 3K: estimates of biomass and abundance from Canadian surveys.

The results indicated that the biomass index for Div. 2J and 3K combined generally increased from the late-1970s to peak in 1984. The index then declined steadily to 1990. There was a sharp decrease by about 50% between 1990 and 1991, and the index reached its lowest level observed by 1992. The 1992 value was only about 20% of the peak value observed in 1984. The estimates generally increased since then with the 1995 value about the same as that of 1990. It should be noted that the 1995 survey was actually conducted with the new survey trawl and is not a converted value.

An examination of the age structure indicated that the ages 6+ abundance declined from the mid-1980s. By 1994, the age 6+ abundance was far below anything previously observed, but was followed by a slight increase in 1995 to near the low 1992 value. Ages 10+ have been declining since at least the early-1980s and by 1994, and again in 1995 appeared only incidently in the survey catches. On the other hand, the abundance index of ages 3-5 slowly increased from the early-1980s to about 1989. From 1989 to 1991, however, this index also declined very sharply to a level less than half the 1989 estimate. The ages 3-5 index increased dramatically since then to reach the highest level observed in the 1995 survey. This sharp increasing trend in recent years is a result of high indices of abundance of the 1990-94 year-classes.

EU stratified-random surveys in Div. 3M (SCR Doc. 96/54). These surveys indicated that Greenland halibut biomass index on Flemish Cap in depths to 730 m ranged from 4 300 tons in 1989 to 8 500 tons in 1992. The estimated biomass from this survey series in 1993 declined to 7 200 tons, but increased again to about 7 900 tons in 1994. The estimated biomass in the 1995 survey was 10 700 tons which is the highest in the series. 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 with some increase in 1995. 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. The increased population estimate in 1995 is the result of an increase in estimated numbers for all ages 1-9. However, the cohort at age 1 (1994 year-class) accounted for nearly one-third of the 1995 abundance estimate and 6-8 times higher than the previous three years' estimates at the same age.

Russian surveys in Flemish Cap and Pass (SCR Doc. 96/8, 68). A stratified-random survey was conducted in part of Flemish Cap in Div. 3M during May 1995 to a depth of 730 m. The abundance index was 2.5 million fish and the biomass index was 1 100 tons. An exploratory survey on the distribution of Greenland halibut in Flemish Pass indicated an increase in mean length from about 36 cm at 601-700 m to 45 cm at 901-1 100 m. Considering both surveys together, fish were caught from 12-110 cm in length, although very few were caught beyond about 60 cm. The bulk of the catch was in the range of 35-55 cm comprising ages 4-7 with a mode at age 5. It was noted that most fish were immature.

A stratified-random survey was also conducted in the area of the Sackville Spur in Div. 3LM during February 1996 in a depth range from 732- 1 463 m. Fish were caught in the size range of 20-109 cm although most fish were caught in a range of 34-46 cm and comprised almost entirely of immature fish. The abundance index was 46.1 million and biomass index was 31 800 tons.

EU-Spain stratified-random surveys in Div. 3NO Regulatory Area (SCR Doc. 96/49). During the spring of 1995 and 1996, stratified-random bottom trawl surveys were conducted by EU-Spain in the Regulatory Area of Div. 3NO to a depth of 730 m in 1995 and 1 100 m in 1996. The estimated biomass was about 2 800 tons in 1995 and 3 500 for comparable strata in 1996. However, more than 90% of the estimated biomass in 1996 was attributable to strata not surveyed in 1995. The size composition was bimodal in 1995 at 20 and 32 cm and trimodal in 1996 at 22, 28 and 36-38 cm. These modes likely represented the 1993, 1992 and 1991 year-classes, respectively.

EU longline survey (SCR Doc. 96/34). A longline survey was conduced in 1996 in the Regulatory Area in a depth range of 562-3 028 m. Although Greenland halibut were caught as deep as 2 083 m, it was considered that for practical purposes the distribution of Greenland halibut was covered by the present commercial fishery (about 1 800 m). The mean size increased by depth from about 48 cm in 700-1 000 m to 80 cm in 1 300-1 600 m beyond which it remained stable.

iii) **Recruitment indices**

During both the 1994 and 1995 assessments STACFIS concluded that the 1990 and 1991 year-classes were above average abundance based on survey trends in year-class strength. Although STACFIS has no reason to change this view, no new data were available in the current assessment to confirm that view further. This is because these year-classes likely have begun migrating from the Div. 2J and Div. 3K survey area at ages 4 and 5 by the time of the 1995 survey.

Early indications from surveys in Div. 2J and 3K would suggest that the 1992 and 1993 year-classes may also be above average abundance. However, STACFIS cautions that estimates of abundance of these year-classes at very young ages are very sensitive to the length conversion factors for small sizes between the two survey gears. More confidence in the strength of these year-classes will be developed over the next 1-2 years' surveys.

Both the 1995 Canadian survey in Div. 2J and 3K and the EU survey in Div. 3M also estimated the 1994 year-class at age 1 to be high. STACFIS reiterates its concern, however, that these estimates also be treated with caution until the year-class strength can be confirmed at older ages through subsequent surveys.

iv) **Biological studies**

Maturity in Greenland halibut (SCR Doc. 96/73). Maturity ogives were constructed for data collected from the Canadian commercial deepwater gillnet fishery in Div. 0B, 2G and 3K during August and September 1995. The catches were sampled from depths of 1 200-1 300 m in Div. 0B and 2G and 900-1 000 m in Div. 3K. Most fish sampled in Div. 0B and 2G were mature whereas in Div. 3K a large portion of the sampled catch was immature. The length at M_{50} decreased from south to north. When compared to previous years (1993 and 1994) for Div. 2G and 3K, considerable between year variability was observed with an increasing percentage of mature fish at length for both Divisions from 1993 to 1995.

Sex ratios and mortality (SCR Doc. 96/35). An analysis of the commercial fishery data from EU-Spain in the Regulatory Area from 1992-94 was reviewed. Results indicated that the ratio of males to females was similar only in the very small size groups (i.e. <30 cm) after which the proportion of females increased. There were virtually no males beyond 70 cm in length. Little difference was found in growth rate between males and females. Based on catch curve analyses, it was concluded that the natural mortality rate increased for males compared to females after males mature.

c) **Assessment Results**

According to the longer term indices of population size the fishable stock has declined substantially in recent years. The decline of age 6+ abundance was particularly evident from Canadian surveys in Div. 2J and 3K with recent estimates among the lowest levels observed. Data from the Portuguese otter trawl fishery in the Regulatory Area of Div. 3L also indicated that the commercial stock had declined to the lowest level observed by 1995, based on CPUE trends since 1988. Although the total catch in 1995 had been significantly reduced compared to the previous four years, STACFIS felt that it was too soon to expect any recovery of the stock.

The catch by commercial fishing vessels exhibited a relatively wide range of age groups, however, most of the catch continued to be comprised of young, immature fish most of which were several years younger than the age of sexual maturity.

In its 1994 and 1995 assessments, STACFIS indicated that the 1990 and 1991 year-classes were above average. Although STACFIS has no reason to change this view, no new data were available in the current assessment to further confirm this view. There were indications from survey data that the 1992, 1993 and 1994 year-classes may also be above average abundance. STACFIS cautions, however, that estimates of these cohorts at older ages need to be obtained in future surveys to confirm relative strengths of these cohorts more confidently.

15. **Roundnose Grenadier in Subareas 0 and 1** (SCR Doc. 96/29; SCS Doc. 96/3, 9, 13)

a) **Introduction**

A total catch of 154 tons, has been reported for 1995 compared to 33 tons for 1994 (Fig. 46).

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

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	0
Catch	0.1	0.4	0.5	0.08	0.29	0.19	0.12	0.20[1]	0.03[1]	0.28[1,2]	

[1] Provisional.
[2] Includes 128 tons non-reported and 24 tons roughhead grenadier from Div. 1A misreported as roundnose grenadier.

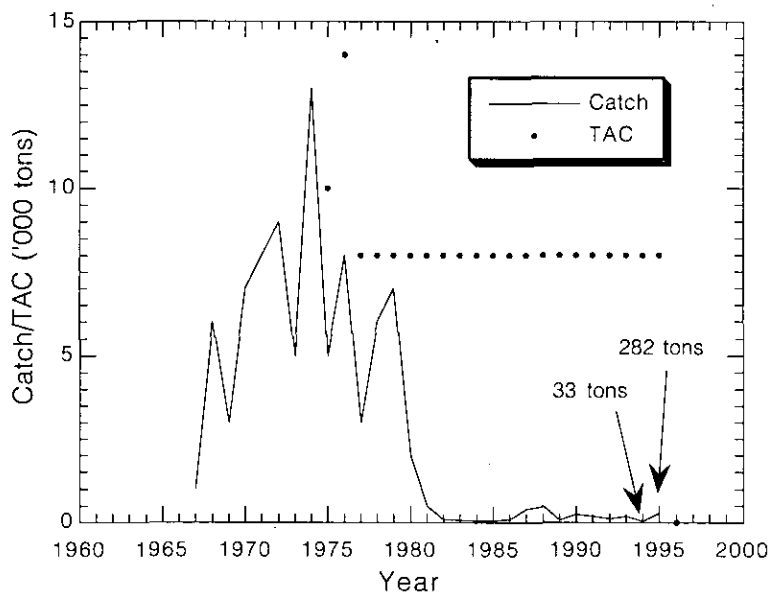


Fig. 46. Roundnose grenadier in Subareas 0+1: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

There has been no directed fishery for roundnose grenadier in Subareas 0+1 since 1978. The by-catch in the Greenland halibut fishery, which is mainly roundnose grenadier is reported to constitute between 3% and 36% of the Greenland halibut catches. No update of the catch/effort analysis which was presented previously (*NAFO Sci. Coun. Rep.*, 1985, page 72) was possible.

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 (Fig. 47):

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995
Biomass	45.8[1]	44.0[2]	5.9[3]	20.3[4]	41.7[4]	40.2[4]	8.2[4]	3.04[4]	6.67[4]

[1] June/July depth 400-1 000 m.
[2] September/October.
[3] April/May.
[4] August/September.

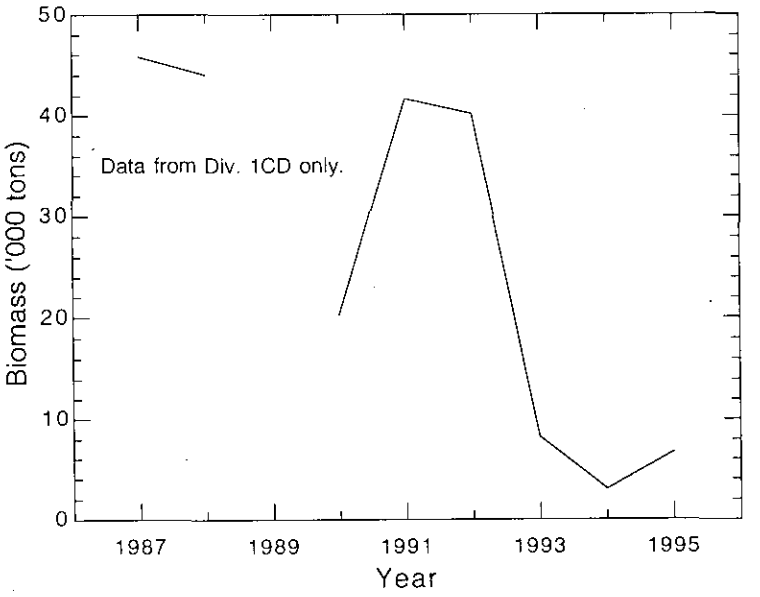


Fig. 47. Roundnose grenadier in Subareas 0+1: biomass estimates from surveys in Div. 1CD.

In 1995 a survey was conducted in August. The survey gave an estimated biomass of 7 000 tons, which is a significant increase compared to 3 000 ton in 1994, but still substantially below the level in the late-1980s and the early-1990s. Only a few roundnose grenadier were taken at depths less than 600 m and 76% of the biomass was found in Div. 1D in depths greater than >1 000 m.

The joint Japan/Greenland surveys do not cover the entire stock area as roundnose grenadier also occur deeper than 1 500 m and Subarea 0 is not included in the estimate. A Canadian survey in 1986 gave a biomass estimate for SA 0+1 on 110 000 tons, of which 90% was found in SA 1. USSR and GDR conducted surveys covering both Subareas in 1987, 1988 and 1990, and STACFIS **recommended** that *the biomass estimates for roundnose grenadier in Subareas 0+1 from the USSR and GDR surveys in 1987, 1988 and 1990 should be presented at the June Meeting in 1997.*

c) **Assessment Results**

The trawlable biomass for Subarea 1 is an underestimate of the total, but the biomass has decreased drastically compared to earlier years. Although there has been an increase in the estimated biomass in 1995 the biomass is still at a very low level.

16. **Roundnose Grenadier in Subareas 2 and 3** (SCR Doc. 96/12, 34, 39, 54, 69; SCS Doc. 96/12, 13)(with some comments on roughhead grenadiers)

a) **Introduction**

Catches of roundnose grenadier averaged about 26 000 tons prior to 1979, but since then have averaged slightly less than 4 000 tons (Fig. 48). Reported catches from 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 catches of roughhead grenadiers 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:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TAC	11	11	11	11	11	11	11	11	3[1]	3[1]	1[1]
Catch[2]	7	7	5	5	1	1-10[3]	3			•	
Catch[4]	7	8	6	5	4	8-14[3]	4	4[5]	3[5]	+[5]	

[1] Inside Canadian zone only.
[2] Includes adjustments reported in SCS Doc. 94/13, and SCR Doc. 94/29.
[3] Includes estimates of misreported catches which could not be determined precisely.
[4] Original as reported to NAFO.
[5] Provisional data.

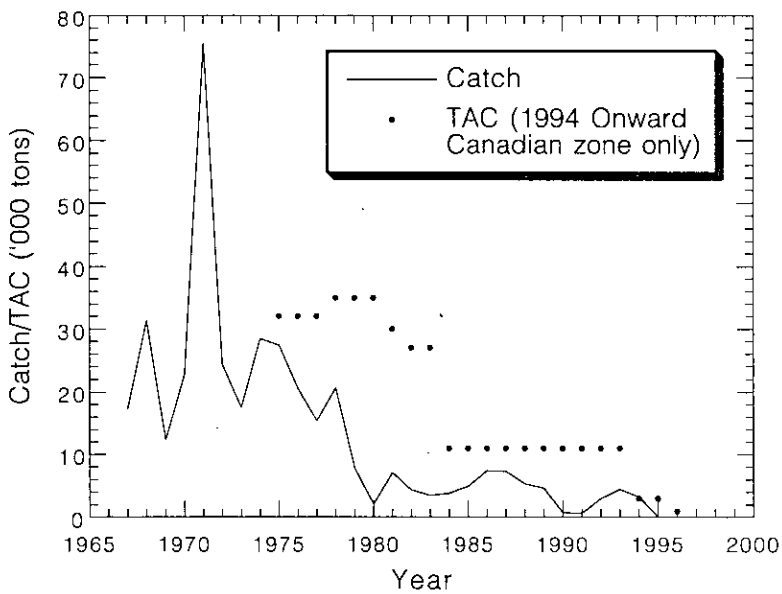


Fig. 48. Roundnose grenadier in Subareas 2+3: catches and TACs.

The estimated 1995 catch was only 59 tons, down from about 3 993 tons in 1994, all of which was reported by Japan.

Catches of *roughhead grenadiers* in the Regulatory Area ('000 tons) have been estimated to be:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Catch	+	1	1	0.3	3	4	5	6	5	3

b) **Input Data**

i) **Commercial fishery data**

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 grenadiers only.

ii) **Research survey data**

There are no new research survey data available for roundnose grenadiers. Information is available for roughhead grenadiers, but detailed examination of the various data for this species remains to be done.

17. Capelin in Divisions 3N and 3O

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 1996.

Nominal catches and TACs ('000 tons) for the recent period are as follows (Fig. 49):

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Advised TAC	0	10	10	18	30	30	30	0	0	0
TAC	0	10	15	28	30	30	30	0	0	0
Catch	0	1	7	9	25	+	+	+[1]	0[1]	0[1]

[1] Provisional.

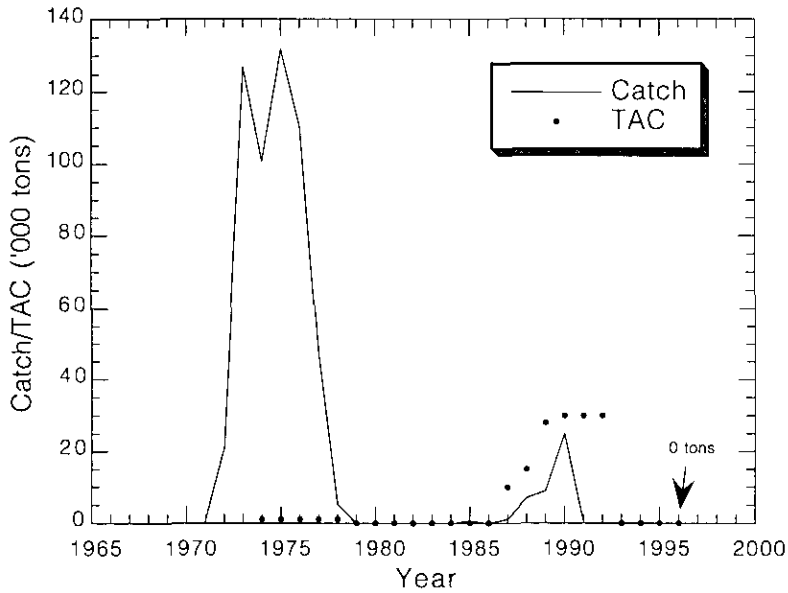


Fig. 49. Capelin in Div. 3N and 3O: catches and TACs.

b) **Input Data**

The mean estimate of biomass of capelin, based on acoustic survey carried out by the USSR was 900 000 tons during 1975-77. During 1981-88 the mean estimate was only 300 000 tons. The estimate from the 1994 survey was only 83 000 tons which represented an approximate 50% reduction from the 1993 estimate. No surveys were conducted in 1995 and none are planned for 1996.

During the 1990s, below normal oceanographic temperatures delayed the spawning season of capelin by about 4-6 weeks and resulted in extensions and shifts in distribution to areas such as Flemish Cap that are not normally part of the capelin distribution. It is not known the extent to which these changes have affected the distribution and spawning of Div. 3NO capelin.

18. Squid in Subareas 3 and 4

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 to 6 000 tons in 1994, mainly as a by-catch in the silver hake fishery of Cuba.

Nominal catches and TACs ('000 tons) for the recent period are as follows (Fig. 50):

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
TAC	150	150	150	150	150	150	150	150	150	150
Catch (SA 3+4)	1	+	1	7	11	4	2	3[1]	6[1]	1[1]
Catch (SA 5+6)				7	12	12	18	18[1]	20[1]	15[1]

[1] Provisional.

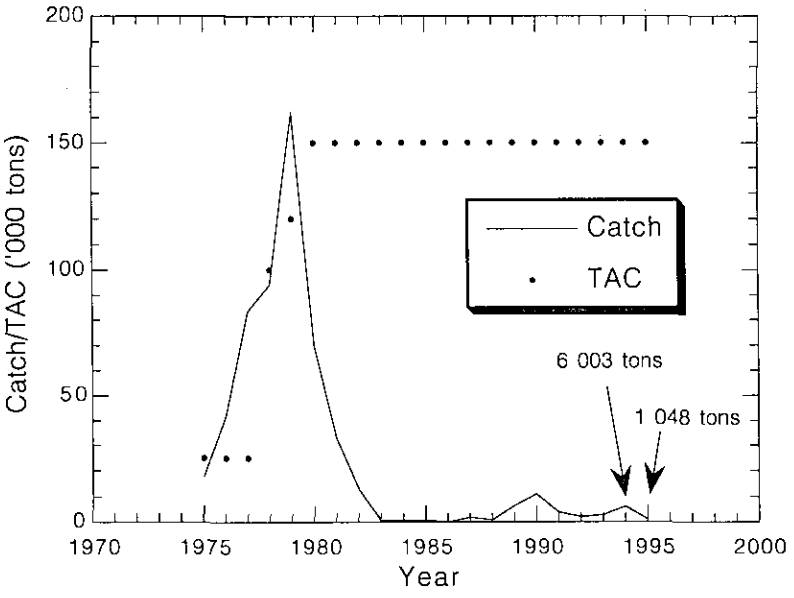


Fig. 50. Squid in Subareas 3 and 4: catches and TACs.

b) **Input Data**

There were no data available for review.

19. **Other Finfish in Subarea 1** (SCR Doc. 96/4, 5, 29, 36; SCS Doc. 96/4, 9, 13)

a) **Introduction**

Catches of Greenland cod, American plaice, Atlantic and spotted wolffishes, starry skate, lumpsucker, Atlantic halibut and sharks are 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. In 1995, reported catches of other finfishes amounted to 3 711 tons representing an increase of 9%, compared to the 1994 catch (3 373 tons). Most recent catches of other finfishes were dominated by Greenland cod (68%) and the category of non-specified finfish (17%).

Catch figures do not include catches discarded by the trawl fisheries directed to shrimp.

Nominal reported catches (tons) are as follows:

Species	1993	1994	1995
Greenland cod	1 896	1 854	2 526
Wolffishes	157	100	51
Atlantic halibut	43	38	23
Lumpsucker	246	607	447
Sharks	10	34	46
Non-specified finfish	411	643	618

b) **Input Data**

i) **Commercial fishery data**

By-catch information for the shrimp fishery was presented based on two sources; the Greenland shrimp survey catches taken within the areas of commercial fishery activities and 20 trawl hauls taken by a commercial trawler in 1996. Length frequencies derived from

commercial catches revealed that the shrimp trawl was capable of catching all predominant fish sizes in the stocks of American plaice and Atlantic wolffish. However, catchability was unknown. The estimated by-catch in 1994 in Subarea 1 was low. This however, might be explained by the severely depleted status of these stocks. Lacking further information on age composition and natural mortality of recruits, no proper method to assess the impact of the by-catches on survival rates was available.

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. 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 shifts were coincidental with dramatic changes in survey estimates of 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. 51), losses in abundance being less pronounced. Length distributions revealed that at present, these stocks are mainly composed of small and juvenile fish. In spite of the incomplete survey coverage (50 %), the estimates for 1995 do not indicate significant changes from this assessment. An assessment of the population dynamics of American plaice off West Greenland was presented for the first time. For the 1982-94 period, the analysis provides key information about geographic distribution patterns, growth, maturity, age composition, mortality as well as recruitment variation of this non-commercial stock based on survey data. Regarding the age composition and resulting high mortalities, concern was expressed about the application of the 1994 age-length key to the length frequencies of previous years due to a lack of otolith material. However, the results were consistent with findings of the other American plaice stocks in the Northwest Atlantic. The recently depleted status of the stock off West Greenland is explained by high mortality rates of fully recruited age groups. Sources of these high total mortalities could not be determined. Based on a spawning stock-recruitment relationship, it is suggested that short term recovery of the stock is unlikely.

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 1995, one stratified random bottom trawl survey was carried out. The estimated biomass of most species classified to other finfishes contributed 16% to the total finfish catch and remained unchanged at lowest level of the time series after a continuous decline up to 1992.

c) **Assessment Results**

In view of dramatic declines in survey abundance and biomass indices to extremely low levels, together with significant reduction in fish sizes, STACFIS concluded that the demersal stocks of American plaice, Atlantic and spotted wolffish and starry skates are severely depleted. The status of the demersal fish assemblage has remained at that low level since 1990 and there are no signs of any recovery.

STACFIS expressed concern about the continuing recruitment failure. Although data from 1994 indicated that the by-catches from the shrimp fishery are low, the possible impacts of the by-catches in this fishery are still unknown.

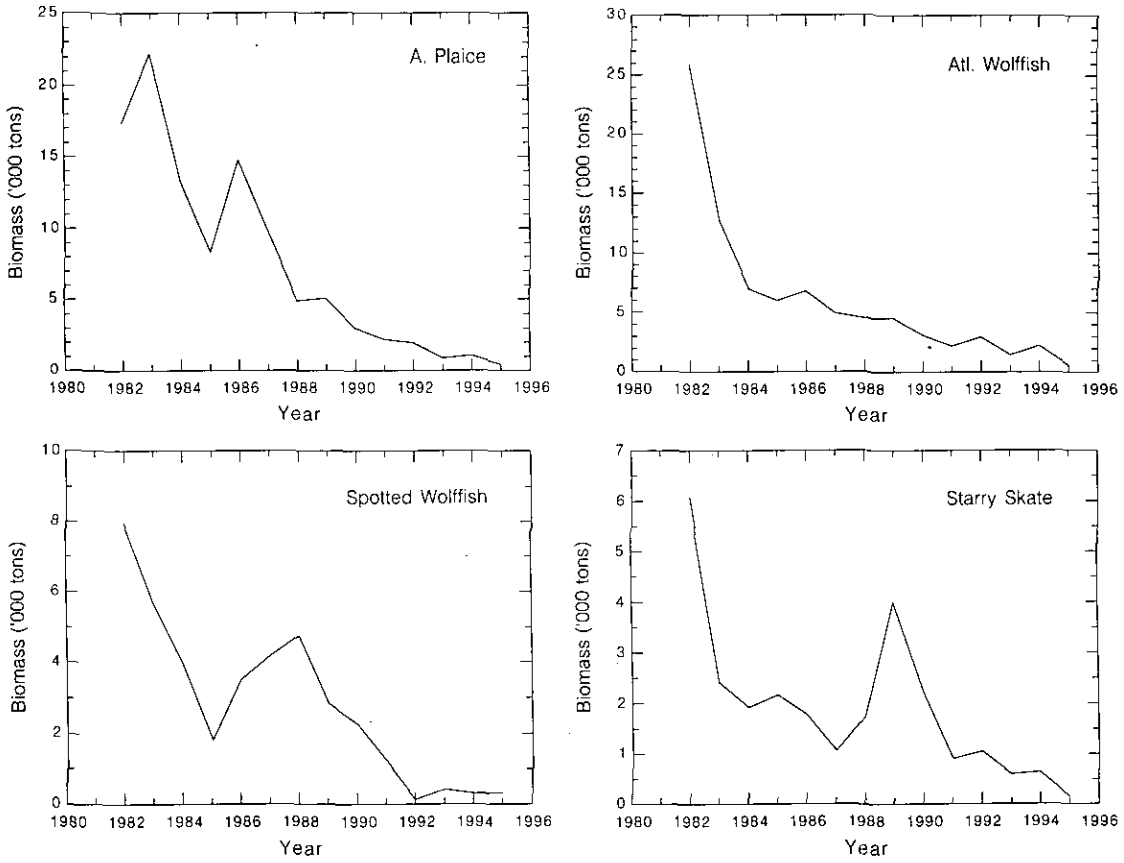


Fig. 51. Finfish in Subarea 1: estimates of biomass indices from German groundfish surveys, of various finfish species. Incomplete survey coverage in 1995 (50%).

d) **Recommendations**

STACFIS **recommended** that *the examination of the by-catch of Subarea 1 other finfish in the shrimp fishery be continued.*

STACFIS noted that time series of abundance and biomass indices of important by-catch species which could be derived from the Greenland shrimp surveys and the Greenland-Japan groundfish surveys were not available and **recommended** that *these should be presented at the June Meeting in 1997 on a species by species, as well as a length disegregated basis.*

IV. AGEING TECHNIQUES AND VALIDATION STUDIES

1. Silver Hake Ageing Methodology Report

STACFIS was informed that, J. Hunt (Canada) who had undertaken to produce this report, was understood not to be in a position to do so at this time. It was agreed, under this circumstance, to abandon the initiative. The necessity for this decision was regretted, as there has been considerable interest in the methods for ageing silver hake among scientists working on ageing problems of other hake species.

2. Report of the ICES Workshop on Age Reading of *Sebastes* spp.

As agreed to during the September 1995 Meeting, the co-Chairman, D. B. Atkinson (Canada), presented to STACFIS the report of the ICES sponsored Workshop on Age Reading of *Sebastes* spp. The meeting was held in Bremerhaven, Germany during 4-8 December 1995, with participants from Canada, Germany, Iceland, Norway, Russian Federation and Spain.

The goals of the Workshop included:

a) agree on most appropriate structure,

b) document appropriate terminology,

c) document similarities/differences in interpretations of the participants as well as reasons,

d) establish a set of protocols to be followed for age reading the agreed structure of North Atlantic redfish,

e) determine age validation requirements,

f) document differences between age determinations using agreed structure and other structures used in the past including comments on implications,

g) compile information on existing and historical datasets which may be useful in dealing with comparisons/conversions between structures,

h) recommending procedures for complete evaluation/conversion of historic data, and

i) make recommendations regarding future activities and schedules.

All of the goals were achieved during the Workshop. The most important recommendations were:

> *In future, all routine age reading for North Atlantic redfish should be done using otoliths. Inherent in this is the belief that proper interpretation of otoliths will yield the most accurate estimate of true age.*

and

> *Until such time as validation studies of scale interpretation are carried out using internationally approved methods, age estimation based on scale interpretation should not be used (except for considerations in relation to possible conversions of historical data).*

STACFIS was informed the final report (ICES C.M. Doc. 1996/G:1) also contains an extensive bibliography on redfish age determination.

3. **Update on Joint ICES/NAFO Workshop on Ageing of Greenland Halibut**

During 26-29 November 1996 an ageing workshop on Greenland halibut sponsored by both ICES and NAFO will be held at Reykjavik, Iceland, in order to standardize age interpretations of the species throughout the North Atlantic. The workshop will be co-convened by K. H. Nedreaas (Bergen, Norway) representing ICES and W. R. Bowering (St. John's, Canada) representing the NAFO Scientific Council. The workshop will focus on age readings from otoliths only.

Several otolith exchanges and respective analyses in advance of the meeting have already taken place among several countries to determine the extent of the variability and biases that currently exist. These exchanges and analyses have been conducted under the direction of G. Bech, Copenhagen, Denmark. At present there are scientists and research technicians totalling 16 individuals from 8 countries that have indicated their intentions to attend. When a final list of attendees has been confirmed the co-convenors will develop an agenda and a plan of work consistent with the number of attendees and levels of age reading experience.

V. OTHER MATTERS

1. **Report on Canadian Trawl Survey and Comparative Fishing Experiments**

a) **Groundfish Survey Trawls used at the Northwest Atlantic Fisheries Centre (NWAFC)** (SCR Doc. 96/50, 51)

Since the beginning of stratified random surveys in 1971 the Department of Fisheries and Oceans in St. John's Newfoundland has operated four different Fisheries Research Vessels (FRV) using

a corresponding number of unique commercial bottom trawls to conduct surveys in the Newfoundland region. Since the autumn of 1995 a new standard survey trawl, the Campelen 1800 shrimp trawl, has been used on board the *FRV Teleost* and the *FRV Wilfred Templeman*, and a quality control program was implemented to standardize fishing protocol.

Data on trawl performance and geometry were collected by an acoustic trawl instrumentation package and permitted a comparison of the survey trawls used on board the *FRV Teleost* and the *FRV Wilfred Templeman* used during the autumn survey. The use of this instrumentation and standardized fishing protocol aboard each vessel has minimized variation in towing speeds, bottom contact and tow duration during the survey.

There was a significant difference in door spread of the Campelen trawls from each vessel which had some effect on wing spread, trawl opening and bridle (herding) angles. The effect of this difference on trawl geometry, performance and herding abilities may be most significant when new data are collected on the *FRV Wilfred Templeman* fishing in depths up to 1 200 m. This makes it difficult to comment on the difference in fishing power of the two vessels. However, physically constraining door spread with a restrictor rope may standardize fishing power with little effect on performance and catchablity .

b) **Comparative Fishing Trial** (SCR Doc. 96/28, 77)

In 1995 Department of Fisheries and Oceans, Science Branch, Newfoundland region acquired a new research vessel the *FRV Teleost*. In an attempt to maintain continuity in the survey time series, a comparative fishing experiment was conducted between the *FRV Gadus Atlantica* using the Engels 145 hi-lift otter trawl with bobbin foot gear and the *FRV Teleost* using the Campelen 1800 shrimp trawl rigged with rockhopper foot gear. A total of 285 successful paired tows were conducted in the winter of 1995.

Equations have been developed for converting catches at length, of five major groundfish species, obtained by the *Gadus* to *Teleost* equivalents. A criterion was developed for determining whether one vessel fished on an aggregation missed by the other vessel and used as a basis to omit these data from the final analysis. The overall trends in annual abundance estimates from autumn stratified random surveys remained the same when the conversion factors were applied to cod and Greenland halibut in Div. 2J+3K. However, there was a divergence in the estimates for Greenland halibut from 1991 to 1994 in Div. 2J even though both indices were increasing. The conversion factors were very sensitive to numbers at small sizes and should be limited to the particular species size range encountered in this trial.

STACFIS accepted the conversion equation for Greenland halibut to reconstruct abundance indices to *Teleost* equivalents . It was considered premature to use the conversion for cod due to concerns over the precision at both ends of the size range. Research is continuing on this subject for American plaice, witch flounder and redfish.

Further studies. It was noted that further comparative fishing trials will be conducted between the Campelen and Engel trawls and the Campelen and the Yankee 41 shrimp trawl aboard the *FRV Wilfred Templeman.*

To resolve the high discrepancy between survey estimates from EU-Spain and Canada for several species, STACFIS **recommended** that *comparative fishing trials between EU-Spain and Canada take place in May 1997 while both countries are conducting their surveys in the Regulatory Area of Div. 3NO.*

c) **Canadian 1995 Autumn Survey** (SCR Doc. 96/27)

In 1995 Canada again conducted a stratified-random survey in NAFO Div. 2J, 3K, 3L, 3N and 3O. The duration extended from September 1995 to January 1996. With a change to the Campelen 1800 shrimp trawl, 2 existing Juvenile groundfish surveys were combined with the annual autumn survey. Allocation of sets was proportional to stratum area within a Division and a minimum of 2 sets in each stratum. Additional sets were allocated in five strata in Div. 3NO to meet requirements of the juvenile flatfish survey.

The original survey plan provided an acceptable compromise between the timing of previous juvenile flatfish surveys (August-September) and autumn groundfish surveys (October-November) in Div. 3NO, and matched the timing of past Div. 2J+3KL surveys reasonably well. However, with

delays and mechanical problems with the *RV Teleost* the Div. 2J+3K portion of the survey required an additional 3 weeks to be completed. Even with the additional time the coverage was poor in northern regions of Div. 2J and no deepwater (>731 m) sets were conducted in Div. 3NO. Completion of the survey was some six week later than usual. 1996 was the first year the *RV Wilfred Templeman* was used in Div. 3K and no conversions factors for *FRV Wilfred Templeman* (Engel *vs* Campelen) exist as yet.

2. Other Business

There being no other business, the Chairman, prior to the adjournment, thanked the participants and in particular the Designated Experts, along with the Secretariat for their work during the meeting. STACFIS welcomed the incoming Chairman, J. Casey (EU-United Kingdom), who will begin after the September 1996 Meeting.

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

Chairman: D. Power Rapporteur: M. B. Davis

The Committee met at Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada on 9 and 12 June 1996, to discuss various matters pertaining to statistics and research referred to it by the Scientific Council. Representatives from Canada, Denmark (in respect of Faroe Islands and Greenland), the European Union, Japan, Russian Federation and the United States of America were present.

1. Opening

The Chairman opened the meeting welcoming participants. M. B. Davis (Canada) was appointed rapporteur. The status of the recommendations from the 1995 meetings of STACREC were reviewed. It was agreed that most of the recommendations would be addressed in the agenda of the meeting, and no other immediate consideration would be needed.

2. Fisheries Statistics

a) Progress Report on Secretariat Activities in 1995/96

i) Acquisition of STATLANT 21A and 21B reports for recent years

In 1995, the General Council was informed of the concerns of STACREC relative to outstanding data for STATLANT 21A and 21B, particularly with respect to the deadlines for submissions. As of the start of this June meeting, there were still a number of outstanding submissions.

The Committee noted that while the June 30 deadline for STATLANT 21B data is not practical for EU Statistical Agencies for the delivery of data from the previous year, it also indicated that the current situation of delays of two to three years in delivery of data from some Contracting Parties was undesirable. It was noted that the submission deadlines of May 15 (STATLANT 21A) and June 30 (STATLANT 21B) were adopted into the Rules of Procedure for the Scientific Council and therefore part of the Convention. Accordingly, STACREC **recommended** that *the Scientific Council inform the General Council that submission of data has not improved but in fact the situation has deteriorated, and emphasised that the Scientific Council work is seriously stifled by the lack of fishing data in time for the June Meeting.*

The following table provides a list of outstanding data:

STATLANT 21A		STATLANT 21B	
1994	1995	1993	1994
Cuba	Canada (SF only)	Faroes	Canada (SF only)
Korea	Cuba	USA	Cuba
Lithuania	Estonia	Russia (to resubmit)	E/Denmark
USA (partial)	E/Denmark	France (SP)	E/Great Britain
	E/Spain		Faroes
	Faroes		Greenland
	Greenland		Korea
	Lithuania		Lithuania
	USA		Norway
	France (SP)		USA
			France (SP)

In addition, STACREC highlighted that notification of no fishing activity is as important as fishing data.

ii) **Acquisition of statistical information from other NAFO Standing Committees**

As in 1995, STACREC noted that some information made available in reports and Working Papers of other Standing Committees was being used by Designated Experts in the stock assessment process. The Secretariat provided a list of relevant documents to Designated Experts in February 1996. Although there was no feedback given to the Secretariat, it was agreed that providing this list on an annual basis would be useful.

iii) **Publication of statistical information**

NAFO Statistical Bulletin, Vol. 42, containing 1992 data was published. Clarification of 1989-92 data from EU/France (M) and France (St. Pierre and Miquelon) was not received so only the provisional data were published.

The Secretariat informed STACREC that the STATLANT database was being transferred to Microsoft Access software running under Windows 95. The old dBase database was inadequate for responding in a timely fashion to short-notice requests for information. The new system will provide increased flexibility to respond to these requests. However, STACREC observed that the transfer was not finished in time for the June 1996 Meeting, but was expected to be up and running prior to the September meeting.

Regarding *NAFO Statistical Bulletin,* Vol. 43, there were a number of issues pertaining to the 1993 data which must be clarified prior to publication. These include a number of items in the above table such as missing data from the USA and the Faroe Islands and data from the Russian Federation which required clarification. The Committee agreed that publication be delayed until the data problems were reconciled.

iv) **Considerations of non-availability of data**

Provisional nominal catches and the decadal list of catches by stock area have not been available for the last two June Scientific Council meetings. The Committee agreed that available data will be published as Working Papers until such time as they can be finalized for inclusion in the SCS Doc. series.

v) **Considerations on documentation of catches used in the assessment process**

STACREC acknowledged that the persistent divergence in recent years between the 'official' nominal catches reported in STATLANT forms and those that are available from other sources and used in stock assessments needs to be noted to users of STATLANT data, and accordingly, STACREC **recommended** that *a special note be appended to the appropriate sections of all documents reporting STATLANT data, indicating that users of the data should note that the actual catches for some species/stocks may differ from those reported in the document.* As such the user should also be directed to the relevant Scientific Council Reports for information on the assessments.

With regard to previously published Statistical Bulletins, STACREC also **recommended** that *a special note be circulated to recipients of previous issues of the Statistical Bulletin indicating that the Scientific Council had in some years used estimated catches from other sources of data to determine actual catch levels for stock assessment purposes.*

b) **Gear Codes**

With the introduction of gear, particularly a new twin trawl in the Div. 3M shrimp fishery, there has been a requirement to modify the STATLANT 21B questionnaire to include the new codes. The Secretariat reported that modifications had been made for the twin trawl shrimp gear. This gear will now be reported as gear code 19 'otter shrimp twin trawl' (OTS).

c) **Catches not Specified by Species**

In 1995, the Secretariat contacted certain Contracting Parties to clarify outstanding catches of non-specified flounder and determine if future reporting could be broken out by species. The Canadian Maritime region indicated that it could not report all catches by species while the Canadian Newfoundland Region reported that it was possible to report nearly all of the catches by species. South Korea was contacted but to date have not responded.

In the Regulatory Area, roughhead grenadier has been reported as roundnose grenadier by EU-Spain and EU-Portugal. The EU representative indicated that the appropriate forms indicating species would be circulated to EU Member States, and this should remedy the reporting situation. STACREC reiterates that catches should be reported by species as outlined in the Guidelines for the STATLANT forms.

d) **Reporting of Catches for *Pandalus borealis***

It was noted that *Pandalus borealis* in Div. 3M has been reported as northern deepwater prawn and pink (= pandalid) shrimp and appears as such in the *NAFO Statistical Bulletin*. In the past, the interpretation was that shrimp north of Div. 3K was Northern shrimp (Code 632) because *Pandalus borealis* was the only species occurring in the shrimp fisheries. Recently, significant catches of *P. montagui* have been taken in Div. 0B, and there is now a likely confusion in the interpretation of those data coded as 639 (pink shrimp). Suggestions to resolve the problem will be solicited from the Designated Experts, and this matter will be addressed at the Annual September 1996 Meeting when shrimp scientists will be present.

e) **Catch Statistics for Seals**

Inconsistencies have been observed in the reporting of Greenland seal catches. In some years, the numbers caught were estimated from pelt sales, and this was thought to result in an underestimate of total removals. While it was acknowledged that the statistics have been clarified as far as possible, STACREC decided to attach footnotes to seal statistics published in the *NAFO Statistical Bulletin*, to inform the users of the inconsistencies.

f) **Preparation for CWP 17th Session, March 1997**

The Inter-agency Consultation in preparation for the 17th Session of CWP is scheduled to take place 9-10 July 1996 in Rome, Italy. The agenda items will be addressed and any preparations required for the March 1997 CWP Meeting will be identified. The Assistant Executive Secretary of NAFO will attend the Rome meeting.

The 17th Session of CWP is scheduled for the 3-7 March 1997 in Hobart, Tasmania, Australia. The meeting will deal with the complete agenda that is prepared in Rome. The Assistant Executive Secretary will prepare an outline of statistical activities of NAFO and identify needs identified by the Scientific Council prior to the CWP Meeting. It was suggested that before the CWP Meeting, an examination of definitions of fishing effort as they are printed in STATLANT 21B and other items listed in the STATLANT questionnaire be undertaken to see if they are still currently applicable.

It was noted that the Council made a recommendation last year that along with the Chairman of STACREC, the Assistant Executive Secretary would represent NAFO at the 17th Meeting of CWP.

With respect to national representation, STACREC at this meeting also **recommended** that *a representative from Japan be requested to attend the meeting to represent the Scientific Council at the 17th Session of the CWP.*

3. **Biological Sampling**

a) **Report on Activities in 1995/96**

The provisional list of biological sampling for 1994 was tabled (SCS Doc. 96/5), with a request to National Representatives to provide updates and/or corrections.

b) **Report by National Representatives on Commercial Sampling Conducted**

Cuba: No report available.

Canada (N): Canadian commercial fisheries in 1995 remained reduced because of continued moratoria and reduced TACs. Shrimp catches remained high and landings for crab increased compared to 1994. Data relative to length and age were collected for most commercial catches as required from Subareas 0-5. Sampling at sea was accomplished by observers and extensive sampling for cod was conducted on the Div. 2J+3KL and Div. 3P and Div. 4R Sentinel surveys.

Canada (M): Canadian commercial fishing activity continued to be restricted in 1995, due to low TACs and closures. Where commercial catches occurred, data on length composition and ageing material were collected through port sampling programs and at sea observers. These programs were supplemented in 1995 by many initiatives where data were collected in partnership arrangements with commercial fishing interests. 'Sentinel' surveys were conducted using commercial fishing vessels in Div. 4T, 4Vn, 4VWX, 4X and 5Z. In addition, two industry surveys were conducted for under-utilized species: a deep-sea survey to investigate the viability of various species, primarily grenadiers, and a monkfish (*Lophius americanus*) directed survey.

Several tagging projects were conducted by the commercial industries in 1995, with tags applied to herring, Div. 4X winter flounder, Atlantic halibut, swordfish and porbeagle shark.

Denmark-Greenland - Subarea 1: Sampling at sea for shrimp and Greenland halibut (trawl and longlines). Sampling in port for Greenland halibut from trawl and longline fisheries cod (pound net) and salmon (gillnet). Ongoing biological studies on shrimp, Greenland halibut, salmon, cod, snow crab, scallops were continued. Standard oceanographic studies (transects) during summer were continued.

EU - Denmark: No report available.

EU-France: No sampling, no fishing.

EU-Germany - Subarea 1: In the annual groundfish survey there were only 35 valid tows due to technical problems. Biological samples were taken along with CTD casts and two standard transects.

EU-Portugal: 3 trawlers and 2 gillnetters were sampled in 1995. Trawlers gathered data from February to October, while the gillnet fishery was sampled from April to July. Catch rate, biological information and depth ranges were recorded.

EU-Spain: The Spanish national sampling program was replaced by the NAFO Observer Program. Consequently, no biological sampling was conducted in 1995. There will be two observers gathering biological data on commercial vessels in 1996. There will be three surveys: the EU (Spain and Portugal) Flemish Cap Survey in July, the EU Flemish Pass survey in February, and the Tail of the Grand Bank survey in April.

Japan: There were 3 vessels in NAFO waters and Greenland halibut data were gathered from one.

Russian Federation: Information for Greenland halibut relative to catch rates in SA 2+3, relative to length of Greenland halibut in Div. 3L and Div. 3M and redfish in Div. 3M were obtained. There will be 2 Russian surveys in Div. 3M in 1996 and there will be one observer on a shrimp vessel.

USA: Approximately 42 700 age determinations were completed for 15 species of finfish and shellfish derived from research vessel surveys and commercial port samples.

c) **Report on Data Availability for Stock Assessments (by Designated Experts)**

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 (1995).

			Biological Sampling					
Stock	Country[1]	Catch	CPUE	Sex	Length	Age	Individual Weight	Maturity
3M Cod	E/PRT	+	X		X	X	X	
	E/ESP	+						
	FAR	+						
	OTHERS	+						
3NO Cod	CAN	+						
	E/PRT	+		X	X	X	X	
	NCP	+						
SA 1 Redfish	GRL	+	X		X			
3LN Redfish	CAN-M	+						
	CAN-N	+						
	JPN	+						
	E/PRT	+	X	X	X	X		
	RUS	+						
3M Redfish	E/PRT	+	X	X	X	X	X	
	RUS	+		X	X			
	JPN	+						
	LVA	+						
	NOR	+						
4VWX Silver hake	CAN	+	X	X	X	X	X	X
3LNO American plaice	CAN-M	+						
	CAN-N	+						
	E/PRT	+		X	X			
	E/ESP	+						
3M American plaice	E/PRT	+		X	X	X	X	
3NO Witch flounder	E/PRT	+			X			
	CAN	+						
3LNO Yellow-tail flounder	E/ESP	+						
SA 0 + 1B-F Greenland halibut	GRL	+	X	X	X	X		
	NOR	+	X					
	RUS	+						
	CAN	+						
	JPN	+	X					
1A Greenland halibut	GRL	+		X	X	X	X	
SA 2+3 Greenland halibut	CAN	+	X	X	X	X		
	E/PRT	+	X	X	X	X	X	
	RUS	+		X	X			
SA 0+1 Roundnose grenadier	GRL	+		X	X			
	JPN	+						
	RUS	+						

Table 1. (continued)

		Biological Sampling						
Stock	Country[1]	Catch	CPUE	Sex	Length	Age	Individual Weight	Maturity
SA 2+3	E/ESP	+	X	X				
Roundnose grenadier	JPN	+						
3L Capelin	CAN			X	X	X	X	X
3NO Capelin	CAN							
SA 3+4 Squid	CAN	+		X	X			
SA 1 Other Finfish								
Greenland cod	GRL	+						
Wolffish	GRL	+						
Atlantic halibut	GRL	+						
SA 0+1 Shrimp	GRL	+	X	X	X	X	X	X
Denmark Strait Shrimp	GRL	+	X	X	X	X	X	
3M Shrimp	CAN	+	X		X	X		
	EST	+	X					
	FRO	+	X					
	GRL	+	X	X				
	ISL	+	X					
	NOR			X				

[1] Country abbreviations as found in *NAFO Statistical Bulletin*; 'OTHER' and 'NCP' refer to estimates of non-Contracting Parties who did not report catches to NAFO.

4. Biological Surveys

a) Review of Survey Activities in 1995

An inventory of biological surveys conducted in 1995, 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 1995 relative to their stocks.

Table 2. Inventory of biological surveys conducted in the NAFO Area during 1995.

Subarea	Division	Country	Month	Type of survey	*No. of* sets
				Stratified-random Surveys	
1	A-F	GRL	7-8	Trawl survey for shrimp and groundfish	194
	B-D	GRL+JPN	8-9	Trawl survey for Greenland halibut	80
	D-F	E/DEU	10	Groundfish, oceanography	35
2+3	JKLMNO	CAN-N	9-12	Groundfish	455
			11-12	Groundfish	152

Table 2. (continued)

Subarea	Division	Country	Month	Type of survey	No. of sets
3	K	CAN-N	4	Greenland halibut	
	LNO		5-6	Groundfish	330
	M	EU	7	Groundfish	121
		RUS	5	Groundfish	58
	NO	E/ESP	5	Groundfish	77
	P	CAN-N	4	Groundfish	181
	Ps		2	Groundfish	42
3+4	PV	CAN-N	8	Redfish/deepwater survey	156
4	VW	CAN-M	3	Spring groundfish	
			7	Summer groundfish	
	WX	CAN-M	10	Silver hake juvenile	
	X	USA	4	Spring bottom trawl	14
		CAN-M	7	Summer groundfish	
		USA	8	Gulf of Maine bottom trawl	4
			10	Autumn bottom trawl	9
5	Y	USA	8	Gulf of Maine bottom trawl	77
				Northern shrimp trawl	53
	YZ		3-4	Spring bottom trawl	169
			9-10	Autumn bottom trawl	198
	Z	CAN-M	3	Georges Bank groundfish	
		USA	2-3	Winter bottom trawl	69
			6-8	Sea scallop	254
6	ABC	USA	2-3	Winter bottom trawl	86
			3	Spring bottom trawl	152
			6	Sea scallop	230
			9	Autumn bottom trawl	153
				Other Surveys	
1	A	GRL	7-8	Longline, inshore Greenland halibut	52
	B-F		6-7	Gillnets, inshore juvenile cod	196
2+3	JKL	CAN-N	2	Seal distribution and feeding	
			6-7	Juvenile/adult cod acoustics	32
			7	Oceanography	
			9	0-group cod and capelin	66
			9-10	Capelin acoustics	28
	JKLN		3-4	Harp and hooded seal distribution	
	JKLNO		9	0-group cod and capelin	73
3	K	CAN-N	10	Herring acoustics	
	KL		9-10	Groundfish	44
	L	EU	2	Selectivity of trawls	
		CAN-N	4	Inshore cod stock structure	
			5	Inshore cod acoustics	
			5-6	Crab	27
			6-7	Experimental trawling	
			7	Ichthyoplankton dynamics	120
			7	Gear trials	106
			8	Crab	26
			9	Crab	49
			9	Crab	40
			11	Inshore stock structure of cod	
	LN		6	Iceland scallops	
	LNOP		1-3	Comparative fishing	
	M	RUS	5	Greenland halibut	13
	Ps	CAN-N	1	Herring acoustics	

Table 2. (continued)

Subarea	Division	Country	Month	Type of survey	No. of sets
				Other Surveys	
3	Ps	CAN-N	1-2	Cod acoustics	
			2-3	Gear trials	
			10-11	Juvenile cod habitat research	
4	R	CAN-N	8	Iceland scallops	111
	RS		4-5	Groundfish acoustics/trawling	
	V	CAN-M	6	Cod recruitment	
			10	Cod recruitment	
	X	USA	1	Ecosystem monitoring	13
			6	Ecosystem monitoring	10
			7-9	Marine mammal	
			7-9	Marine mammal/harbour porpoise	
		CAN-M	11	Larval herring	
			11	Ecosystem monitoring	12
5	Y	USA	7-9	Marine mammal/harbour porpoise	
	YZ		1	Ecosystem monitoring	38
			6	Ecosystem monitoring	74
			7-9	Marine mammal	
			11	Ecosystem monitoring	50
	Z	CAN-M	8	*Georges Bank scallops*	
			11	Larval herring	
	Ze	USA	3	GLOBEC stratification	36
			4	GLOBEC mooring	4
			4	GLOBEC stratification	152
			4	Predator-prey shakedown	6
			4-5	Predator-prey	142
			5	Globec stratification	215
			5	GLOBEC broad scale	264
			6	GLOBEC broad scale	240
			6-7	Predator-prey	110
			7	GLOBEC broad scale	230
			7	Predator-prey	126
			10-11	GLOBEC mooring	15
	Zw		1	Gear comparison	103
			8	*Trawl standardization*	19
6	ABC	USA	6	Ecosystem monitoring	53
			11	Ecosystem monitoring	49
	BC		3	Harbour porpoise	
	GH	RUS	5-7	Alfonsino	33

b) **Surveys Planned for 1996 and Early-1997**

An inventory of biological surveys planned for 1996 and early-1997, 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 1996 and early-1997.

Area	Country	Type of Survey	Dates
		Stratified-random Surveys - 1996	
1A-F	GRL	Trawl survey for shrimp and groundfish	Jul-Aug
1B-F	E/DEU	Groundfish, Oceanography	Sep 20-Oct 31
2GH	CAN-N	Groundfish	Sep 16-Oct 11
	JPN/CAN-N	Groundfish	Aug 1-30
2J+3KLNO	CAN-N	Groundfish and juvenile	Sep 23-Dec 20
2J+3KLMNO		Groundfish trawl/acoustics	Oct 21-Dec 20
3LM	RUS	Greenland halibut	Feb 17-24
3LNO	CAN-N	Groundfish	May 6-Jun 28
3NO	E/ESP	Groundfish	May 7-24
3M	EU	Groundfish	Jun 21-Jul 23
	RUS	Groundfish	Apr 30-May 12
3N	EU	Groundfish	May
3P	CAN-N	Groundfish	Apr 9-May 3
3Ps	CAN-N/EU-FRA	Scallops	Mar 15-22
3OP+4R	CAN-N	Redfish and groundfish	Jul 30-Aug 16
3Pn+4R		Groundfish	Jan 3-25
4VW	CAN-M	Spring groundfish	Mar
		Summer groundfish	Jul
4WX		Silver hake juvenile	Oct
4X		Summer groundfish	Jul
4X+5YZ+6A	USA	Fishing power	Sep 23-Nov 11
4X+5YZ +6ABC		Spring bottom trawl	Mar 4-Apr 26
4X+5YZ +6ABC		Autumn bottom trawl	Sep 9-Nov 1
5Y	USA	Gulf of Maine trawl	Aug 5-16
		Northern shrimp trawl	Aug 5-16
5Z	CAN-M	Spring Georges Bank	
5YZ+6ABC	USA	Winter bottom trawl	Feb 5-Mar 2
5Z+6ABC		Sea scallop	Jul 29-Aug 26
		Other Surveys - 1996	
1A	GRL	Longline, inshore Greenland halibut	Jul-Aug
		Scallops	Sep
1D-B		Gillnets, inshore juvenile cod	Jun-Jul
2J	CAN-N	Cod/shrimp acoustics	Feb 6-16
2J+3KL	CAN-N	Oceanography	Apr 24-May 5
		Seal sampling	Apr 24-May 3
		Acoustic research - cod	Jun 3-21
		Oceanography	Jul 16-Aug 4
		Marine salmon	Sep 9-30
2J+ 3KLNO		Multi-species 0-group survey	Aug 19-Sep 6
2J+ 3KLMNO		Multi-species 0-group survey	Aug 19-Sep 6

Table 3. Continued.

Area	Country	*Type of Survey*	Dates
3K	CAN-N	Crab	Sep 3-20
		Herring acoustics	Nov 2-29
3KL		Seal sampling	Jan 20-29
3L		Inshore cod acoustics/sampling	Apr 15-26
		Cod acoustics	Apr 29-May 8
		Juvenile cod habitat study	May 10-24
		Capelin acoustics survey	May 13-31
	RUS	Greenland halibut	May 13-28
	CAN-N	Crab	May 27-Jun 14
		Zooplankton	Jun 17-18
		Experimental trawling	Jul 2-12
		Crab	Jul 29-Aug 9
		Crab	Sep 23-Oct 4
		Juvenile cod habitat study	Oct 7-31
		Inshore cod acoustics/sampling	Dec 2-13
3LM		Iceland scallops	Apr 23-May 3
3LMN	EU	Longline	Apr-May
3LNO		Comparative fishing	Jan 27-Feb 18
			Jan 29-Feb 16
			Feb 3-21
			Mar 16-30
			Mar 18-28
		Gear trials	Jul 9-19
3LPs		Fish behaviour and catchability	Aug 12-30
3Ps		Herring acoustics	Jan 8-Feb 2
3P+4V	CAN-N	Acoustic survey - redfish	Jan 6-17
		Acoustic research - redfish	Jul 22-28
4V	CAN-M	Cod recruitment	Jun
		Cod recruitment	Oct
4X		Larval herring - Bay of Fundy	
4X+5YZe	USA	Porbeagle	Sep 5-20
4X+5YZ+6A		Fishing power	Sep 23-Nov 1
4X+5YZ +6ABC		Ecosystem monitoring	Nov 4-19
5Y	USA	Ecosystem monitoring	Jan 29-Feb 2
		Harbour porpoise	Aug 6-28
		Harbour porpoise food	Aug 19-Sep 2
5YZe		Cod spawning	Jan 16-26
		Cod/haddock spawning	Mar 1-12
5Ze		GLOBEC broad scale	May 6-17
		Predator-prey	May 20-31
		GLOBEC broad-scale	Jun 3-14
		Predator-prey	Jun 17-28
			Aug 28-Sep 6
		GLOBEC mooring	Nov 4-13
5Z	CAN-M	Larval herring - Georges Bank	Nov
	USA	Marine mammal	Jun 17-Jul 31
6BC	USA	Apex predator	Apr 14-May 26

Table 3. Continued.

Area	Country	Type of Survey	Dates
		Surveys Planned for Early-1997	
3K	CAN-N	Herring acoustics	Jan 6-31
3KL		Seal assessment	Mar 10-28
3L		Cod catchability and trawls	Mar 3-14
3LNO		Comparative fishing	Feb 3-21
3LPs		Fish behaviour and trawling	Feb 3-28
3Pn+4R		Groundfish (stratified)	Jan 3-30

c) **Review of Stratification Schemes**

A document outlining errors and subsequent corrections to the stratification scheme in Div. 3P was tabled. The errors occurred in the transcribing of the NAFO line separating Div. 3P and Div. 4V onto stratification charts. The charts were revised reflecting the true line. In the process of revising the charts more precise positions based on pilot references were also determined for lines defined in part by headland points of reference. STACREC considered that these revised references would be useful to facilitate the drawing of accurate stratification charts, yet would not alter the basic statistical areas for reporting purposes but would require a change to the text in NAFO Convention Annex III describing the scientific and statistical Subareas, Divisions and Subdivisions. Accordingly, in order to provide an accurate position of headland references relative to Div. 3P (NAFO Handbook, 1996, see text with respect to Subarea 3 on pages 43-45), as described in SCR Doc. 96/55, Serial No. N2731, STACREC **recommended** that *the Scientific Council address the issue of revising NAFO Convention text in Annex III relative to Div. 3P as follows:*

- *define "Cape Ray" as 47°37.0' north 59°18.0' west*
- *define "Cape North" as 47°02.0' north 60°25.0' west*
- *replace "Burgeo Island" with 47°30.7' north 57°43.2' west*
- *replace 46°50' north 58°50' west with 46°50.7' north 58°49.0' west.*

d) **Update on Coordination of Surveys**

Information relative to this item was considered under the Scientific Council agenda.

In addition, EU-Portugal reported that the EU research community funded the Div. 3M surveys from 1993 to 1996. It was noted that 1996 will be the last year for the Flemish Cap survey but that a proposal has been forwarded to the European Commission to continue this time series. The Committee noted that the Flemish Cap survey was an important source of information relative to providing advice for many stocks in Div. 3M.

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 June 1995 meeting of STACREC 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 meeting, however, no document was tabled at this meeting. It was noted that an analysis of Div. 2J and 3KL information by Canada has been conducted and should be available for the June 1997 meetings. It was also noted that there was some information available from the EU from Div. 3LMN, and the data will be tabled in future.

6. Review of SCR and SCS Documents

a) Interannual variations in feeding intensity and structure of trophic links of prespawning cod on the Newfoundland Shelf (Div. 3L) (SCR Doc. 96/10)

Results from Russian bottom trawl surveys in 1978-91 indicated that mature cod on the Newfoundland Shelf fed rather actively before spawning, and intensity of their feeding showed little or no reduction with gonad maturation. The main reason of prespawning cod feeding activity reducing on the spawning grounds was the absence of the prey species.

The most intensive feeding of prespawning cod was observed in 1982-86; cod fed on capelin actively. In the beginning and in the end of the investigation period, intensity of cod feeding was average but since 1989 it has been observed to be comparatively low. In this period, cod fed on capelin less actively but more actively on shrimp and crabs. Sand lance were of marked importance in the feeding by prespawning cod until 1985.

The highest fatness was registered in 1981-82 and in 1985, the lowest in 1989-91. No distinct relation between fatness and the intensity of feeding cod moving to Newfoundland shores was found.

b) By-catch species in the Greenland halibut Spanish fishery (NAFO Divisions 3LM and 3NO): 1991-1994 (SCR Doc. 96/12)

The specific composition of by-catch was studied. 17 species, their presence calculated by depth strata, month, division and variations in monthly yield by Division in the Spanish Greenland halibut fishery, developed in the NAFO Regulatory Area for the period 1991-94.

Two groups of species were identified depending on the importance of their presence in catches: the more and less frequent species. The more frequent species were considered to be those with a value of above 5 kg/hour annual yield, i.e. skate, roundnose grenadier and rough-head grenadier, American plaice, witch flounder and redfish. Analyzing the data on a monthly basis, however, revealed higher values of yield than other species. Some species showed a pattern by station such as grenadiers, skate and American plaice, particularly in Div. 3N. On the other hand, other species had increased yields in recent years.

In this fishery, the characteristic species of the demersal fisheries (skate, American plaice) showed a wider bathymetric distribution than those considered typical in each case.

The transfer of effort southwards (Div. 3NO) in recent years, mainly in the case of small vessels, had meant variation in the composition and relative abundance of by-catch in this fleet.

c) Preliminary results from selectivity of "SORT-V" sorting grid system on the basis of single grid regarding the Greenland halibut (*Reinhardtius hippoglossoides*) in the NAFO Regulatory Area (Div. 3L) (SCR Doc. 96/37)

Selectivity of "SORT-V" sorting grids of 1.2 m long and of 1 m width with 35-40 mm bar distance were experimented. For the system with 35 mm bar system, the fish size resulting in 50% retention made up 33.1-33.8 cm and the selectivity range 3.6-4.2 cm. For the system with the 40 mm bar distance these parameters were 33.8 and 12.9 cm, respectively. Specimens below 30 cm long escaped completely. Thus, the SORT- system with 35 mm grid completely provided a fulfilment of

fisheries rules with regards to Greenland halibut minimum length allowable for catch.

d) **Russian investigations and deep water fishery on the Corner Rising** (SCR Doc. 96/38)

The USSR/Russia have been carrying out the investigations and an exploratory fishery on the 'Corner Rising' (34°-37°N, 47°-53°W) since 1976 and the document provides the list of 26 expeditions of research and exploratory vessels to 1996. The total catch during that period amounted to 19 500 tons. The ichthyofauna on the underwater mountains was represented by 175 fish species from 53 families. A list is provided in the paper of species, found in the catches of pelagic and bottom trawls. The basis of catches comprised Alfonsino (*Beryx splendens*), most frequent species were also Black Scabbard (*Aphanopus carbo*), Barrelfish (*Hyperogliphe perciforma*), Cardinalfish (*Epigonus telescopus*), Wreckfish (*Poliprion americanus*), and Flint-perch (*Hoplostethus mediterraneus*). The data on size and age composition of those fishes are given in the paper, their feeding, vertical distribution and behaviour.

The limited stocks of valuable fishes above the underwater mountains of the Corner Rising demand that a cautious approach (in commercial terms) should be taken in the development of any intensive fishery in the region.

e) **United States research report for 1995** (SCS Doc. 96/10)

Biomass trends for 14 species in Subareas 5 and 6 based on the 33-year autumn series of NOAA/NMFS, Northeast Fisheries Science Center research vessel bottom trawl survey results extending back to 1963 were reviewed. Traditional demersal stocks including those of cod, haddock, pollock, redfish and yellowtail flounder, have declined steadily over the past two decades, and currently remain at or near their lowest recorded levels. Spawning biomass of Georges Bank haddock increased in 1995 due to recruitment from the 1992 year class. However, stocks of Georges Bank cod, yellowtail flounder and winter flounder remained low.

Pelagic species such as Atlantic herring and mackerel have increased substantially since the early-1980s. Atlantic herring biomass was estimated to be currently well above the high levels observed in the late 1960s. There is now strong evidence of stock recovery on Georges Bank (Div. 5Ze) based on adult and larval survey results and incidental commercial catches. The Atlantic mackerel stock biomass (Subareas 2-6) currently remains at record-high levels.

f) **Corrections to the stratification scheme in 3P** (SCR Doc. 96/55)

Abundance and biomass estimates for cod were re-calculated based on a revised stratification. It was noted implications for assessment will be fully documented in August 1996 when the Subdiv. 3Ps assessment is conducted by Canada in Newfoundland.

7. **Other Matters**

a) **Tagging Activities**

The Secretariat compiled a list of tagging activities in 1995 (SCS Doc. 96/8). Representatives were requested to check the list and report any errors and omissions. STACREC **recommended** that *scientists undertaking any tagging activities inform the Secretariat in order that the information may be widely circulated, and hence better returns may be obtained.*

b) **Scientific Data Collection by the New Observer Program**

It was noted that the new pilot observer program adopted by the Fisheries Commission for 01 January 1996 to 31 December 1997 required 100% coverage of vessels fishing in the Regulatory Area. It was also noted that these observers shall carry out such scientific work (for example, collecting samples) as requested by the Fisheries Commission based on the advice of Scientific

Council. The Committee welcomed the concept that more extensive sampling were possible under the new observer scheme but regretted that existing national sampling programs were being reduced because of the new program. *STACREC endorsed the following suggestions* as it relates to the new program: (i) current national sampling programs should be maintained at least at a minimum level of sampling until the observers under the new scheme are adequately trained in biological sampling (ii) training of the observers should be in concurrence with national sampling or national observer programs, and (iii) sampling by observers be under the direction of the national laboratories where scientific information is processed.

c) **Other Business**

i) **List of Fishing Vessels**

At the September 1995 meeting, 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. From fisheries science stand-point, it was noted the Scientific Council rarely used the publication, but the Committee had then requested the Secretariat to investigate the background to the requirement and its usage within NAFO. The Secretariat reported that through discussions with other Standing Committees and representatives, there was not much interest. Based on this response, STACREC **recommended** that *the Secretariat discontinue the soliciting and publication of such information, and discontinue the List of Fishing Vessels.* However, it was also noted that there is a possible alternate source of data, as Contracting Parties were required to notify the Secretariat of vessels fishing within the Regulatory Area.

ii) **Conversion Factors**

The EU reported on the preliminary results of a study of the conversion factors (landed weight to the live weight equivalent) submitted to FAO on the FISHSTAT CF1 questionnaire. These factors are important in the compilation of STATLANT catch statistics *and of the data* used in catch quota monitoring systems. The analysis of the three FAO surveys in 1985, 1988 and 1992 showed that there was a logical increase in the magnitude of the factors with the degree of processing. The study is continuing to resolve a serious lack of information on the origin of the factors. However, initial indications were that many of the factors do not result from physical tests conducted in the country in which they were applied but were assigned from factors appearing in the literature from other sources. The final report of the study will be presented to STACREC at a subsequent meeting.

8. **Acknowledgements**

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

APPENDIX IV. REPORT OF STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chairman: H.P. Cornus Rapporteur: K.H. Nygaard

The Committee met at Keddy's Dartmouth Inn, 9 Braemar Drive, Dartmouth, Nova Scotia, Canada on 10, 14 and 15 June, 1996. In attendance were H. P. Cornus (EU-Germany, Chairman), J. Morgan (Canada), V. A. Rikhter (Russian Federation), M. Stein (EU-Germany), A. Vazquez (EU-Spain), K. H. Nygaard (Denmark-Greenland) and the Assistant Executive Secretary (T. Amaratunga).

1. Opening

The new Chairman, H. P. Cornus, was welcomed by the Committee, and the agenda was **adopted** adding a few items to the Provisional Agenda. K. H. Nygaard (Denmark-Greenland) was appointed rapportèur.

2. Review of STACPUB Membership

The number of STACPUB members was reviewed in response to a question raised by Scientific Council. Although 5 new Contracting Parties have joined NAFO in recent years and more publications for review are foreseen, STACPUB did not feel it necessary to expand the number of members at this time, particularly noting that any changes would require a change in the Rules of Procedure. Different views on the issue were, however, presented by STACPUB members, as a larger number of members would have the advantage of a more diverse expertise, whereas the current small number has the advantage of effectiveness. It was further stated, that STACPUB functions in preselection of papers do not require a thorough analysis of the quality of papers. This responsibility solely lies on the author and the editorial review process.

Apart from the change of Chairman, no other changes to the STACPUB membership had been made since June 1995.

3. Review of Scientific Publications Since June 1995

a) Journal of Northwest Atlantic Fishery Science

STACPUB was pleased to note that Volume 18, containing 6 miscellaneous papers, 1 note and 2 notices (115 pages) was published with the publication date of April 1996.

Volume 19 is to be issued containing papers presented at the NAFO 1993 Symposium on "Gear Selectivity/Technical Interactions in Mixed Species Fisheries". 8 papers are in the final stages of preparation but a few papers are still in various stages of review. A decision by STACPUB regarding the future for this publication was deferred to agenda item 6 d.

Of the 30 oral and 21 poster contributions presented at the NAFO 1995 Symposium on "The Role of Marine Mammals in the Ecosystem", 26 papers have been received and are in advanced stages of the review process by Editors. This issue is expected to be completed in late-1996 or early-1997.

There are additionally 12 miscellaneous papers in various stages of review.

b) NAFO Scientific Council Studies

STACPUB noted with content that Studies Number 23, containing 6 miscellaneous papers and 3 notices (95 pages) was published with the publication date of September 1995.

Studies Number 24, containing an Introduction, 12 papers presented at 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" including a discussion of the papers, an Obituary for R. W. Trites and 3 notices (155 pages), was published with the publication date of January 1996. STACPUB acknowledged the expedient publication of this issue.

Studies Number 25, containing 5 miscellaneous papers is in the final stages of preparation. Publication of this issue is expected to be completed in mid-1996.

At the Scientific Council Meeting during June 1995, the Council agreed that a special issue of Studies should be published containing papers presented at the Joint ICES/NAFO Working Group on Harp and Hooded Seals held during 5-9 June 1995. Of the 13 papers presented, 12 have been received and are in the final preparation stage for Studies Number 26, which is expected to be published late-1996.

There are presently 4 miscellaneous papers in hand at the Secretariat, which are in the process of being edited.

c) **NAFO Statistical Bulletin**

NAFO Statistical Bulletin, Vol. 42 for 1992 was published without EU-France (Metropolitan) and France (St. Pierre and Miquelon) data, in October 1995.

Deadline for submission of STATLANT 21B reports for 1993 was 30 June 1994. As of May 1996, data were still outstanding from Faroe Islands, Norway, France (St. Pierre and Miquelon) and USA. The reports from Russia are also awaiting clarification.

Deadline for submission of STATLANT 21B reports for 1994 was 30 June 1995. As of May 1996, data were still outstanding from Canada (M), Cuba, Greenland, EU (Denmark, United Kingdom), Faroe Islands, France (SP), Korea, Lithuania, Norway and USA. This situation has not changed since last year.

d) **NAFO Scientific Council Reports**

The volume (244 pages) containing reports of the 1995 meetings of the Scientific Council in June, September and November was published and distributed on schedule in January 1996.

e) **List of Fishing Vessels**

Due to a lack of data from many Contracting Parties the question of usefulness of this publication was raised at the September 1995 Meeting of the Scientific Council. It was agreed that this publication is rarely used by the Council. The Secretariat was requested to inquire as to its usefulness to other Committees. The lack of responses from other Standing Committees suggests that the publication is of little practical value, and considering the costs of production involved, STACPUB **recommended** *that the publication of the "List of Fishing Vessels" be discontinued.*

f) **Inventory of Sampling Data**

Inventory of Sampling Data, 1985-89 was published in March 1993. The next issue for 1990-94 is targeted for December 1996, and the final updates and verifications are now needed from the Contracting Parties. STACPUB draws the attention of the Contracting Parties to meet the deadlines for submission.

g) ***Index of Lists of Titles***

The provisional index and lists of titles of 115 research documents (SCR Doc.) and 22 summary documents (SCS Doc.) which were presented at the Scientific Council Meetings during 1995 were compiled and presented in SCS Doc. 96/6 (June 1996).

STACPUB expressed the wish for the same information to be contained as a computer file at the Secretariat in the future, as this would be of great advantage in search for titles.

4. ***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.

5. Promotion and Distribution of Scientific Publications

a) Invitational Papers

STACPUB looks forward to the invitational paper by R. G. Halliday and A. T. Pinhorn on comparison of management methods and resource trends in North Atlantic fishery management systems. This paper is in an advanced stage of review and the authors have informed the Secretariat that it can be delivered to the Secretariat by the end of June 1996.

STACPUB also looks forward to an invitational paper by M. Stein on the climatic variability in the Labrador Sea based on the Russian/German Data Evaluation Project on historic ICNAF/NAFO oceanographic data.

Further STACPUB was pleased to expect invitational papers by D. Parsons on the Flemish Cap shrimp and by S.A. Horsted on an update and evaluation of catch statistics for West Greenland cod.

b) Distribution of Abstracts from Research Documents

STACPUB discussed the uneven distribution of abstracts from research documents to literature databases, particularly to ASFA. STACPUB **recommended** that *abstracts of SCR Doc. and SCS Doc. be propagated to ASFA through the national ASFA representative.* This process could be greatly eased by authors following the guidelines (in accordance with notes in the Provisional Agenda, see Appendix V of the NAFO Sci. Coun. Circular Letter 96/27) for preparation of research documents and further by the addition of relevant key words to the paper.

6. Editorial Matters Regarding Scientific Publications

a) Review of Editorial Board

STACPUB was informed that Associate Editor G. P. Ennis (Canada) on Invertebrate Fisheries Biology had requested in May 1996 to withdraw from the Editorial Board because of his plans for retirement, and also that Associate Editor S. A. Murawski (USA) on Vertebrate Fisheries Biology informed STACPUB during this meeting that he will withdraw from the Editorial Board. STACPUB expressed the Committee's sincere appreciation of the dedicated, analytical and comprehensive work done by the Associate Editors and extended best wishes.

Furthermore two other Associate Editors for already vacant positions in Vertebrate Fisheries Biology and Biomathematics have to be appointed.

STACPUB reviewed a number of possible candidates for the four vacant positions and agreed A. Richards (USA) as Associate Editor on Invertebrate Fisheries Biology, H. Rätz (EU-Germany) as Associate Editor on Vertebrate Fisheries Biology, F. Serchuk (USA) as Associate Editor on Vertebrate Fisheries Biology and P.A. Shelton (Canada) as Associate Editor on Biomathematics, be invited to the Editorial Board.

b) Progress Report of Publication on Shrimp in Div. 3M

D. Parsons (Canada) informed STACPUB that the publication compiling papers on Flemish Cap shrimp has been finished as a draft report, and is to be submitted to the Secretariat for formal review during summer 1996.

c) Progress Report of Publication on West Greenland Cod

Among the papers that have already been submitted for consideration, the editorial work has progressed with 2 of the papers being judged as more suitable for publication in a Studies issue; 3 papers for which the editorial comments are presently being finalized by authors for Journal publications; and 2 papers are still not available to the editor. The editor H. Lassen (EU-Denmark) has accordingly proposed that the papers be published as and when they are received, and not be further considered for a single publication. STACPUB supported this proposal, but expressed its regrets that a compilation of the information in a single volume could not be achieved.

d) **Progress Review of Journal Issue of 1993 Symposium**

As stated under item 3a, a few papers are still in various stages of review, delaying the process of publication. STACPUB agreed that since substantial progress has been made so far on this special issue, an attempt should be made to retrieve these papers and finalize the complete publication before September 1996. Should this not be possible, the Journal Vol. 19 will be published without these outstanding papers.

e) **Considerations for Publishing Symposium Proceedings**

Collection of papers from a Symposium in a single publication was found useful, and STACPUB at its meeting in June 1995 agreed that publication of Symposium proceedings be issued as supplementary issues of either Journal or Studies. It is, however, stressed that a firm structure with specific deadlines for the whole process is necessary to avoid delays in publication. This should already be stipulated in the call for papers, and the whole process of the publishing of proceedings should not exceed one year.

f) **Progress Review of Publication of 1994 Special Session**

This publication has been published in Studies Number 24 as of January 1996, and thanks for the expeditious work were extended to the Assistant Executive Secretary and the Secretariat by STACPUB.

g) **Progress Review of Publication of 1995 Symposium**

A total of 25 papers have been submitted for a special issue of the Journal on proceedings from the "NAFO/ICES Symposium on the Role of Marine Mammals in the Ecosystem", held in September 1995. The special issue is co-edited by J. Sigurjonsson (Iceland) and G. Stenson (Canada). All papers should be returned to the authors after peer review by the end of June 1996 and a deadline of September 1996 has been set for the return of modified manuscripts. The final versions of papers are expected to be ready for publication by October 1996.

7. **Papers for Possible Publication**

a) **Procedures for STACPUB Review**

STACPUB noted that some authors did not seem to be aware of the use of the questionnaire regarding their wishes for review of their papers. To ensure that all the appropriate research documents are considered for publication, STACPUB therefore suggested that in addition to the questionnaire (to be filled out by authors while handing in research documents) the Chairmen of the Standing Committees and Designated Experts should also hand in their proposals for nominations of papers suitable for publication to STACPUB.

b) **Review of Proposals Resulting From the 1995 Meetings**

Of the 15 papers nominated at the June 1995 Meeting, 7 papers have been submitted, and 1 response of intent have been received.

In addition 2 papers from outside of the STACPUB nomination process were submitted since June 1995 for consideration for the Journal. These are in the hands of the Associated Editors.

c) **Review of Contributions to the 1996 Meetings**

STACPUB members were again able to focus their considerations on those documents which were suggested by authors for publication. Members undertook to offer comments as to how each document could be improved.

STACPUB considered the SCR Documents suggested by authors as well as 1 SCR Doc. suggested by STACPUB members and nominated the following 15 including the standard papers on overview of environmental conditions: SCR Doc. 96/1, 5, 10, 12, 14, 15, 17, 24, 25, 30, 32 and 33 as a combined paper, 38, 41, 53.

STACPUB deferred to the September 1996 Meeting considerations on an additional 10 SCR Doc. suggested by authors, as these were found to be related to the Div. 2J and 3KL cod stock (see item 7d). Further, 1 SCR Doc. suggested by STACPUB members was deferred.

d) **Considerations on a Special Issue on Northern Cod**

A proposal was put forward to consider 22 SCR Doc. (including the 10 papers mentioned above under item 7c and 2 Working Papers presented at the meeting on the Div. 2J and 3KL cod stock), to compile one special issue of Studies. STACPUB found this useful and agreed to review these papers before the September 1996 Meeting.

8. **Other Matters**

STACPUB agreed that the Chairman of the Committee in accordance with the discussions in STACPUB on editorial review and publication, will write to the Associate Editors providing a background to the new initiatives STACPUB wishes to take with respect to expeditious editorial review.

9. **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 as rapporteur while making a full contribution to the meeting as a member.