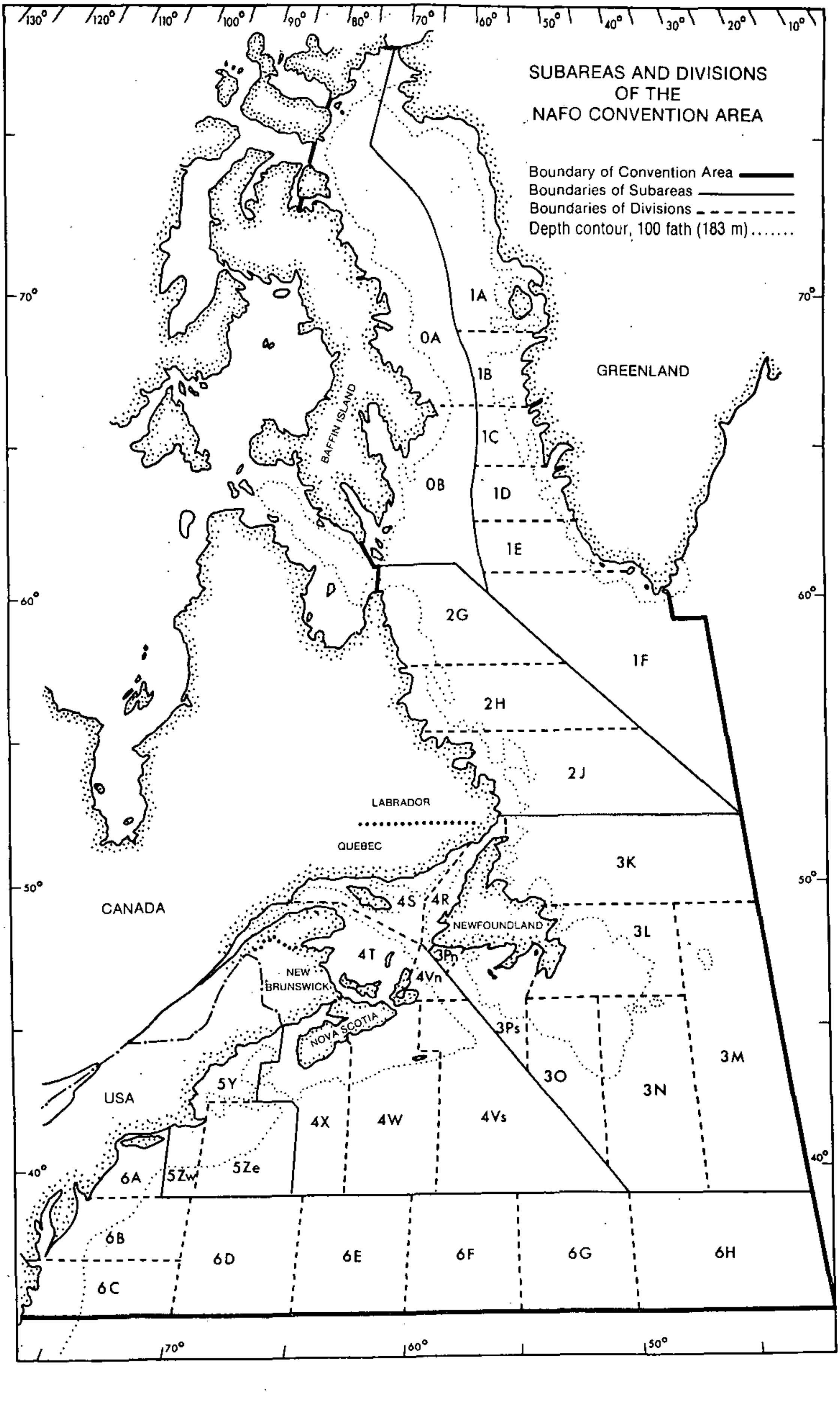
ISSN-0250-6416

NORTHWEST ATLANTIC FISHERIES ORGANIZATION

Scientific Council Reports 1982

Dartmouth, Canada
December 1982

CONTENTS


SUBAREAS AND DIVISIONS
OF THE
NAFO CONVENTION AREA
Boundary of Convention Area
Boundaries of Subareas
Boundaries of Divisions
Depth contour, 100 fath (183 m)
130°
120°
110°
100°
90°
80°
70°
60°
50°
40°
30°
20°
10°
70°
60°
50°
40°
GREENLAND
BAFFIN ISLAND
LABRADOR
QUEBEC
CANADA
NEWFOUNDLAND
NEW BRUNSWICK
NOVA SCOTIA
USA
0A
0B
1A
1B
1C
1D
1E
1F
2G
2H
2J
3K
3L
3M
3N
3O
3Pn
3Ps
4R
4S
4T
4Vn
4Vs
4W
4X
5Y
5Ze
5Zw
6A
6B
6C
6D
6E
6F
6G
6H

PART A

REPORT OF SCIENTIFIC COUNCIL

Main Scientific Meeting - 1982

CONTENTS

REPORT OF SCIENTIFIC COUNCIL

Main Scientific Meeting - 1982

Chairman: R. Wells   Rapporteur: V. M. Hodder

The Council and its Standing Committees met at the Holiday Inn, Dartmouth, Nova Scotia, Canada, during 7-18 June 1982, to consider and report on the various matters listed in the agenda (see Part C, this volume). In addition to dealing with matters of general scientific interest, the Council considered requests by the Fisheries Commission and the coastal Contracting Parties (Canada and the European Economic Community) for advice on management in 1983 of a number of stocks in Subareas 0 to 4. In reviewing the provisional agenda circulated before the meeting, the Council noted the Canadian request for advice on the management in 1983 of the Northwest Atlantic seal stocks (SCS Doc. 82/VI/1) and unanimously agreed to include this item in its agenda for the meeting. Prior to the opening session of the Council on 7 June, the *ad hoc* Working Group on Squid Research met during 2-5 June to review all available information on squid biology and distribution, and its report is included as an integral part of the Standing Committee on Fishery Science (STACFIS). The first meeting of the recently-established Subcommittee on Environmental Research met during 7-8 June and its report is Annex 1 to the Report of STACFIS. Representatives attended the various Council and Committee meetings from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France, and the Commission of the European Communities), Japan, Portugal, and the Union of Soviet Socialist Republics (USSR), and observers were present from Spain and the United States of America (USA) (Part C, this volume).

The reports of the Standing Committees, as adopted by the Council, are given in Appendix I (STACFIS), Appendix II (STACREC) and Appendix III (STACPUB). Lists of research and summary documents are given in Part C of this volume. Brief summaries of the committee reports and other matters considered by the Council are given in Sections I to VI below. [Due to 1981 fisheries statistics being incomplete at this meeting, Section I(1) below was approved at the September 1982 Meeting of the Council.]

I. FISHERY SCIENCE (APP. 1)

1. General Fishery Trends

The total nominal catch of all species (except seaweeds) in Subareas 0 to 6 was 2.82 million tons in 1981, a decrease of 3% from the 1980 nominal catch of 2.89 million tons (see Appendix I, Table 1). The total catch of "groundfish" species was 1.23 million tons in 1981, the same level as in 1980, with only little variation for the species in this category. The total catch of "pelagic" species was 583,000 tons in 1981, a decrease of 9% from the catch of 643,500 tons in 1980, due to significant declines for Atlantic herring and Atlantic menhaden. For the "other finfish" category, the 1981 catch of 102,000 tons was the same as in 1980. The total catch of "invertebrates" species declined slightly to 902,000 tons in 1981 from 918,000 tons in 1980, the significant decrease in the catch of squids (64%) being mostly offset by increased catches of scallops and crabs.

With respect to the total nominal catches of finfish and invertebrates by subarea, increases were recorded for Subarea 0 (2,800 to 3,400 tons), Subarea 2 (60,000 to 68,000 tons) and Subarea 5 (561,000 to 570,000 tons), whereas decreases were recorded for Subarea 1 (125,000 to 114,000 tons), Subarea 3 (492,000 to 489,000 tons), Subarea 4 (770,000 to 750,000 tons) and Subarea 6 (878,000 to 824,000 tons).

2. Assessment of Finfish and Squid Stocks

STACFIS reviewed the state of, and advised on catch levels in 1983 for, a number of stocks in Subareas 0 to 4 which lie completely or partly within the 200-mile fishery zones of Canada and the EEC (SCS Doc. 82/IV/1 and 82/VI/11) and the three stocks which lie outside national fishery zones in Div. 3M. Insofar as it was possible, total allowable catches (TACs) for 1983 were advised and these are listed in the last column of Table 1. Details of the stock assessments are given in the report of STACFIS (Appendix I). Some general observations are as follows:

a) The most important change in the proposed conservation measures is the advice of STACFIS that there be no directed fishery for cod in Div. 3M in 1983, due to the very low and continually declining abundance of this stock.

b) Advice concerning the cod stock in Div. 2J+3KL was deferred to the September 1982 Meeting, at which time additional information from research vessel surveys and the commercial fishery should be available in order to eliminate uncertainty about the value of terminal fishing mortality used in the assessment.

c) For the cod stock in Subarea 1, management options at various levels of fishery mortality and the short-term effects on catch and biomass are presented rather than a TAC associated with a particular level of fishing mortality, in accordance with the request of the EEC.

Table 1. Summary of recent catches (1976-81) and TACs (1976-82) for stocks reviewed at the June 1982 Meeting of STACFIS, together with the advised TACs for 1983.

Species	Stock area	*Nominal catches (000 tons)*						*TACs (000 tons)*							
		1976	1977	1978	1979	1980	1981[1]	1976	1977	1978	1979	1980	1981	1982	1983
Cod	1	33	38	38	48	47	48	45	31	...	...	...	50	...	( )[2]
	2J+3KL	214	173	139	167	175	161	300	160	135	180	180	200	230	( )[3]
	3M	22	25	33	30	11	14	40	25	40	40	13	12.7	12.4	(0)[4]
	3NO	24	18	15	28	20	24	43	30	15	25	26	26	17	(26)
Redfish	1	14	31	8	9	8	6	-	-	13	...	...	...	...	( )[2]
	3M	17	20	17	20	16	14	16	16	16	20	20	20	20	(20)
	3LN	21	16	12	14	16	27	20	16	16	18	25	25	25	(25)
Silver hake	4VWX	97	37	48	52	45	41	100	70	70	70	90	80	80	(80)
A. plaice	3M	1	1	1	1	1	1	2	2	4	2	2	2	2	(2)
	3LNO	52	44	50	49	49	50	47	47	47	47	47	55	55	(55)
Witch	3NO	6	6	3	3	3	2	10	10	10	7	7	5	5	(5)
Yellowtail	3LNO	8	12	16	18	12	15	9	12	15	18	18	21	23	(19)
G. halibut	0+1	16	13	12	19	8	6	20	20	20	25	25	25	25	(25)
	2+3KL	25	32	39	34	33	30	30	30	30	30	35	55	55	(55)
R. grenadier	0+1	9	3	6	7	2	<1	14	8	8	8	8	8	8	(8)
	2+3	21	15	21	8	2	7	32	35	35	35	30	27	27	(11)
Wolffishes	1	6	6	6	17	5	4	-	-	-	-	...	...	...	(5-6)
Capelin	2+3K	216	152	55	11	6	12	160	212	212	75	5	10	10	(50)
	3LNO	144	74	30	12	14	25	180	200	200	10	16	30	30	(60)[5]
Shrimp[6]	0+1	50	42	34	35	44	47	-	36	40	29.5	29.5	...	...	( )[7]
Squid-*Illex*	2-4	42	83	94	162	70	30	-	-	100	100	150	150	150	(150)

[1] Provisional statistics.
[2] See relevant section of STACFIS Report (Appendix I).
[3] Deferred to September 1982 Meeting.
[4] No directed fishery.
[5] TAC pertains to Div. 3L only.
[6] TAC pertains to offshore grounds.
[7] Deferred to later mid-term meeting.

d) A decrease in TAC for 1983, compared with 1982, is advised for yellowtail flounder in Div. 3LNO, and for roundnose grenadier in Subareas 2+3.

e) An increase in TAC for 1983 is advised for capelin, in view of some improvement in abundance in Subarea 2 and Div. 3K and in Div. 3L, but there should be no fishery for this species in Div. 3NO in 1983. It was noted that better advice for management in 1983 would be possible if the stocks were reassessed early in 1983.

f) No change in TAC was advised for cod in Div. 3NO, redfish in Subarea 1, Div. 3M and Div. 3LN, silver hake in Div. 4VWX, American plaice in Div. 3M and Div. 3LNO, witch flounder in Div. 3NO, Greenland halibut in Subareas 0+1 and Div. 2J+3KL, wolffishes in Subareas 1, and squid-*Illex* in Subareas 3+4.

g) In view of the substantial contribution of shrimp recruitment to annual yields and the present inability to predict recruitment, the assessment of the shrimp stocks in Subareas 0+1 and at East Greenland was deferred to a mid-term meeting, preferably in early 1983.

3. Assessment of Seal Stocks

a) Harp seals

Information on catches in 1982 was incomplete, but at least 154,500 seals had been taken up to 4 May from the quota of 175,000 animals. A primary purpose of considering the seal stocks at this meeting was to review a paper on the population dynamics of harp seals which could not be dealt with adequately at the November 1981 Meeting (*NAFO Sci. Coun. Rep.* 1981, pages 109-122). A slightly revised version of the paper was presented containing one substantive change, namely, the modification of the 1967 age structure used to initiate the population model. This resulted in lower estimates of natural mortality (0.0775-0.0825) than previously (0.0950-0.0975), and hence higher estimates of current stock size and replacement yield.

A major criticism of the population model is that the equations used to estimate hunting selectivities of the immature age-groups produce biased results, which lead to more uncertainty in estimating the initial age distribution and hence in estimating natural mortality. Therefore, with the present methodology and current data, it does not appear possible to discriminate between mortality rates in the range of 0.07-0.12. Another criticism is that minor changes in assumptions could lead to considerable increase in the 95% confidence limits calculated for the estimates of pup production and natural mortality. This greater variance implies that it is not possible to say that the population is increasing under recent catch limitations, although the analysis does support the results of previous studies that the rapid decline in population was halted with the imposition of conservation measures in 1971. It is also not possible to say that the stock can support a catch in excess of 200,000 animals despite the optimistic estimates derived from the model. It was agreed that these uncertainties could only be resolved in future by obtaining accurate estimates of pup production.

No new data were available for the Canadian Arctic and West Greenland catches, but the increased catches recorded for the late 1970's are consistent with the hypothesis of an increase in production, although it is possible that the increased catches resulted from increased mechanization of hunting.

b) Hooded seals

Preliminary statistics indicate a catch of approximately 10,000 seals in 1982 from a quota of 15,000. Uncertain economic conditions resulted in premature termination of the hunt. Jaws from about 250 females were collected at the Front and 150 pups were tagged in the Gulf of St. Lawrence. Two adult females were obtained in the Gulf bearing tags applied 4 and 5 years previously. No new data were presented to improve the previous assessment.

c) General comment

The Council noted that the hasty arrangements of the meeting of the *ad hoc* Working Group on Seals and inadequate time for scientists to prepare for the meeting made it impossible for the experts to adequately consider the Canadian request (SCS Doc. 82/VI/1).

4. Flemish Cap Project

The Council noted that the *ad hoc* Working Group on the Flemish Cap Project had met on 4-5 June 1982 and reviewed the results of research on a variety of aspects related to environmental influences on the production and survival of cod and redfish larvae, juveniles and adults. The Council noted that there were no specific proposals for research on Flemish Cap in 1982 but that a prospectus for future coordinated research was discussed, recognizing that the low abundance of cod in the area would severely constrain the proposed research from attaining the long-term objectives of the project. Nevertheless, the Council endorsed the recommendations of STACFIS concerning the research proposed for 1983 and agreed that the Working Group should meet at the September 1982 Meeting to finalize the schedule of winter and spring surveys in 1983 and to consider any available new information.

5. Squid Research

The Council noted that the *ad hoc* Working Group on Squid Research had met during 2-5 June 1982 and reviewed the results of studies on the commercial fishery in 1981 and data from on-shelf and off-shelf surveys undertaken during summer and autumn of 1981 and during winter and spring of 1982 in relation to the hypotheses developed at its first meeting in 1980. Biological investigations included growth rates, maturation, gametogenesis in males and females, fecundity, spawning in captivity, predation and predators. After reviewing all available information in relation to the hypotheses, the following scenario was developed as a guide to future studies: *Most adult Illex in the northern part of the area of distribution in the Northwest Atlantic move southwestward in autumn from the continental shelf and slope to at least the Chesapeake Bay-Cape Hatteras area. Spawning, although protracted, occurs mainly in the late autumn-early winter period, may be either demersal or pelagic, occurs on or off the continental shelf as far as the Gulf Stream, and is principally confined to areas south of Chesapeake Bay. The Gulf Stream system provides a key transport mechanism for larvae and juveniles.*

The Council endorsed the research program proposed for early 1983, which has as its primary goal the study of spawning, egg, and early larval stages of *Illex* in and south of Subarea 6, with the secondary goal being the continuation of current studies on off-shelf distribution and abundance of juveniles in Subareas 3 to 5 and the continued development of on-shelf abundance indices for recruits. It was noted that a Canadian research vessel will undertake an extensive survey of the southern region (Cape Hatteras to northern Florida) in January-February 1983 and that a USSR research vessel will conduct an off-shelf survey in Subareas 3 and 4 during February-March 1983.

The Council considered the view of STACFIS that the primary function of the *ad hoc* Working Group on Squid Research in organizing the research program had been achieved and agreed that (i) future aspects of coordination should be undertaken by STACREC, and (ii) future assessments and consideration of biological studies be undertaken directly by STACFIS.

6. Environmental Research

The Committee noted that the Environmental Subcommittee, which was established at the September 1981 Meeting, had met for the first time on 7 June 1982. The full report of the Subcommittee is at Annex 1 to the Report of STACFIS (Appendix I) and a brief summary of matters dealt with is given in the latter report.

7. Gear and Selectivity Studies

The Council noted the results of silver hake mesh selection studies by Cuban scientists on the Scotian Shelf in early 1982, and the results of trawl selection studies by USSR scientists on redfish, Greenland halibut, roundnose grenadier, yellowtail flounder and American plaice in Subareas 2 and 3. Such studies represent valuable additions to knowledge on trawl selectivity and will be useful in future assessments of the long-term effects of changes in mesh size on the stocks.

8. Ageing Studies

The Council welcomed the presentation of the report of the Shrimp Ageing Workshop which initiated its work at Quebec City, Quebec, in May 1981 and continued its discussion at the November 1981 Meeting, and thanked the co-conveners (J. Fréchette and D. G. Parsons) and other participants for their work.

The Council noted that ageing problems continue to persist for the cod stock in Div. 3M and the silver hake stock in Div. 4VWX, despite recent ageing workshops, and agreed that the scientists involved should attempt to resolve the discrepancies because of their implications on stock assessments.

9. Maximization of Yield per Recruit for Cod and Redfish in Division 3M

The Council noted that STACFIS has not yet been able to provide the Fisheries Commission with more specific advice on this matter than was given at the June 1981 Meeting (*NAFO Sci. Coun. Rep.* 1981, pages 49-50), and agreed that, if the required additional information was not available at the September 1982 Meeting, the item not be included in future agenda of the Scientific Council until the appropriate data become available.

II. RESEARCH COORDINATION (APP. II)

1. Statistics and Sampling

a) CWP Activities relevant to NAFO

The Council noted NAFO's involvement in the forthcoming meeting of the CWP (Coordinating Working Party on Atlantic Fishery Statistics) at Luxembourg during 21-28 July 1982 and the report, prepared by the Assistant Executive Secretary, on NAFO's statistical program and publications. It was also noted that NAFO representation at this session, as agreed at the June 1981 Meeting, would be T. K. Pitt (Chairman of STACREC), J. G. Boavida (Portugal) and V. M. Hodder (NAFO Secretariat).

b) Fishery Statistics

The Council again expressed concern about the difficulties being encountered by the Secretariat in obtaining fisheries statistics for stock assessments and for timely publication in the Statical Bulletin. Council representatives of countries, which are persistently late in providing fishery statistics, are encouraged to take an active role in ensuring that national statistical officers give priority to the preparation and submission of the required reports in accordance with the designated deadlines.

c) Sampling data

The Council noted that, in view of the changes in reporting procedures for 1979 and subsequent years, guidelines are needed to enable the Secretariat to undertake appropriate summarization of the detailed sampling data if the existing data base is to be extended beyond 1978. To examine the implications resulting from the recent changes in sampling requirements, the Council agreed to establish a small working group of scientists from five research institutes and the Assistant Executive Secretary. It was suggested that this *ad hoc* Working Group should attempt to meet during the September 1982 Meeting and to report to STACREC at the June 1983 Meeting.

d) International Scientific Observer Scheme

Canada reported that several bilateral agreements had been finalized and that others are pending. The USSR reported an agreement with the German Democratic Republic. It was noted that coverage in 1981 amounted to only 78 observer days under the scheme.

e) List of Fishing Vessels

The Council noted that the 1980 list which was scheduled for publication in 1981 has not yet been published because data for some countries had not been received. It is expected that the outstanding data will be available in the near future. Meanwhile, the Council agreed that the Secretariat should proceed with plans to acquire and compile the 1983 data for inclusion in the triennial volume.

f) Other matters

i) The Council noted the problem of reporting statistics for the Canadian *Pandulas montaguii* fishery which overlaps the NAFO boundary between Subarea 0 and Hudson Strait. It was agreed that *P. montaguii* be added to the NAFO List of Species Items and that the reported catches be included in Div. 0B with an appropriate note indicating that the catches were made adjacent to but outside the Convention Area.

ii) The Council noted the problem of obtaining sampling data for stocks where catches are below the level specified in the minimum sampling guidelines, and agreed that, for such fisheries, countries should attempt to collect at least five samples per stock per year distributed throughout the fishery.

2. Biological Surveys

a) Survey activities

The Council noted that STACREC had reviewed research vessel survey activities in the Northwest Atlantic in 1981 and survey plans for 1982, the details of which are listed in Tables 1 and 2 of Appendix II.

b) Manual on Groundfish surveys

The Council noted that the Manual on Groundfish Surveys in the Northwest Atantic has been published in *NAFO Scientific Council Studies* No. 2.

c) Other survey matters

i) The Council noted the renewed interest in experiments designed to study the performance of research trawls and agreed that such work was important in improving the quality of research vessel survey data.

ii) The Council recognized the large amount of survey work carried out in recent years and noted the usefulness of survey data in providing independent measures of stock status. The Council encourages the continued critical review of biomass surveys with respect to both gear performance and calibration with commercial indices of abundance. The Council noted that interest was developing towards the production of catchability coefficients and recommended that a review of their derivations be presented at the June 1983 Meeting.

iii) The Council agreed that future coordination of surveys related to the squid research program would fall under the aegis of STACREC.

III. PUBLICATIONS (APP. III)

1. Review of Publications

The Council noted in STACPUB's review of the status of publications, that the initial aim of publishing spring and autumn issues of the *Journal of Northwest Atlantic Fishery Science* is expected to be achieved in 1982, and that the contributions to the symposia on "remote sensing" and "environmental conditions during the 1970-79 decade" are also expected to be published in 1982. However, concern was again expressed about the delays in publication of *List of Fishing Vessels* for 1980 and *Statistical Bulletin*, Vol. 30 for 1980, due to the absence of data for some countries.

2. Distribution and Promotion of the Journal

The Council noted that the Secretariat had implemented several of the proposals of STACPUB, developed at the September 1981 Meeting, concerning the organization of national distribution lists and subscription lists, the promotion of the Journal through abstracting and subscription services, and the upgrading of Journal reprints. The Council agreed that a report on Journal costs, revenues and distribution statistics for the 1982 fiscal year should be prepared for the June 1983 Meeting.

3. Editorial Board

The Council noted with regret the resignation of Dr. W. Templeman as Associate Editor for Vertebrate Fisheries Biology and that the Editor would seek a replacement for nomination at the September 1982 Meeting.

4. Ichthyoplankton Identification Manuals

The Council, concurred with STACPUB's proposal to have the *ad hoc* Working Group on Production of Ichthyoplankton Manuals meet again during the September 1983 Meeting to review progress on this important matter, noting that a manuscript for the area from Cape Hattaras to the Scotian Shelf was currently being peer-reviewed.

5. Papers for Possible Publication

The Council noted that STACPUB had reviewed all papers presented to the November 1981 and June 1982 Meetings and had nominated 13 of them for possible publication in one of the Council's publication series, subject to revision by the authors and acceptance by the Editor. It was agreed that the Report of the Shrimp Ageing Workshop should be published in *NAFO Scientific Council Studies*.

6. Microfiche for Storage and Retrieval of Documents and Publications

The Council noted STACPUB's interest in determining the feasibility of utilizing microfiche or microfilm for storage and retrieval of scientific papers, particularly the unpublished research documents, and agreed to solicit from the scientists present the availability of microfiche equipment in their laboratories. Scientists representing 10 fisheries institutes indicated that such equipment was or could be made available, although there may be differences in standards. It was agreed that the project should be pursued, and the Executive Secretary was requested to provide for the September 1982 Meeting, if possible, technical information on microfiche production and on the degree of compatability between the systems in use in the various laboratories.

IV. COLLABORATION WITH OTHER ORGANIZATIONS

1. Eleventh Session of the CWP

The Council noted that the 11th Session of the CWP will be held at Luxembourg during 21-28 July 1982, hosted by EUROSTAT, and that NAFO will be represented by Dr. T. K. Pitt (Chairman of STACREC), Capt. J. G. Boavida (Portugal), and Mr. V. M. Hodder (NAFO Secretariat). A preliminary report of the Session is anticipated for the September 1982 Meeting of the Council.

2. Proposed NAFO/ICES Study on Redfish at Greenland

The Council reviewed SCS Doc. 82/VI/5, which outlined efforts to date to interest ICES in the establishment of a special NAFO/ICES study group to examine the biological relationships of the West Greenland and Irminger Sea redfish stocks. Although the matter has not yet been formally addressed by ICES, the General Secretary has suggested that, pending a formal decision by ICES at its Annual Meeting in October 1982, the Scientific Council should initiate the establishment of the group at its June Meeting. The Council agreed to this procedure and requested Canada and the EEC to nominate scientists as NAFO participants. As soon as the working group is formally established, the list of members nominated to represent NAFO and ICES should be communicated to the Secretariat of both organizations. The Council expressed a desire that the joint study group, if and when it is formally set up, should preferably meet in the spring, so that a report of its activity can be available for the regular June meeting of the Scientific Council.

V. RULES OF PROCEDURE

1. Proposed Amendment to Rule 3.1 Regarding Election of Officers

The Council again considered the Canadian proposal to amend Rule 3.1 of the Rules of Procedure for the Scientific Council (*NAFO Sci. Coun. Rep.* 1981, page 132), which was deferred from the June 1981 and September 1981 Meetings due to the lack of a quorum. The Scientific Council representatives of the six Contracting Parties present unanimously agreed that Rule 3.1 as adopted on 13 June 1980 (*NAFO Sci. Coun. Rep.* 1979-80, page 109) should be amended to read as follows:

> "The Chairman and Vice-Chairman shall take office at the conclusion of an annual meeting. Election of these officers shall take place at such annual meeting or at the special meeting held immediately preceding such annual meeting".

In the absence of a quorum at this meeting, the Executive Secretary was requested to conduct a vote on the proposed Rule 3.1 (stated above) and to report the results of the vote at the September 1982 Meeting of the Scientific Council.

VI. FUTURE SCIENTIFIC MEETINGS

1. Annual Meeting, September 1982

The Scientific Council and its Standing Committees will meet during the Fourth Annual Meeting of NAFO (8-17 September 1982) to consider the following items:

a) Special session on stock discrimination in marine fishes and squid of the Northwest Atlantic.
b) Further assessment of the cod stock in Div. 2J+3KL.
c) Coordination of the Flemish Cap research program.
d) Report of the *ad hoc* Working Group on Herring Tagging which met in January 1981.
e) Further consideration of maximization of yield per recruit for cod and redfish in Div. 3M.
f) Matters relevant to STACPUB, including a review of progress on ichthyoplankton identification manuals.
g) Report on vote concerning amendment to Rule 3.1 of the Scientific Council Rules of Procedure.
h) Plans for future meetings.

The Council noted that about 30 papers were expected for the Special Session on Stock Discrimination (Convener: T. D. Iles).

2. Mid-term Meeting for Assessments

The Council noted that STACFIS had not been able to provide advice for management in 1983 of the shrimp stocks in Subareas 0 and 1 and off East Greenland and that a meeting early in 1983 was suggested for this purpose. The Council also noted that STACFIS could provide better advice for management in 1983 of the capelin stocks in Subareas 2 and 3 at a meeting in early 1983 if better advice than that provided at the present meeting was considered necessary. Furthermore, the Council noted that STACFIS could not at the present meeting, for reasons given above, adequately deal with the Canadian request for advice on the seal stocks. It was agreed that these matters be considered at the September 1982 Meeting, when mid-term meeting dates would be decided.

3. Main Scientific Meetings in June 1983 and June 1984

In view of the difficulty encountered by the Secretariat in arranging meeting facilities in June, it was agreed that the Main Scientific Meeting in 1983 be held during 8-23 June and in 1984 during 6-21 June.

4. Annual Meeting in September 1983

The Council noted that it would be necessary at the forthcoming September 1982 Meeting to select a suitable symposium theme for the September 1983 Meeting.

VII. ADJOURNMENT

The Chairman expressed his thanks to the Secretariat for arranging the excellent meeting facilities at the Holiday Inn, Dartmouth, and for their efficiency in servicing the meeting. He also thanked the chairmen and rapporteurs of the various committees and working groups and all other participants for their cooperation and contributions to the success of this meeting. The meeting was adjourned at 1130 hours on 18 June 1982.

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

Chairman: J. P. Minet

Rapporteurs: Various

The Committee met at the Holiday Inn, Dartmouth, Nova Scotia, Canada, during 8-15 June 1982, to consider and report on various matters referred to it by the Scientific Council (see Part C, this volume), particularly with regard to the provision of advice on conservation measures for certain finfish and invertebrate stocks in Subareas 0 to 4 and the harp and hooded seal stocks in the Northwest Atlantic. Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France, and the Commission of the European Communities), Japan, Portugal, Spain, USSR and USA.

Various scientists, designated by the Chairman, assisted in the initial preparation of draft reports on the various assessment topics considered by the Committee (Section II). The sections of this report, initially considered by *ad hoc* working groups, were organized by the conveners of these groups: A. W. Mansfield for Seals (Section III), J. T. Anderson for the Flemish Cap Project (Section IV), and T. W. Rowell for Squid Research (Section V). The report of the Subcommittee on Environmental Research (Chairman: R. W. Trites) is at Annex I.

Section I of this report entitled "Fishery Trends" could not be completed at this time due to the absence of 1981 STATLANT 21A nominal catch statistics for several countries, including Denmark (M), Iceland, Norway, Poland, Romania, Spain, UK, and USA. [Section I below was subsequently completed and approved at the September 1982 Meeting of the Council.]

I. FISHERY TRENDS

1. General Trends for the NAFO Area

The total nominal catch of all finfish and invertebrates (Table 1) decreased from 2.89 million tons in 1980 to 2.82 million tons in 1981 (3%), after having declined from 3.02 million tons in 1979. The total groundfish catch in 1981 was essentially the same as in 1980 at 1.23 million tons (44% of the total). The total pelagic fish catch of 583,000 tons in 1981 was 9% less than in 1980 (643,500 tons), due mainly to declines in Atlantic herring (13%) and Atlantic menhaden (8%), which constitutes 92% of the total for this group. Catches of the "other finfish" category in 1981 was the same as in 1980 at 102,000 tons, the most significant species in this group being capelin, with a catch of 39,000 tons in 1981. The total catch of invertebrates declined from 918,000 tons in 1980 to 902,000 tons in 1981 (2%). The significant decline in the catches of squids (56%) was partially offset by increases in the catches of scallops (6%) and crabs (26%).

2. Subarea 0

The usual low catch increased slightly from 2,800 tons in 1980 to 3,400 tons in 1981, with shrimp being the dominant species taken.

3. Subarea 1

The total nominal catch of all species declined from 125,000 tons in 1980 to 114,000 tons in 1981 (9%), significant decreases being noted for Atlantic redfish (25%). The catches of Atlantic cod (48,000 tons) and northern shrimp (43,000 tons), which account for 80% of all species caught, were essentially the same in 1981 as in 1980.

4. Subarea 2

The total nominal catch of all species increased slightly from 60,000 tons in 1980 to 68,000 tons in 1981 (13%), due mainly to increases for Greenland halibut and capelin. The catch of Atlantic cod (41,000 tons) was the same in 1981 as in 1980.

5. Subarea 3

The total nominal catch of all species in 1981 (489,000 tons) was only slightly less than in 1980 (492,000 tons). Decreases in the catches of Greenland halibut (19%), Atlantic herring (37%) and squid (54%) were largely offset by increases for Atlantic redfish (7%), American plaice (5%) and capelin (42%).

6. Subarea 4

The total nominal catch of all species declined slightly from 770,000 tons in 1980 to 750,000 tons in 1981 (3%). Declines in the catches of American plaice (16%), witch flounder (50%), Atlantic herring (7%), Atlantic mackerel (25%) and squid (60%) were mostly offset by increases in the catches of Atlantic cod (5%), haddock (16%), Atlantic redfish (38%), pollock (16%) and crustaceans (16%).

Table 1. Nominal catches (000 tons) for 1980 and 1981[1]. (The symbol + indicates less than 500 tons.)

Species items	SA 0		SA 1		SA 2		SA 3		SA 4		SA 5		SA 6		Total	
	1980	1981	1980	1981	1980	1981	1980	1981	1980	1981	1980	1981	1980	1981	1980	1981
Atlantic cod	-	-	47	48	41	41	214	216	234	245	62	55	+	+	598	605
Haddock	-	-	-	-	-	-	1	1	44	51	35	31	+	+	80	83
Atlantic redfishes	+	-	8	6	4	4	67	72	29	40	10	8	-	+	118	130
Silver hake	-	-	-	-	-	-	+	+	44	41	8	9	10	11	63	61
Red hake	-	-	-	-	-	-	+	-	1	+	3	1	2	1	6	3
Pollock	-	-	-	-	-	-	1	+	32	37	24	22	+	+	56	59
American plaice	-	-	1	+	+	+	58	61	19	16	14	13	+	+	92	91
Witch flounder	-	-	-	-	+	+	6	7	6	3	3	3	+	+	16	14
Yellowtail flounder	-	-	-	-	-	-	13	15	3	3	19	15	1	1	35	33
Greenland halibut	2	+	7	6	2	5	31	25	7	3	+	-	-	-	49	40
Other flounders	-	-	+	+	+	+	1	1	7	8	18	19	12	8	39	37
Roundnose grenadier	+	-	2	+	1	3	1	4	-	-	-	-	-	-	4	7
White hake	-	-	-	-	+	-	3	3	17	18	4	6	-	+	24	27
Wolffishes	+	-	5	4	+	+	2	3	3	3	1	1	+	+	12	10
Other groundfish	+	-	7	5	1	1	1	1	8	8	11	13	7	8	34	33
Atlantic herring	-	-	+	+	-	+	16	10	161	150	83	65	+	+	260	225
Atlantic mackerel	-	-	-	-	-	+	6	7	16	12	2	1	1	7	25	27
Atlantic butterfish	-	-	-	-	-	-	-	-	-	-	5	4	2	1	6	6
Atlantic menhaden	-	-	-	-	-	-	-	-	-	-	69	79	272	235	340	314
Other pelagics	-	-	-	-	-	-	1	1	2	1	2	3	6	7	12	11
Capelin	-	-	+	+	5	10	19	27	4	2	-	-	-	-	27	39
Other finfish	+	-	5	2	2	1	5	5	18	12	9	11	35	32	75	63
Squids	-	-	-	-	-	-	35	16	35	14	10	4	32	16	111	49
Clams	-	-	-	-	-	-	-	-	4	5	36	30	237	256	277	291
Scallops	-	-	-	-	-	+	+	+	27	23	106	149	44	17	178	189
Other molluscs	-	-	-	-	-	-	-	-	2	2	7	9	175	165	184	176
Shrimp	1	4	43	43	4	3	+	+	9	9	+	1	1	+	58	59
Other crustaceans	-	-	-	-	-	-	11	15	38	44	18	18	41	60	109	137
Other invertebrates	-	-	-	-	-	-	-	-	-	-	1	+	+	+	1	1
Total	3	4	125	114	60	68	492	489	770	750	561	570	878	824	2889	2818

[1] Provisional data for 1981 from SCS Doc. 82/VI/7 (+ Corrigendum)

7. <u>Subarea 5</u>

The total nominal catch of all species increased slightly from 561,000 tons in 1980 to 570,000 tons in 1981 (2%). Declines were recorded for Atlantic cod (11%), haddock (11%), Atlantic redfish (20%), Atlantic herring (22%) and squids (60%), but these were mainly offset by increases in the catches of Atlantic menhaden (14%) and scallops (41%).

8. <u>Subarea 6</u>

The total nominal catch of all species declined from 878,000 tons in 1980 to 823,000 tons in 1981 (6%), due mainly to decreases in the catches of flounders (30%), Atlantic menhaden (14%), squids (50%) and scallops (61%), the only significant increase being recorded for crustaceans (46%).

II. STOCK ASSESSMENTS

1. <u>Cod in Subarea 1</u> (SCR Doc. 82/VI/50)

a) <u>Fishery trends</u>

The estimated nominal catch of 54,000 tons in 1980 was used in the assessment, and provisional statistics for 1981 show a nominal catch of 48,000 tons. Since 1978, directed fishing for cod has been allowed only for Greenland fishermen. A quota of 20,000 tons was set for their offshore fishery in 1980, whereas a quota of 50,000 tons for 1981 was applied to the total fishery. The by-catch of cod was limited to 10% in the fishery for redfish and to 3% in fisheries for other regulated species. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)[1]	107	60	45	31	...	...	20[2]	50[3]	...
Catch (000 tons)	48	48	33	73[4]	73[4]	99[4]	54[4]	48[5]	

1 Catches limited to Greenlanders' fishery and to by-catch since 1978.
2 Quota for offshore Greenland fishery only.
3 Quota for offshore and inshore Greenland fishery.
4 Estimates used for assessment of the stock.
5 Provisional data.

b) Trends in distribution, abundance and stock composition

Catch-per-unit-effort for Greenland trawlers decreased in 1980 to about half the level of 1979 but increased by about 160% for 1980 to 1981. The best catch rate in 1981 was obtained in Div. 1E, but catch rates increased in all three divisions fished by the trawlers (Div. 1C, 1D and 1E). Contrary to the situation in 1980, no cod fishing by trawlers took place in Div. 1B. Their effort in Div. 1F was negligible in both years. In the inshore fishery, the decrease in catches observed in Div. 1F in 1980 continued in 1981, whereas catches in Div. 1B to 1D increased, being most pronounced in Div. 1C. Nevertheless, Div. 1E and 1F seems to have remained the most important area for inshore fishing in 1981.

The age composition of offshore samples from trawler catches and landings showed great variation, even between hauls close to each other in both location and time. The 1973 year-class seems to have been the major one in Div. 1E, whereas individuals of the 1977 year-class were dominant in the non-spawning concentrations in Div. 1C and 1D. Spawning schools in these divisions had their major contribution from the 1975 year-class. The inshore samples from Div. 1F varied much in age composition. Some samples were heavily dominated by the 1973 year-class, whereas others showed the 1976 or 1977 year-class as the major one. All samples from Div. 1B-1E were strongly influenced by the 1977 year-class, especially those from Div. 1B and 1C.

The trends in the fishery and the age composition of the landings reflect a continued southward displacement, the decline of the 1973 year-class, and the recruitment of a relatively good 1977 year-class, which seems to have its present major distribution in Div. 1C-1E and in the southern part of Div. 1B. Recruitment prospects seem somewhat improved. The 1977 year-class will no doubt constitute the major part of the landings in 1982 and 1983. The 1979 year-class may also be relatively good. Both of these year-classes are likely to have their distribution concentrated in Div. 1C and 1D. It is therefore likely that a relatively higher part of the total catch will be taken in these divisions in 1983-84 than was the case in 1979-81.

c) Assessment parameters

Mortality rates and partial recruitment. New data obtained in 1981 do not indicate any changes in natural mortality or in partial recruitment. Natural mortality was again set at M = 0.20, and relative F values for age-groups 3 and 4 at 1.5% and 27.4% of the value for fully recruited age-groups. The estimate of total mortality (Z = 0.90) was derived from catch curves for age-groups 6-8 over the years 1979-81, thereby including the 1973 year-class in the plots. Considering that M = 0.20 and that the inclusion of the 1973 year-class in the data could mean an emigration coefficient of about 0.15, a terminal F-value of 0.55 is indicated for 1981, compared to a value of 0.63 for 1980. This decrease is in line with the apparent decrease in trawler fishing effort from 1980 to 1981. Virtual-population-analysis (VPA) computer runs were made with a terminal F-value of 0.54 for 1981.

Year-class estimates. The 1978 and 1981 year-classes are both expected to be poor, and the present estimate of the strength of each is 20 million fish at age 3. The 1979 year-class is expected to be a relatively good one, but its size cannot be assessed more precisely until it has been fished for a year or two. The Committee therefore considered upper and lower estimates of 150 million and 75 million fish in its prognosis. The 1980 year-class is tentatively estimated at 75 million recruits, but its size will also have to be adjusted when observed in the fishery.

d) Results of assessment

The VPA gave values of year-class strength and of fishing mortality rather close to those obtained in last year's analysis (SCR Doc. 81/VI/48). The important 1973 year-class seems to have been of a strength corresponding to 231 million recruits (age 3), whereas the 1977 year-class, tentatively estimated at 200 million fish last year, shows a value of 186 million fish. The 1975 year-class still seems to be of a size between 30 and 40 million fish, less than initially expected.

Table 2. Subarea 1 cod: prognoses of spawning biomass at the beginning of each year and catch during the year for various levels of F (options A to I) and for a constant catch of 55,000 tons (option J), assuming lower and upper limits for the size of the 1979 year-class at age 3.

		A	B	C	D	E	F	G	H	I	J
Recruitment of 1979 year-class: 75 million fish at age 3											
1982	Sp. biomass (000 tons)	65	65	65	65	65	65	65	65	65	65
	Fishing mortality	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
	Catch (000 tons)	55	55	55	55	55	55	55	55	55	55
1983	Sp. biomass (000 tons)	220	220	220	220	220	220	220	220	220	220
	Fishing mortality	0.10	0.20	0.25	0.30	0.40	0.48	0.55	0.60	0.70	0.27
	Catch (000 tons)	22	42	52	61	78	90	101	108	121	55
1984	Sp. biomass (000 tons)	232	210	200	190	172	159	148	141	128	197
	Fishing mortality	0.10	0.20	0.25	0.30	0.40	0.48	0.55	0.60	0.70	0.23
	Catch (000 tons)	29	51	60	68	81	89	94	97	102	55
1985	Sp. biomass (000 tons)	303	253	232	213	178	155	138	126	106	234
	Fishing mortality	0.10	0.20	0.25	0.30	0.40	0.48	0.55	0.60	0.70	0.21
1986	Sp. biomass (000 tons)	367	290	258	230	184	154	132	119	97	270
Recruitment of 1979 year-class: 150 million fish at age 3											
1982	Sp. biomass (000 tons)	65	65	65	65	65	65	65	65	65	65
	Fishing mortality	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
	Catch (000 tons)	55	55	55	55	55	55	55	55	55	55
1983	Sp. biomass (000 tons)	220	220	220	220	220	220	220	220	220	220
	Fishing mortality	0.10	0.20	0.25	0.30	0.40	0.48	0.55	0.60	0.70	0.25
	Catch (000 tons)	24	46	56	66	85	98	110	117	132	55
1984	Sp. biomass (000 tons)	233	211	200	190	172	159	148	141	128	201
	Fishing mortality	0.10	0.20	0.25	0.30	0.40	0.48	0.55	0.60	0.70	0.17
	Catch (000 tons)	36	65	77	88	105	116	124	129	137	55
1985	Sp. biomass (000 tons)	396	336	309	285	242	213	190	176	150	335
	Fishing mortality	0.10	0.20	0.25	0.30	0.40	0.48	0.55	0.60	0.70	0.16
1986	Sp. biomass (000 tons)	458	362	323	288	230	192	165	148	120	379

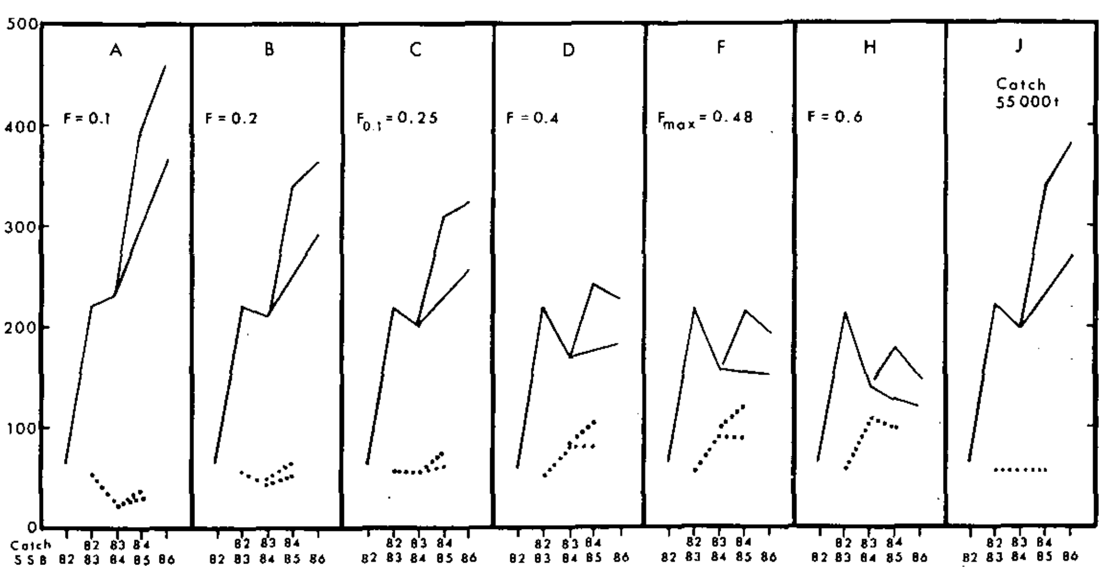


Fig. 1. Subarea 1 cod: projected catches (lower curve) and spawning stock biomass (upper curve) by various fishing strategies and assuming the nominal catch in 1982 to be 55,000 tons. Catch relates to the upper row of years, whereas spawning stock biomass (SSB) relates to the beginning of the year in the lower row. The two levels of catch in 1983-84 and of spawning stock in 1985 relate to upper and lower estimates of the numbers of recruits expected from the 1979 year-class.

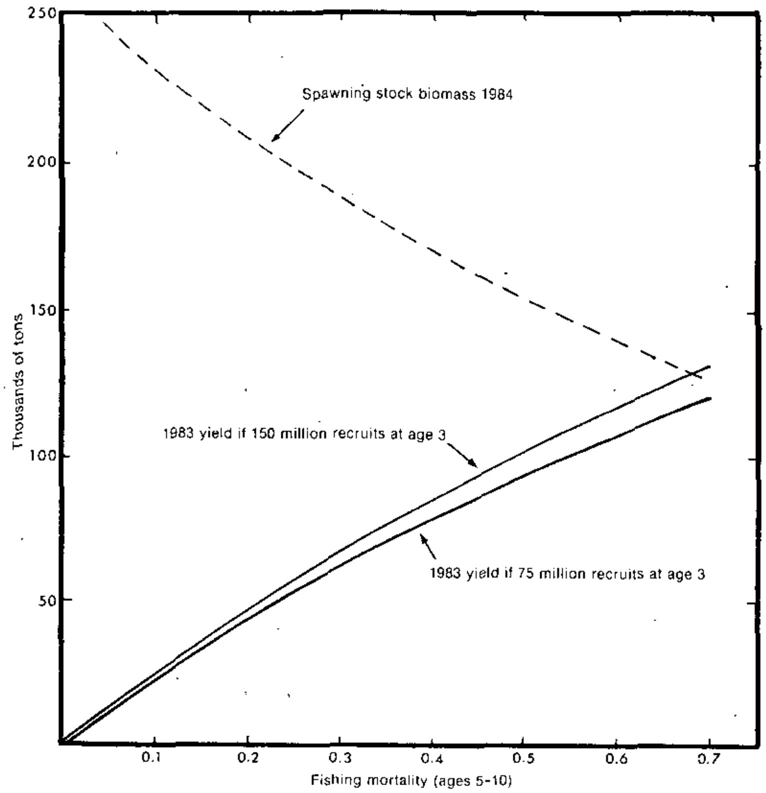


Fig. 2. Subarea 1 cod: estimates of yield in 1983 and resultant spawning stock biomass at the beginning of 1984 for various levels of fishing mortality in 1983.

e) Forecasts

The EEC has requested advice on catch and spawning stock size for the years 1983-86 under various fishing strategies and an estimated catch of 50,000 tons in 1982. However, analyses made before the Committee was informed of the request are based on a catch of 55,000 tons in 1982. Since a catch somewhat higher than 50,000 tons is likely, the Committee presents the forecasts on the basis of a 1982 catch of 55,000 tons. The results of the calculations under the assumptions given above for recruiting year-classes are set out in Table 2 and illustrated in Fig. 1 and 2.

The Committee reiterates its advice from last year (*NAFO Sci. Coun. Rep.* 1981, pages 32-35) that, since the dependency of recruitment upon spawning stock size cannot be ignored, the rebuilding of the spawning stock to a much higher level than at present should form the basis for management.

2. Cod in Divisions 2J, 3K and 3L (SCR Doc. 82/VI/68)

a) Fishery trends

Nominal catches were as high as 800,000 tons in 1968 but declined to a low level of 139,000 tons in 1978, corresponding closely to the TAC. The decline in catches was coincident with a decline in catch rates. The 1981 catch was less than the TAC, due mainly to a lower than expected catch by inshore gears. This decline in inshore catch, mainly in the cod-trap fishery, was probably the result of changed environmental conditions. Recent management strategy has been to limit catches to a level associated with fishing at or below the $F_{0.1}$ level. Recent TACs and nominal catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	657	554	300	160	135	180	180	200	230
Catch (000 tons)	373	288	214	173	139	167	175	161[1]	

[1] Provisional data

b) Assessment parameters

Biological sampling of commercial catches and landings was used to estimate the age composition and mean weight-at-age of removals in 1981. The 1974 and 1975 year-classes were dominant in the catches, as they had been in 1980. This was confirmed by data from research surveys carried out by Canada, Federal Republic of Germany, France and USSR. The 1978 year-class appeared to be relatively strong in Div. 3K and 3L but not in Div. 2J.

Catch rates for 1959-82, standardized with respect to gear type by country, division and month, were derived from available catch and effort data. Values were lowest in the mid-1970's but have since shown a steady increase, particularly in 1981. Preliminary data indicate that the 1982 catch rate is only slightly below the 1981 level.

Partial recruitment estimates for 1981 were obtained from averaging the selectivity coefficients over the period 1975-79 from VPA. These values along with average weight-at-age estimates from the 1981 commercial fishery are as follows:

Age (years)	4	5	6	7	8	9	10	11	12	13
Partial recruitment	0.18	0.48	0.70	0.85	1.00	1.00	1.00	1.00	1.00	1.00
Average weight (kg)	0.76	1.15	1.63	2.21	2.87	3.82	5.31	6.34	7.12	7.48

These data were used in a virtual population analysis (VPA) to obtain estimates of population numbers and biomass for 1981 (SCR Doc. 82/VI/68). Regressions of exploitable biomass on standardized catch rates for the period 1962-81 were used to obtain predicted values of stock biomass from the catch rates for 1980 and 1981. Best agreement between predicted biomass values and those estimated in the VPA was achieved with terminal F = 0.12 in 1981.

c) Conclusions

Some problems were expressed concerning the parameters used and the interpretation of the analytical assessment presented in SCR Doc. 82/VI/68. Although it was agreed that catch rates had increased and that total stock biomass appears to be increasing, some conflicting evidence existed when determining the extent of this biomass increase. A major difficulty was in the interpretation of recent high catch rates as absolute indicators of stock increase.

Although the results from surveys conducted by Canada, France and Federal Republic of Germany had indicated an increase in abundance from 1980 to 1981, it was considered that this increase may have resulted from an increase in availablity. This factor may have been responsible, as well, for part of the substantial increase in commercial catch rates from 1980 to 1981.

There was some indication that catchability may have changed in recent years (since 1973). Consequently, it was not possible to determine whether all years in the catch-rate series should be used or only those since 1973, because the estimates of biomass and abundance were quite different, depending on the catch-rate series used. Terminal F-values varied from 0.12 to 0.25, the higher value being obtained when the VPA results were related to the more recent series. Use of the data for the more recent period (1974-81) caused problems when exploitable biomass was compared to catch rate, mainly because of the small number of data points and the consequent influence of extreme values. Because of these uncertainties, the Committee was unable to determine an appropriate terminal F-value for 1981 and was therefore unable at this time to provide advice on a TAC for 1983. Advice concerning this stock was deferred to the September 1982 Meeting when additional information from surveys and the commercial fishery should be available.

In view of the difficulties in assessing this stock, STACFIS

recommends

that a more extensive research program relating to the inshore cod fishery in Div. 2J, 3K and 3L should be considered to obtain additional information needed to enhance the assessment.

3. Cod in Division 3M (SCR Doc. 82/VI/2, 63, 66)

a) Fishery trends

Nominal catches from this stock declined from a high of 60,000 tons in 1965 to an average level of 24,000 tons during 1973-77. Recent catches and TACs are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	40	40	40	25	40	40	13	12.75	12.4[1]
Catch (000 tons)	25	22	22	27	33	30	11	14[2]	

[1] Excludes anticipated catches by Spain.
[2] Provisional data.

Fluctuations in estimated stock size and recruitment (SCR Doc. 82/VI/2) are shown in Fig. 3.

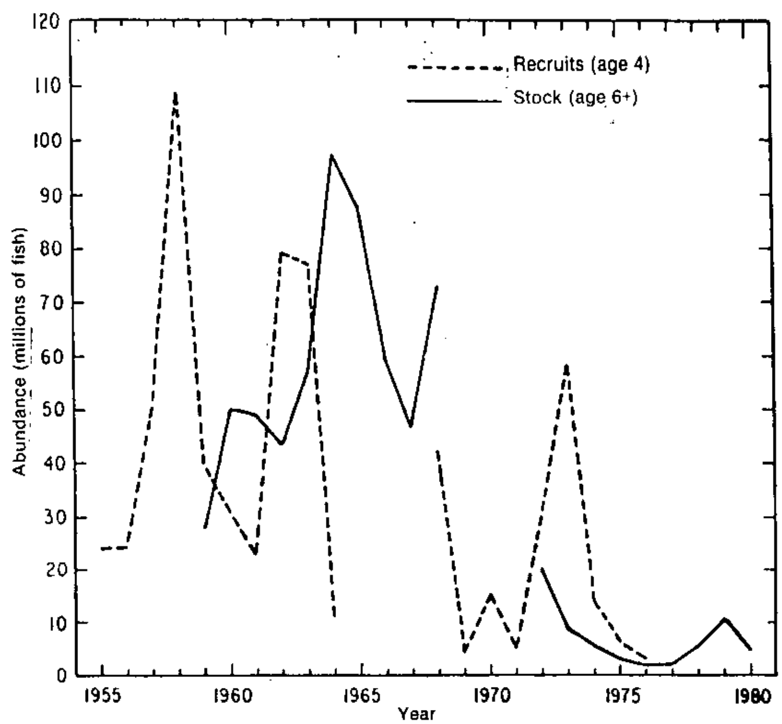


Fig. 3. Fluctuations in stock size and recruitment for cod in Div. 3M.

b) Assessment

Examination of catch rates from the Norwegian long-line fishery corroborated previous results which indicated a decline from 1979 to 1980. More recent catch and effort data from the commercial fishery were not available. Length and age compositions from research and commercial catches indicated that a few year-classes were dominant. The commercial data showed that 50-70% of removals was due to the strong 1977 year-class. Results from the Canadian research survey indicated that 40% of the population was comprised of the 1980 and 1981 year-classes. Results from the USSR research survey in 1981 and 1982 showed that the 1981 year-class was very strong but that the 1980 year-class was poor, while the 1979 year-class was strong. This discrepancy was attributed to differences in ageing.

Abundance estimates from recent USSR surveys (SCR Doc. 82/VI/63) are as follows:

	Mar 1979	May 1980	Jun 1981	Dec 1981	Apr 1982
Abundance (millions)	67.4	32.2	36.9	21.4	25.2
Biomass (000 tons)	67.2	48.2	92.6	32.2	33.1
Average weight (kg)	0.997	1.503	2.509	1.505	1.313

The abnormally high average weight from the June 1981 survey makes interpretation of results from that survey difficult. Abundance estimates in numbers, with 95% confidence limits, from Canadian research surveys (SCR Doc. 82/VI/66) are as follows:

	1978	1979	1980	1981	1982
Abundance (millions)	47.0	11.6	8.5	5.3	2.9
Lower limit	39.7	8.7	6.7	4.0	2.3
Upper limit	55.6	15.4	10.8	7.1	3.5
Z (ages 4-10)	1.93	1.25	0.94	1.71	

The calculated total mortality rates (Z) are high relative to estimates of natural mortality (M = 0.2) and optimum fishing mortality ($F_{0.1}$ = 0.2).

The Committee noted that there was some by-catch of cod in the redfish fishery, but data were insufficient for explicit calculations to be carried out. Noting the very low and continually declining abundance, and dominance of the age composition of the population by young fish, STACFIS advises that there should be no directed fishery for cod in Div. 3M during 1983.

Resumption of the fishery should not take place until such time as results from the research surveys show a recovery of the stock. Maintenance of a small experimental commercial fishery for the purpose of obtaining information about the stock could not be justified on scientific grounds.

4. Cod in Divisions 3N and 3O (SCR Doc. 82/VI/57)

a) Fishery trends

Nominal catches declined from a high of 227,000 tons in 1967 to the TAC level, of 15,000 tons in 1978. TACs have remained low since that time to permit stock rebuilding. Recent catches and TACs are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	101	88	43	30	15	25	26	26	17[1]
Catch (000 tons)	73	44	24	18	15	28	20	24[2]	

1 Excludes anticipated catches by Spain.
2 Provisional data.

b) Assessment parameters

Biological sampling of commercial catches and landings was used to estimate the age composition and mean weight-at-age of removals in 1981. The 1974 and 1975 year-classes predominated (53%) in the catch, as they had in 1979 and 1980. Canadian research survey data indicated that the 1975 and 1978 year-classes were strong but that the 1978 year-class was the more abundant one.

Catch rates for 1959-81, derived from available catch and effort data, standardized with respect to gear type by country, division and month, showed considerable fluctuation in recent years, which may have been due to the small amount of catch and effort data available. Such data were available mostly from the Canadian otter-trawl fishery which takes cod mainly as by-catch.

Partial recruitment estimates for 1981 were obtained from averaging the selectivity coefficients over the period 1974-79 (excluding 1976), as derived from VPA. These values along with the average weight-at-age estimates from the 1981 commercial fishery are as follows:

Age (years)	3	4	5	6	7	8	9	10	11	12
Partial recruitment	0.07	0.45	0.85	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average weight (kg)	0.90	1.27	1.84	2.69	3.55	5.33	7.13	9.10	9.01	10.15

These data were used to update the VPA to obtain estimates of population numbers and biomass for 1981. Regressions of exploitable biomass on standardized catch rates were used to predict stock biomass from the catch rates for 1980 and 1981. Best agreement between predicted biomass values and those estimated in the VPA was achieved with terminal F = 0.18 in 1981.

Population numbers at age were used to project population biomass in 1983, using the following parameters: constant catch of 26,000 tons in 1982 and 1983, partial recruitment and average weight-at-age values given above, and a recruitment level of 15 million fish at age 3 in 1982 and 1983. This level of recruitment was chosen as an approximation of the lowest level appearing in the VPA, because the 1979 and 1980 year-classes appear to be poor from survey data. The projected mid-year biomass (age 3+) in 1983 was approximately 180,000 tons.

c) Conclusions

Recent assessments of this stock have indicated that it is in a depressed condition, with the younger age-groups predominating in the population, and a cautious approach to exploitation was recommended. The present assessment indicates that the stock is still predominated by younger age-groups but is showing some general improvement in terms of estimated biomass and catch-rate levels. Some uncertainties and inadequacies expressed related to: lack of any sampling data for the catch by the Spanish fleet in 1981 (estimated at 50% of the TAC), fluctuations in catch rates in recent years, and the use in recent years of catch rates only for Canadian (Nfld) otter trawlers which take cod mainly as by-catch in the flounder fishery. It was considered that the assessment results may be optimistic.

At the Second Special Meeting of the Fisheries Commission (FC Doc. 81/IV/4, revised), it was agreed that the TAC for this stock should not be increased beyond the 1980 level of 26,000 tons until the biomass reached half the level required for the long term sustainable catch at F_{max}. At the Third Annual Meeting of the Fisheries Commission (FC Doc. 81/IX/14), that biomass level was quantified as 200,000 tons, being the age 3+ annual mean biomass. The present assessment projects the 1983 biomass of age 3+ fish at 180,000 tons. In view of this short-fall in terms of target biomass together with the uncertainties expressed above, STACFIS advises that the yield for 1983 remain at the intended 1980-82 level of 26,000 tons.

5. Redfish in Subarea 1

a) Fishery trends

Nominal catches have fluctuated widely since 1950, increasing from 150 tons in 1951 to a maximum of 61,000 tons in 1962, generally decreasing thereafter to a low level of about 3,000 tons in 1971-74, and increasing thereafter to a level of about 7,000 tons in the last three years. There is indication that the official catches for 1977, 1978, and 1979 may have been overestimated. Recent catches are as follows:

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Catch (000 tons)	3	3	9	14	31	8	9	8	6[1]

[1] Provisional data

b) Assessment

The *Sebastes marinus* stock was assessed at the April 1979 Meeting (*ICNAF Redbook* 1979, page 74). A further assessment has not yet been possible due to the lack of sufficiently good fishing effort data for recent years. The previous assessment, based on a general production model analysis, indicated an MSY (maximum sustainable yield) level of about 10,000 tons and an equilibrium catch at 2/3 F_{MSY} of about 9,000 tons. However, the correlation coefficient from the regression of catch-per-effort on fishing effort ($r = 0.63$) indicates that catch levels derived from the model have fairly large variances.

6. Redfish in Division 3M (SCR Doc. 82/VI/58)

a) Fishery trends

Nominal catches increased from 700 tons in 1967 to 42,000 tons in 1972 and then declined to values between 14,000 and 20,000 tons since 1975 under TAC regulation. Recent catches and TACs are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	40	16	16	16	16	20	20	20	20
Catch (000 tons)	35	16	17	20	17	20	16	14[1]	

[1] Provisional data

b) Abundance

Length frequencies from the commercial fishery indicate that a large proportion of the 1981 catch consisted of 27-29 cm fish, implying that the fishery was largely concentrated on the successful year-classes of the early 1970's. Research surveys also indicated that these year-classes were relatively abundant but that subsequent year-classes of the 1970's were poor. However, the 1980 and 1981 year-classes appear to be relatively strong.

c) Assessment

Because of a change in fleet composition in the early 1970's and a paucity of fishing effort data for the 1960's, catch/effort data for 1972-80 only were standardized, using the multiplicative model. Catch rates have increased since 1979, following recruitment of the year-classes of the early 1970's to the fishery. Calculation of Z (1954-63 year-classes) from Canadian research survey data indicated F-values in the range of 0.09-0.12, although there were indications that fishing mortality on year-classes of the early 1970's may have been higher during 1979-81.

The Committee noted the inadequacy of the data available for this stock and the resultant difficulties in carrying out an assessment. Although the year-classes of the early 1970's will contribute significantly to the fishery over the next few years, it was noted that subsequent year-classes up to that of 1979 appear to be very weak. STACFIS, reiterating the problems associated with this assessment, advises that the TAC for 1983 remain at 20,000 tons.

7. Redfish in Divisions 3L and 3N (SCR Doc. 82/VI/59)

a) Fishery trends

Nominal catches fluctuated considerably prior to 1974 but have stabilized somewhat since then under TAC regulation. Recent catches and TACs are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	28	20	20	16	16	18	25	25	25
Catch (000 tons)	22	18	21	16	12	14	16	27[1]	

[1] Provisional data

b) Abundance

Length frequencies from the commercial fishery in Div. 3N in 1981 indicated the exploitation of relatively small fish (20-30 cm in length), due to concentrated fishing in shallower depths because of rough bottom at depths greater than about 350 m. Canadian (Nfld) vessels caught fish over a wide range of size in Div. 3L, except in November-December when 25-35 cm fish were taken. Research length frequencies from both Canadian and USSR research surveys in Div. 3L in 1981 indicated the dominance of 27-30 cm fish. The Canadian survey also indicated considerable numbers of larger fish. Few or no fish less than 20 cm were detected in either survey.

c) Assessment

Catch/effort data for 1959-81 were standardized using the multiplicative model. The 1968 and 1974 points appeared to be anomalous, probably because the data for these years were available for only 2.2% and 0.3% of the total catches respectively. Regressions of catch-per-unit-effort indicated that significance was achieved only when these apparently anomalous points were included.

Catch curves constructed from Canadian research-vessel survey data gave varying estimates of F, but data from the 1979 survey, considered to be the best with regard to coverage, indicated a value of 0.12. This is slightly below values of $F_{0.1}$ for other redfish stocks (0.13-0.15). During the 1959-78 period, nominal catches averaged 22,000 tons annually. The Committee, noting the inadequequencies in the data base, considered that the above may be interpreted as indicating that exploitation of this stock approximates the $F_{0.1}$ level. STACFIS therefore advises that the TAC for 1983 should remain at 25,000 tons.

8. Silver hake in Divisions 4V, 4W and 4X (SCR Doc. 82/VI/1, 13, 49, 65)

a) Fishery trends

The fishery on this stock commenced in 1958. Peak catches occurred in 1963 (123,000 tons), 1970 (169,000 tons) and 1973 (299,000 tons). Recent catches and TACs are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	100	120	100	70	80	70	90	80	80
Catch (000 tons)	96	116	97	37	48	52	45	41[1]	

[1] Provisional data.

b) Abundance

The observed monthly distributions of USSR catches of silver hake and several groundfish species were reviewed (SCR Doc. 82/VI/1). From the Canadian Observer Program, it was noted that the catch rate had decreased from 1.88 tons/hour in 1979 to 1.18 tons/hour in 1981 (SCR Doc. 82/VI/65). The observed data series indicates that there has not been a significant change in fishing effort since the "small mesh gear line" was established in 1977.

c) Assessment parameters (SCR Doc. 82/VI/65)

Catch composition. The age compositions of catches in 1961-80 were the same as those used in the previous assessment (SCR Doc. 81/VI/74), except that removals in 1979 were adjusted to reflect the final reported nominal catch in that year. Some discrepancies were noted between age compositon data presented by USSR (SCR Doc. 82/VI/13, 14) and by Canada (SCR Doc. 82/VI/65).

The 1981 age composition used in the current assessment was estimated from length frequencies and otolith ageing of samples collected by Canadian observers aboard vessels engaged in the silver hake fishery.

Partial recruitment. Partial recruitment values were derived by averaging F-values over the 1977-80 period obtained from trial VPA runs, with M assumed to be 0.40 (*ICNAF Sel. Papers* No. 3, pages 29-31). The resultant values indicated that the age of full recruitment has shifted from age 3 to age 4, following the introduction of the 1977 regulations.

Recruitment. Reliable recruitment estimates have been difficult to derive for this stock. However, commercial catch-at-age data indicate that the 1978 year-class is a good one.

d) Validation of VPA

The Committee considered several methods of validating VPA results, using commercial fishing effort data. However, these methods proved unsatisfactory, because of changes in the fishery brought about by regulatory actions in 1977. Imposition of the "small mesh gear line" and the increase in codend mesh size from 40 to 60 mm in 1977 have resulted in a change not only in the selectivity pattern but also in availability of fish to the fishery. This affected the use of both fishing effort and catch-per-unit-effort time series in validating the VPA. It was recognized that further studies of such research vessel survey data and commercial fishing effort data series should be conducted. In the absence of further information at this time, STACFIS advises that the TAC for 1983 should remain at the 1982 level of 80,000 tons.

9. American plaice in Division 3M

This stock has been regulated since 1974, and nominal catches have ranged from 400 to 2,000 tons. The TAC has been set at the 2,000 ton level except in 1978 when it was increased to 4,000 tons. The reported catches are almost exclusively by-catches in the cod and redfish fisheries of the area. The nominal catch in 1980 was about 1,200 tons but decreased to less than 400 tons in 1981. There is no new information on the stock, and STACFIS advises that the TAC remain at 2,000 tons for 1983.

10. American plaice in Divisions 3L, 3N and 3O (SCR Doc. 82/VI/12, 52)

a) Fishery trends

Nominal catches reached a level of 94,000 tons in 1967 but have not exceeded 53,000 tons since TAC regulation was introduced in 1973. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	60	60	47	47	47	47	47	55	55
Catch (000 tons)	46	43	52	44	50	49	49	50[1]	

[1] Provisional data.

b) Abundance

Catch rates from Canadian commercial trawlers showed an increase over the period from 1977 to 1980, with a slight decline to 0.57 ton/hour in 1981. Data from Canadian research vessel surveys indicate a relatively stable population over the 1977-80 period, with a decrease in 1981. The indicated decrease may be due in part to the incompleteness of the survey in Div. 3N. USSR survey data (SCS Doc. 82/VI/12) indicated very little change in abundance in Divisions 3L, 3N, and 30 from 1980 to 1981.

c) Assessment parameters

Catch composition. Age composition and mean weight-at-age data for Div. 3L and 3N only were derived from Canadian commercial sampling in 1981. As a result of more fishing effort in Div. 3L, a considerable change in the catch-at-age was observed in 1981. There were considerably fewer fish of age-groups 6-9 in the catch and significantly more fish of age-groups 11-19 than have been observed in recent years.

Partial recruitment. Because of the reduction in the catch of fish aged 6-10 in 1981, the values for partial recruitment at these ages were adjusted downward from the values used in the 1981 assessment. The resulting valu-s for 1981 and the average values for 1977-80 (used in projection) are as follows:

Age (years)	6	7	8	9	10	11	12	13+
Partial recruit. (1981)	0.008	0.037	0.123	0.231	0.515	0.750	0.800	1.000
Partial recruit. (1977-80)	0.040	0.150	0.300	0.400	0.600	0.750	0.800	1.000

Fishing mortality. An F-value of 0.325 was used for fully-recruited age-groups in 1981 to initiate the VPA. This value was determined to be the best estimate for terminal F in 1981, based on (i) the regression of biomass (age 8+) from VPA on catch-per-unit-effort, (ii) the regression of fishing mortality (ages 8-18) weighted by population numbers on fishing effort, and (iii) the regression of population numbers (ages 8-18) from VPA on abundance from research vessel surveys.

Recruitment. The geometric mean of population numbers (age 6) from VPA for 1976-80 was used to estimate recruitment to the fishery in Div. 3L and 3N in 1982 and 1983. This value was 236.5 million fish.

d) Projection results

A projection, using the 1981 population numbers from VPA with terminal F = 0.325, average weights at age for 1980-81, and average partial recruitment for 1977-80, indicated that the removal of 48,000 tons in 1982 would lead to a catch of 49,000 tons in 1983 at $F_{0.1}$ = 0.262 (for Div. 3L and 3N only). Catches in Div. 30 have averaged 4,000 tons since 1977. Therefore, STACFIS advises a continuation of the TAC of 55,000 tons in Div. 3LNO for 1983.

11. Witch flounder in Divisions 3N and 30

a) Fishery trends

Nominal catches increased from 4,700 tons in 1969 to a high of 15,000 tons in 1971 and declined to a level of about 3,000 tons in 1978-81. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	10	10	10	10	10	7	7	5	5
Catch (000 tons)	8	6	6	6	3	3	3	2[1]	

[1] Provisional data.

b) Previous assessments have indicated that the stock of witch flounder in this area is located in deep water along the southwest slope of Grand Bank. A general production model analysis, presented at the June 1980 Meeting (SCR Doc. 80/VI/95), indicated an equilibrium catch at 2/3 F_{MSY} of 4,000-5,000 tons. Also, age composition data presented at that meeting indicated that the average fishing mortality was near $F_{0.1}$ when catches were in the range of 5,000-6,000 tons, thus resulting in the advice that the TAC for 1981 should not exceed 5,000 tons. No new data were available for consideration at this meeting, but, in view of the apparent stability of recent catch levels, STACFIS advises that the TAC of 5,000 tons, in effect since 1981, should remain for 1983.

12. Yellowtail flounder in Divisions 3L, 3N and 3O (SCR Doc. 82/VI/53, 62)

a) Fishery trends

The nominal catch peaked at 39,000 tons in 1972 and declined to 8,000 tons in 1976. Because of a reduction in directed fishing effort for yellowtail flounder in 1980 and 1981, the TAC was not taken in either year. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	40	35	9	12	15	18	18	21	23
Catch (000 tons)	24	23	8	12	16	18	12	15[1]	

[1] Provisional data.

b) Abundance

The catch rates of Canadian (Nfld) otter trawlers increased steadily over the 1976-80 period but showed a slight decline in 1981 to a level of 0.61 ton/hour. Data from the Canadian research vessel survey indicated a decline in abundance in 1981, but the survey coverage was not as extensive as in previous years. USSR survey results (SCR Doc. 82/VI/62) also indicated a decrease in abundance from 1980 to 1981.

c) Assessment parameters

Catch composition. Length and age compositions and mean weight-at-age data were derived from Canadian commercial sampling in 1981.

Partial recruitment. These values, derived from a VPA using the catch-at-age data for 1978-81, represent the average of the fishing mortality in 1979 and 1980, standardized to 1.0 for age 9, and older, with an adjustment made at age 4 based on the ratio of catches at age 4 in 1980 and 1981. The values for 1981 and the average values for 1968-76 (used in the projection) are as follows:

Age (years)	4	5	6	7	8	9	10
Partial recruit. (1981)	0.035	0.068	0.222	0.628	0.970	1.000	1.000
Partial recruit. (1968-76)	0.010	0.130	0.460	1.000	1.000	1.000	1.000

Terminal fishing mortality. For the partial recruitment values given above, terminal F in 1981 was estimated to be 0.90. This value was determined to be the best estimate, based on the regression of biomass (age 4+) from VPA on catch-per-unit-effort and the regression of weighted fishing mortality (ages 4-10) on fishing effort.

Recruitment. The geometric mean of population numbers at age 4 from the VPA for 1968-77 was used as an estimate of recruitment at age 4 for the projections to 1983, this value being 100 million fish.

d) Projection results

Results of the projection, using the 1981 population from the VPA at F = 0.9, average weights for 1968-74, and average partial recruitment values (1968-76), show that the removal of 23,000 tons in 1982 would result in a fully-recruited F-value of 0.705, compared with $F_{0.1}$ = 0.518. This indicated that fishing mortality for 1980 (used in the 1981 assessment) may have been underestimated. The projected catch level for 1983 at $F_{0.1}$ is 19,000 tons. It is important to note that using the estimates of the population of age 4 fish in 1981, 1982 and 1983 results in a projected catch for 1983, 34% of which comprises ages 4-6 fish. On the assumptions that the TAC in 1982 will be taken and that recruitment at age 4 in 1982 and 1983 will be at the estimated levels, STACFIS advises that a TAC of 19,000 tons in 1983 corresponds to fishing at the $F_{0.1}$ level.

13. Greenland halibut in Subareas 0 and 1

a) Fishery trends

Nominal catches peaked at 25,000 tons in 1975 and have been less than 20,000 tons since then. Provisional data for 1981 indicate a catch of 5,000 tons, all taken in Subarea 1. There is some indication that the reported catches for 1977-79 may have been overestimated (SCR Doc. 80/VI/72). Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	-	-	20	20	20	25	25	25	25
Catch (000 tons)	14	25	16	13	12	19	8	6[1]	

[1] Provisional data.

b) Assessment

No new commercial data were available for this stock, the status of which has not been assessed since 1978, when a VPA indicated a possible annual yield of 35,000 tons. However, due to some uncertainty about the data, a precautionary TAC of 25,000 tons was advised for 1979 and maintained during 1980-82. Biomass estimates for Div. 0B from a 1981 survey indicated a high level of biomass (SCR Doc. 81/VI/95). However, trawling coverage was represented by only one set per 650 squares miles, and this was considered to be inadequate for reliable estimates of biomass. Furthermore, the major portion of the stock is located in Subarea 1, and the entire catch during 1981 was taken in Subarea 1 from which no biological data are available. Lacking data for an up-to-date assessment, STACFIS advises that the TAC of 25,000 tons should remain in effect for 1983.

14. Greenland halibut in Subarea 2 and Divisions 3K and 3L (SCR Doc. 82/VI/67)

a) Fishery trends

Nominal catches ranged from 25,000 to 30,000 tons during 1971-76, increased to a peak of 39,000 tons in 1978 and subsequently declined to near 30,000 tons in 1981. About 65% of the 1981 catch was taken in the Canada (Nfld) inshore fishery, with the remainder taken by Canadian, USSR and Polish trawlers offshore. Nearly the entire catch in 1981 was taken in Div. 2J, 3K and 3L. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	40	40	30	30	30	30	35	55	55
Catch (000 tons)	27	29	25	32	39	34	33	30[1]	

[1] Provisional data

b) Biomass surveys

Stratified-random trawl surveys of Div. 2J, 3K and 3L in 1981 indicated a minimum trawlable biomass estimate in excess of 165,000 tons. It was noted that this estimate was related to the continental shelf area only and not to the deep waters of the continental slope where the larger, older fish are located. However, it was considered that this estimate is probably indicative of that portion of the population upon which most commercial exploitation occurs.

c) Assessment parameters

Catch composition and weight-at-age. Catch-at-age data for 1981 were derived from samples obtained from Canadian landings which represented 82% of the total catch. Mean weight-at-age data were derived by applying a length-weight relationship from the 1980 survey data to the weighted length-at-age data from the commercial catches in 1981. The age compositions and mean weight-at-age values for 1975-80 were the same as those given in SCR Doc. 81/VI/64. These data were used to determine levels of fishing mortality and stock size over that period.

Partial recruitment. Partial recruitment values were derived by comparing the age composition from the 1980 survey (when commercial fishing was essentially complete) adjusted ahead by 1 year to the commercial age composition in 1981.

Age (yr)	5	6	7	8	9	10	11	12	13	14	15	16	17
Mean weight (g)	392	598	789	985	1235	1700	2460	3507	4794	5944	9055	8710	9576
Part. recruit.	0.06	0.32	0.69	1.00	1.00	0.36	0.07	0.01	0.02	0.02	0.03	0.03	0.03

The partial recruitment pattern calculated for 1981 was found to be clearly dome-shaped, with fish beyond age 10 essentially unavailable to the existing fishery. The Committee considered that the calculated partial recruitment pattern was reasonably representative of the 1981 fishery, because the fishery was mainly prosecuted by near-shore gillnets and by trawlers fishing on the continential shelf, with little fishing on the continental slope or in the more northerly divisions where the larger fish are found.

Fishing mortality. F for fully-recruited age-groups in 1981 was calculated from estimates of survival of age-groups 8 and 9 between the 1980 and 1981 surveys. The value of F derived in this manner was 0.26.

d) Assessment results

The catch-at-age matrix for 1981 indicated that the fishery was highly dependent on four age-groups (6-9) which constituted more than 93% of the total landings (by numbers) with 65% from the 1973 and 1974 year-classes (ages 8 and 7) alone.

The population size from VPA was found to be very sensitive to small changes in terminal F, particularly considering the partial recruitment pattern of the older age-groups. Consequently, the Committee concluded that the method of calculating terminal F should be viewed with caution because of the large variances associated with abundance indices from surveys. It was difficult, therefore, to determine which VPA might be correct. It was agreed, however, that fishing mortality in 1981 was probably well below the $F_{0.1}$ level, considering the exploitation pattern, levels of removals, and the estimates of minimum biomass. STACFIS therefore advises that the TAC for 1983 should remain at 55,000 tons, noting that the TAC should apply to Div. 2J, 3K and 3L only. Any increase in catch beyond the 55,000 tons should be directed in Div. 2G and 2H, where the biomass level may be near that of the more southerly divisions.

15. Roundnose grenadier in Subareas 0 and 1 (SCR Doc. 82/VI/55)

a) Fishery trends

Nominal catches have fluctuated between 400 and 12,000 tons during 1974-81. The TAC remained at 8,000 tons since 1977. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	-	10	14	8	8	8	8	8	8
Catch (000 tons)	12	5	9	3	6	7	2	0.4[1]	

[1] Provisional data.

b) Assessment

The assessments of this stock since 1976 have consistently indicated a TAC of 8,000 tons. There has been essentially no directed fishery in recent years and the TACs were not fully utilized. In the absence of new data, STACFIS advises that the TAC for 1983 remain at 8,000 tons.

16. Roundnose grenadier in Subareas 2 and 3 (SCR Doc. 82/VI/55, 81/IX/106)

a) Fishery trends

Except for a catch of 75,000 tons in 1971, nominal catches ranged from 12,000 to 28,000 tons during 1967-78 but then decreased to 8,000 tons in 1979 and 2,000 tons in 1980. There was an increase in 1981 to about 7,000 tons. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	32	32	35	35	35	35	30	27	27
Catch (000 tons)	28	27	21	15	21	8	2	7[1]	

[1] Provisional data.

b) Assessment

The Committee reviewed an updated analysis of catch/effort data (SCR Doc. 82/VI/55) and a virtual population analysis of the population in Div. 3K (SCR Doc. 81/IX/106).

The catch/effort analysis incorporated not only statistics reported to NAFO but also data collected by the Canadian Observer Program during 1979-81. Regressions of catch-per-unit-effort on fishing effort were not significant, rendering the general production model inapplicable. Althought much discussion centered around the reliability of these data, concern was expressed about the continuing decline in catch rates since the early 1970's and particularly the value for 1981 which is the lowest recorded for the fishery.

The virtual population analysis (SCR Doc. 81/IX/106) indicated long-term yields in Div. 3K of 18,000 and 28,000 tons for M = 0.20 and M = 0.15 respectively. Discussion centered around the discrepancies between yield-per-recruit values at F_{max} for M = 0.20 and M = 0.15 stated in the text of this document (133 g and 337 g respectively) and those inferred from fig. 9 of the same document (86 g and 118 g respectively).

Independent estimates of yield-per-recruit, based on the method of Thompson and Bell (*Rep. Int. Pacific Halibut Comm.*, 8: 49 p., 1934) and utilizing the F-matrix and weight-at-age data in SCR Doc. 81/IX/106, resulted in values close to those in fig. 9 of the document. A summary of the yield-per-recruit (g) values obtained are as follows:

M	SCR Doc. 81/IX/106		Thompson and Bell method	
	F_{max}		$F_{0.1}$	F_{max}
	Text	fig. 9		
0.20	133	≈86	76	≈94
0.15	337	≈118	110	122

Utilization of the values determined by the method of Thompson and Bell indicated a long-term yield in Div. 3K of about 10,000 tons at both values of M. In determining long-term yields, the yield-per-recruit was multiplied by the average number of 2-year-olds (1967-78) derived from the VPA in SCR Doc. 81/IX/106. It was noted that the VPA indicated a steady decline in the number of 2-year-olds from 1967 to 1978 and that the average for the entire period is probably too high. It was therefore considered more appropriate to use the average of the numbers of 2-year-olds given in the VPA for the 1973-76 period. With M = 0.20, the calculations indicate a long-term yield of 5,500 tons in Div. 3K. The average catch for Subareas 2 and 3 since 1967 (excluding Div. 3K and the very high 1971 catch in Div. 2G) has been 5,750 tons. Thus, the long-term yield for Subareas 2 and 3 may be in the order of 11,000 tons.

The Committee noted that reduced catches of roundnose grenadier since 1979 have been in part due to limitations in the allowable by-catch of Greenland halibut, although the stock has been assessed as being abundant in recent years. Although there is much uncertainty about the data available for this stock, it was considered that the downward trend in catch rates and in the numbers of age 2 fish from the VPA could not be ignored. STACFIS therefore advises that a precautionary TAC of 11,000 tons should be imposed for 1983, pending the presentation of further data which would allow reevaluation of the status of the stock.

17. Wolffishes in Subarea 1

a) Fishery trends

The nominal catches reported include two species: Atlantic wolffish (*Anarhichas lupus*) and spotted wolffish (*Anarhichas minor*). The total catches since 1957 have been in the range of 3,000-6,000 tons. The reported catch for 1979 was 17,000 tons, but there is an indication that the officially-reported catches in 1977-79 may have been overestimated. Recent catches are as follows:

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Catch (000 tons)	5	6	6	6	6	6	17	5	4[1]

[1] Provisional data

b) Breakdown into species

The catches for 1981 were not broken down into species, but, following the guidelines given at the June 1981 Meeting (*NAFO Sci. Coun. Rep.* 1981, page 46), about 80% of the catch by weight consists of *Anarhichus minor*.

c) General remarks

It is not possible to carry out a detailed assessment of wolffishes until more biological data become available. However, taking into account the available statistics, the description of the fishery presented by E. Smidt (*NAFO Sci. Coun. Studies* No. 1, pages 35-40) and the discussion at the June 1980 Meeting (*NAFO Sci. Coun. Rep.* 1979-80, pages 85-86), STACFIS advises that a catch level of 5,000-6,000 tons seems to be reasonable.

18. Capelin in Subareas 2 and 3 (SCR Doc. 82/VI/18, 54, 56, 60, 61)

a) Fishery trends

Nominal catches of capelin in Subareas 2 and 3 increased from 2,800 tons in 1971 to 366,000 tons in 1975 and declined to 20,000 tons in 1980. Preliminary statistics indicate a catch of 37,000 tons in 1981. No offshore fishing was allowed in Div. 3LNO during 1979, 1980 and 1981, and only a small experimental offshore fishery was allowed in Subarea 2 and Div. 3K in 1980 and 1981. Recent TACs and catches are as follows:

Area		1974	1975	1976	1977	1978	1979	1980	1981
2+3K	TAC (000 tons)	110[1]	160[1]	160[1]	212[1]	212	75	5	10
	Catch (000 tons)	127	199	216	152	55	11	6	12[3]
3LNO	TAC (000 tons)	148[2]	180[2]	180[2]	200[2]	200	10	16	30
	Catch (000 tons)	158	166	144	74	30	12	14	25[3]

1 Countries without allocations could each take up to 10,000 tons.
2 Countries without allocations could each take up to 5,000 tons.
3 Provisional data.

b) Subarea 2 and Division 3K

i) Commercial catch-effort analysis

The series of catch rates of USSR BMRT-type trawlers has been considered as a useful index of abundance (*ICNAF Redbook* 1979, page 34; *NAFO Sci. Coun. Rep.* 1979-80, page 49; *NAFO Sci. Coun. Rep.* 1981, page 15), although it was noted that the 1979 and 1980 estimates were for the smaller BMRT class and the previous estimates were for the more powerful BMRT-A class trawlers. Catch rates peaked in 1975 at 6.47 tons per hour fished and declined to 1.34 tons per hour fished in 1979. The catch rate of 4.57 tons per hour fished from the experimental fishery in 1980 was considered to be an overestimate. The catch rate of BMRT trawlers in the experimental capelin fishery in 1981 was 3.68 tons per hour fished, indicating that the stock was showing signs of increase. Catch rates for 1972-81 are as follows:

Year	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Catch per hour (tons)	2.81	3.29	4.56	6.47	5.27	4.14	2.29	1.34	4.57[1]	3.68

1 Overestimated.

The results from the experimental capelin fishery in Div. 2J indicated that catch rates were generally good during September and October. The catch rate declined at night when the capelin schools dispersed and moved to the surface and also during periods of increasing wind because the fish scattered into small schools.

ii) Research vessel surveys

A Canadian acoustic survey, conducted in Div. 2J and 3K during 1-20 October 1981, resulted in an abundance estimate of 1,800,000 tons of capelin. This is in contrast to a similar survey conducted in 1980 when the capelin stock was so low that biomass could not be estimated. For the 1981 biomass estimate, 1,500,000 tons were found in Div. 2J and the remainder (300,000 tons) occurred in Div. 3K. The 1979 year-class predominated in Div. 2J, whereas the 1980 year-class predominated in Div. 3K. In the overall survey, the 1979 and 1980 year-classes accounted for 92% of the total numbers of capelin and 82% of the biomass of capelin detected in the area surveyed.

Variance estimates due to survey and sampling design were presented (SCR Doc. 82/VI/54). The 95% confidence interval for the 1981 acoustic survey in Div. 2J+3K, calculated from the variance, was ±460,000 tons. It was noted that this variance resulted mostly from the survey and sampling design. Other potentially large sources of variance (e.g. variance due to target strength) also exist but have not yet been quantified. It would be possible to decrease the variance due to survey design by increasing the number of survey transects, but this would add considerably to the vessel time and expense. Most estimates of coefficient of variation were considered reasonable in view of the low sampling intensity and in comparison with error levels reported in other studies.

iii) Numerical population models

An assessment of the Div. 2J+3K capelin stock using a sequential capelin abundance model, was presented (SCR Doc. 82/VI/56). Two options of the model were available using different estimates of catch-per-unit-effort for 1980, because the measured value for 1980 was considered unreliable. A value of 1.34 tons per hour (the same as the 1979 value) was used in one option, and a value of 2.51 tons per hour (average of the 1979 and 1981 values) was adopted for the other option. Age-specific maturation rates were calculated for each option. Partial recruitment values were available from two sources: one series was derived from a comparison of age-compositions from the experimental fishery and the acoustic survey, and the other was derived from estimates of fishing mortalities in the early years of the series (1972-77) from initial runs of the model. The estimates of partial recruitment from these two sources were combined in the final runs of the sequential capelin abundance model. Estimates of exploitable biomass (1972-80) and catch-per-hour were well correlated with terminal $F = 0.01$ for both options. Because of the extremely low value of fishing mortality used to initiate the model in the terminal year (1981), the Committee concluded that the estimates of biomass and year-class strength were not reliable. Consequently, this analysis did not provide a reliable indication of stock status in 1981 and it was not used as a basis for 1982 and 1983 projections.

An examination of the catch data used in the model indicated that age-2 capelin were prominent in the catches of the last three years, exceeding 50% by number in 1979 and 1981 and 40% by number in 1980. Furthermore, in 1981, age-1 fish made the strongest contribution in the series, accounting for 9% of the catch in numbers. The dependence of the fishery on younger fish is probably a result of the 1974-78 year-classes being relatively weak and therefore not abundant at age 3 and older.

iv) Recruitment estimation and prognosis for 1982 and 1983

Estimates of year-class size from the Canadian acoustic survey in October 1981 were used as a basis for the projection in 1982 and 1983. Estimates of spawning mortality and proportions mature-at-age were derived from the sequential capelin abundance model. The estimated stock sizes in July 1982 and 1983 (the approximate spawning period) and September 1982 and 1983 are as follows:

Age (years)	Number of fish (millions)				
	Sep 1981	Jul 1982	Sep 1982	Jul 1983	Sep 1983
1	84,000				
2	71,000	67,000	63,700		
3	10,000	56,700	46,200	49,600	40,500
4	2,000	8,000	3,700	36,000	16,600
5	1,000	1,600	400	2,900	700
6	<1,000	800	200	300	<100
Mature biomass (tons)		370,000		802,000	
Total biomass (tons)			2,380,000		1,485,000

In these projections, the 1979 and 1980 year-classes account for most of the biomass in both 1982 and 1983. There is no estimate available for the size of the 1981 year-class, which would be age 2 in September 1983. The Committee emphasizes that the estimates of year-class strength and biomass provided in the projections are subject to potentially large errors. It has already been noted that the estimates of year-class size, derived from acoustic surveys, exhibit large variance. In addition, the values of proportion mature-at-age and spawning mortality, both of which are critical in the projections, probably exhibit large annual variations which cannot be taken into account with the available data. Evidence from the acoustic survey and the experimental fishery in the fall of 1981 indicates that the 1979 year-class is relatively abundant and probably stronger than all year-classes since the 1973 year-class. Furthermore, the catch-per-unit-effort index and the abundance estimate from the acoustic survey indicate an improvement in this capelin stock in 1981, a trend which is expected to continue as the 1979 year-class moves through the population.

In view of the anticipated improvement in the stock in 1983, the Committee notes that a commercial fishery could be initiated in the fall of 1983 and advises a TAC level of 50,000 tons. Because of the lack of an estimate for the 1981 year-class which could contribute significantly to the catch as 2 year-olds in 1983 and because of the projected age 3+ biomass of 1,500,000 tons in September 1983, this TAC level might be considered conservative. However, the potential errors in the projections infer that extreme caution should be used in advising a TAC level in 1983. In this respect, the Committee emphasizes that considerably more data will be available following the completion of research in 1982. Furthermore, for a relatively short-lived species, such as capelin, the biological advice is likely to be more accurate if it is provided as close to the fishing season as possible. Thus, a meeting in early 1983 to reassess this capelin stock would utilize all of the 1982 data and would probably increase the accuracy of the biological advice.

c) Divisions 3L, 3N and 30

i) Commercial catch-effort analysis

There was no offshore commercial fishery in these divisions in 1979, 1980 and 1981. The variation in catch rates for USSR trawlers (>2000 GRT) in Div. 3L during 1973-78 was not great, the range being from 2.27 tons per hour fishing in 1973 to 3.88 tons per hour fishing in 1976.

A logbook survey of the inshore capelin fishery in Div. 3K and 3L, designed to provide estimates of catch-per-unit-effort, was initiated in 1981. Return rates for logbooks were 63% for mobile-gear fishermen and 70% for fixed-gear fishermen. Catch-per-unit-effort estimates were made for both mobile-gear and fixed-gear segments of the fishery; the catch-per-unit-effort of traps in Conception Bay and Trinity Bay, where landings were highest, was similar and higher than that recorded from the southern part of the Avalon Peninsula. Discards of capelin, expressed as percent of landings, were 37% for seiners and 33% for trap fishermen. Although it was not possible to quantify the discarding of live and dead capelin, the comments in the logbooks suggested that the majority of discards were released alive from seines and traps. The level of by-catch of cod in capelin traps was negligible when compared to capelin landings. However, if by-catches of young cod occurred in all areas, the total removal of young cod may have been significant.

ii) Research vessel surveys

An acoustic survey by USSR during 28 May-15 June 1981 in Div. 3LNO indicated that immature capelin of the 1979 and 1980 year-classes predominated in Div. 3L whereas prespawning capelin occurred in Div. 3N. Of the capelin occurring in Div. 3L, 91% were from the 1979 year-class, whereas the 1978 and 1979 year-classes predominated in Div. 3N, comprising 56% and 26% respectively. The estimate of mature capelin in Div. 3N was 109,000 tons, and the estimate of immature capelin in Div. 3LN was 421,000 tons. The results of the USSR survey in 1981 are in contrast to those of the USSR survey in 1980 when no substantial concentrations of mature capelin were found. Although juvenile capelin of the 1979 year-class were reported over a large area in 1980, no biomass estimate could be provided.

Canadian acoustic surveys were conducted in Div. 3LNO during 3-29 June 1981. The total biomass estimate of capelin in the area was 1,800,000 tons (95% confidence interval due to survey design ±560,000 tons), composed of 1,600,000 tons of capelin in Div. 3L and 200,000 tons of capelin in Div. 3NO. In Div. 3L, the 1978 and 1980 year-classes were dominant (34% and 32% respectively) and the 1979 year-class represented 25% of the estimate. In Div. 3NO, the 1978 (76%) and 1977 (19%) year-classes were dominant. These biomass estimates from the Canadian acoustic surveys represent an increase over the values for 1980 when 17,000 tons were estimated in Div. 3L and 10,000 tons in Div. 3NO. During the 1980 surveys, the 1979 year-class predominated.

The USSR and Canadian surveys conducted in Div. 3LNO in 1981 differed substantially, especially in Div. 3L. The Canadian survey covered an area closer to the Newfoundland coast and sampled more fish from the 1978 year-class, many of which were large mature fish approaching the coast to spawn. The USSR and Canadian acoustic estimates of 109,000 tons and 184,000 tons respectively in Div. 3NO were in better agreement. A Canadian acoustic survey was also conducted in Div. 3L during 2-21 April 1982. The capelin biomass estimate from this survey was 500,000 tons (95% confidence intervals due to survey design ±270,000 tons). This estimate was lower than expected when compared with that from the 1981 survey. It was noted that this was the first survey conducted early in the year and that capelin may have been less available to the acoustic gear. In addition, ice cover prevented complete survey coverage of fish concentrations found in the northern and northeastern extremities of the survey area. Substantial concentrations of capelin were also found in the near-shore area but they could not be completely surveyed. The 1979 year-class (55%) and 1980 year-class (33%) dominated in the samples collected during the survey.

iii) Numerical population models

There were no analytical analyses available for the stock in Div. 3LNO.

iv) Recruitment estimation and prognosis for 1982 and 1983

Stock size projections for capelin in Div. 3L were made using estimates of year-class size derived from acoustic surveys. The projections based on estimates derived from Canadian and USSR acoustic surveys conducted in June 1981 are as follows:

	Age (years)	Number of fish (millions) Jun 1981	Jan 1982	Jun 1982	Jan 1983	Jun 1984
Canada survey	1	43,000				
	2	33,000	36,100	31,900		
	3	45,000	27,700	24,400	26,700	23,500
	4	10,000	24,300	21,400	13,100	11,600
	5	3,000	2,400	2,100	5,000	4,400
	6	<1,000	400	350	300	300
	Mature biomass (tons)			834,000		658,000
USSR survey	1	42,900				
	2	42,100	36,000	31,800		
	3	3,100	35,300	31,200	26,700	23,600
	4	300	1,600	1,400	16,500	14,600
	5	200	+	+	300	300
	6	-	+	+	-	-
	Mature biomass (tons)			346,000		600,000

The difference in the 1982 estimates of mature biomass from projections are due almost en-entirely to the much larger estimate of the 1978 year-class (age 3) in the Canadian survey of June 1981. However, the estimates of the 1980 and 1979 year-classes are similar, and, since the 1978 year-class will have largely disappeared from the population in 1983, the estimates of mature biomass in 1983 are similar. Although the estimates of the 1979 and 1980 year-classes are similar, both are derived from the acoustic surveys which could be subject to substantial error. In addition, the estimates of the size of the mature portions of the stock in June 1982 and 1983 are dependent on the estimates of the age-specific proportions of mature capelin and the age-specific spawning mortalities, both of which are likely to exhibit significant annual variation. The Committee also recognizes that capelin represent an important source of food for predators, especially cod. In view of these factors, STACFIS advises that an exploitation rate of 10% should be maintained for 1983, resulting in a TAC of 60,000 tons for capelin in Div. 3L.

No stock projections were made for capelin in Div. 3NO in 1983 because no estimates of year-class size were available. However, the estimates of stock size in 1981, derived from acoustic surveys, were well below acoustic estimates of this stock during the mid-1970's. If the 1979 and 1980 year-classes of capelin in Div. 3NO follow the pattern of other areas, some improvement in the status of this stock could be expected in 1982 and 1983. Due to the uncertainty regarding year-class strength and the fact that the biomass was still at a relatively low level in 1981, STACFIS advises that there should be no fishery for capelin in Div. 3N and 3O during 1983. Continued closure of this fishery should allow further increase in the spawning stock in Div. 3N and should protect this stock during its migration through Div. 3O to Div. 3N.

The Committee reiterates its concern regarding the accuracy of its advice in relation to the timing of the scientific meeting to assess the stock. Although an estimate of the size of the 1981 year-class is not important to projections of 1983 stock size in Div. 3LNO because 2 year-olds are assumed to be immature, the estimates of the sizes of the 1979 and 1980 year-classes are of critical importance to stock size projections in 1983. Results of research conducted in 1982, including more precise estimates of these year-classes, would be available in early 1983, and reconsideration of the status of these stocks at this time would probably result in more accurate projections of stock size in 1983.

19. Shrimp in Subareas 0 and 1 and at East Greenland (ICES Area XIV)

The Committee noted the requests of Canada (SCS Doc. 82/VI/1) and the EEC (SCS Doc. 82/VI/11) for advice on management in 1983 of the shrimp stock in Subareas 0 and 1 as well as the EEC request for management options for shrimp at East Greenland (ICES Subarea XIV). Considering the substantial contribution of shrimp recruitment to annual yields and the current lack of ability to accurately predict recruitment, STACFIS advises that it is more appropriate to assess these shrimp stocks and to advise on conservation measures for 1983 at a mid-term meeting early in 1983 when data for the fishery and research surveys will be available.

20. Squid-*Illex* in Subareas 3 and 4

a) Fishery trends

The squid fishery increased rapidly after 1974 to peak at 162,000 tons in 1979 and decreased just as rapidly in the next two years. Recent TACs and catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	-	25[1]	25[1]	25[1]	100	120	150	150	150
Catch (000 tons)	0.4	18	42	83	93	162	70	30[2]	

[1] Countries without specific allocations could each take up to 3,000 tons.
[2] Provisional statistics.

b) Management regime

Since no significant new information was presented on which a forecast of the squid abundance in 1983 might be based, STACFIS continues to support the management regime proposed at the February 1980 Meeting (*NAFO Sci. Coun. Rep.* 1979-80, pages 39-40), and therefore advises that the TAC for 1983 should be maintained at 150,000 tons, subject to adjustment on the basis of any new information forthcoming from the 1982 fishery. The Committee recognized again that this regime implies a substantial loss of yield in years of high squid abundance but that a TAC regulation could result in high fishing mortality in years of low abundance. However, it was noted, from observations on the Scotian Shelf in 1981, that the offshore fishery could be, to some extent, self-regulated, as already noted for the inshore fisheries. When the offshore fishery becomes commercially non-viable due to low catch rates, fishing effort shifts toward other species.

The Committee noted that early-season surveys of juvenile abundance may at some future time allow provision of short-term advice for management 3 to 4 months before the commencement of the fishery, if the developing time series of data provides good correlation between the abundance indices for juveniles from winter-spring surveys, and abundance indices for recuits from random-stratified surveys on the shelf during the fishing season.

c) Commencement date for the fishery

Since no new relevant information on this matter was presented, STACFIS advises no change in the commencement date of 1 July for the 1983 squid fishery.

III. ASSESSMENT OF SEAL STOCKS

1. Introduction

At its opening session on 7 June 1982, the Scientific Council agreed to consider Canada's request for reexamination of the population status and dynamics of Northwest Atlantic harp seals (SCS Doc. 82/VI/1). Accordingly, an *ad hoc* working group, with A. W. Mansfield (Canada) as Convener, met during 10-11 June 1982 to consider the relevant agenda item. Scientists attended from Canada (W. D. Bowen, P. Montreuil, D. E. Sergeant), EEC (F. Larsen, R. Noe), and Norway (A. Bjørge).

2. Harp seals

a) Review of fishery

Complete statistics were not available for the harp seal fishery in 1982, but at least 154,500 animals were reported to have been taken up to 4 May 1982. Recent quotas, allowances and total allowable catches are listed in Table 4, and the catches in the various regions are given in Table 5.

Table 4. Summary of quotas, allowances and total allowable catches of Northwest Atlantic harp seals by region, 1977-82.

Year	Front and Gulf quota[1]	Allowances			Total allowable catch
		West Greenland	Northwest Territories	Labrador North of 54°	
1977	160,000	10,000		Not included	170,000
1978	170,000	10,000		Not included	180,000
1979	170,000		10,000		180,000
1980	170,000	8,200	1,800		183,000
1981	168,000	13,000	1,800		183,000
1982	175,000	...[2]	11,000		

[1] Quota shared by Canada and Norway.
[2] No specific allowance identified.

Table 5. Summary of catches of Northwest Atlantic harp seals, 1977-82.

Year	Catch regulated by quotas	West Greenland	Arctic Canada: Northwest Territories	Arctic Canada: Labrador North of 54°	Total catch
1977	155,143	9,938	1,508	254	166,843
1978	161,723	7,944[1]	2,129	1,263	173,059
1979	160,541	9,301[1]	3,620	619	174,081
1980	171,929	5,177[1]	6,350[2]	3,335	186,791
1981	189,731	...	...	10,863	200,594[2]
1982	...	...	...	...	...

[1] Preliminary estimates
[2] Partial statistics

b) Research in 1982 (SCR Doc. 82/VI/72)

Norway reported field studies at the Front in 1982 (SCR Doc. 82/VI/72), including observations of ice and weather conditions and positions of harp seal patches. In the Gulf of St. Lawrence, Canada collected samples on feeding, reproduction and age composition of wintering harp seals and conducted studies on the energetics of lactating females and pups at the icefields. On the Front, Canada conducted studies on feeding, reproduction, mother-pup energetics, pup growth and neonatal mortality, and collected age samples from various components of the hunt in order to estimate catch-at-age. Information on Danish studies at Greenland was not available. It is too early to expect analysis of 1982 field collections.

c) Population assessment (SCR Doc. 81/XI/166 (revised), 82/VI/70)

i) Current stock size and pup production and recent trends in these parameters

The primary purpose of this meeting was to review SCR Doc. 81/XI/166, initially presented at the November 1981 Meeting, when there had been insufficient time to study it. A revised version of this paper was presented and discussed at the meeting. The method described in the document uses the probability distributions of the observed ratios between survival of the 1967 and 1968 cohorts and the 1971 and 1972 cohorts, together with new mark-recapture estimates of pup production in 1978 and 1979 to obtain the most likely values for pup production in 1967 (the starting point of the model) and for instantaneous natural mortality in the 1967-81 period. The only substantive change in the paper was the modification of the 1967 age structure, used to initiate the model, in order to correct what appeared to be an anomalous predicted increase in pup production during the early 1970's (fig. 4 in SCR Doc. 81/XI/166 revised). This was done by adjusting age frequencies of the 1961-66 cohorts in proportion to the kills of each of these cohorts up to 1967 (table 7). Using the adjusted age frequencies resulted in lower estimates of natural mortality (fig. 5) and hence higher estimates of current stock size and replacement yield (fig. 10 and 11).

Several criticisms of the paper are made in SCR Doc. 82/VI/70. The most serious is that equations (19) and (23), which are used to estimate age specific "selectivities", provide biased estimates. Although the magnitude of this bias is not large (probably between 1 and 10%), because of the relatively low fishing mortality experienced by age 1+ animals, it does mean that the selectivities, and hence the initial age-structure, cannot be estimated reliably by the method described. This is a problem because the estimates of natural mortality in the paper are sensitive to changes in the proportion of age 7+ animals in the initial age-structure (any increase in this proportion results in a decrease in the estimated mortality rate, and vice versa). As a result, it is probably not possible with this estimation method, in its current form and with the data currently available, to discriminate between mortality rates in the range of 0.07-0.12.

Another criticism expressed at the meeting was that relatively minor changes in assumptions could result in a considerable increase in the size of the confidence regions calculated for the ratio of survivors of the 1967 and 1968 cohorts, and for the mark-recapture estimates. For example, if the confidence region for the ratio of survivors of the 1967 and 1968 cohorts is calculated from the individual estimates of these ratios (see table 2 of NAFO SCR Doc. 81/IX/166), it is four times the size of that calculated in SCR Doc. 81/XI/166 (revised), assuming a binomial distribution for the ratio. If such confidence regions had been used in the estimation procedure, the size of the joint confidence region for the estimate of natural mortality and 1967 pup production (fig. 3, 5, 8, 9, 10 and 11 in SCR Doc. 81/XI/166 (revised) would be increased.

The results in SCR 81/XI/166 (revised) indicate an increase in both stock size since 1972 and in pup production since 1977. It should be realized that this increase is a direct consequence of the difference between the estimate of pup production for 1967 and the estimates for 1978 and 1979. However, these differences may not be statistically significant. At present, it is not possible to quantify confidence limits on the estimate of pup production in 1967, but the error bounds on the 1978 and 1979 mark-recapture estimates would almost certainly overlap these confidence limits. The results of the analysis support the conclusion of various previous studies that the rapid decline in population size prior to 1971 was halted with the imposition of quotas in 1971.

ii) Current replacement yield (SCR Doc. 81/XI/166 revised)

Although the calculations of stock size and replacement yields could be taken as implying that the Northwest Atlantic stock can sustain a quota considerably in excess of the current one, this is likely not the case. The true 95% confidence regions for the estimates of natural mortality and pup production are undoubtedly wider than the calculated ones, and the estimate of natural mortality (and hence of replacement yield) is sensitive to changes in the calculated 1967 age structure. Therefore the figures in SCR Doc. 81/XI/166 (revised) should not be taken as evidence that the stock can support a catch in excess of 200,000 animals per year.

iii) Trends in population size based on differing levels of total allowable catch (SCR Doc. 81/XI/166 revised)

Assuming the same selectivities as in 1981 and age-specific pregnancy rates as in 1979, the model predicts that the population will continue to increase, even with doubling of the quota, until presumably it is checked by density-dependent processes. It must be emphasized that, in projecting to 1991, the authors do not imply that these trajectories will be followed. The projections assume present mortality and pregnancy schedules and were only made over a 10-year period to allow for temporary changes in estimates of replacement yield due to a shifting population age distribution. In view of preceding comments, it is not possible to say with certainty that the population is increasing under recent catches. These problems can only be resolved by obtaining accurate estimates of pup production in the future.

iv) Trends in catches of harp seals in Canada, north of 60°N latitude, and in Greenland

No new data were available for the Greenland seal fishery since the November 1981 Meeting (SCR Doc. 81/XI/29). At that time, it had been estimated that catches in 1977-80 were probably of the order of 12,000-14,000 harp seals. Increases in the harp seal catch at West Greenland and in Arctic Canada (Northwest Territories) had occurred by the late 1970's.

The timing of the catch increases is consistent with the hypothesis of an increase in production beginning in the 1970's. Other explanations, such as increasing mechanisation of hunting, are plausible and need exploration. Estimated catches at West Greenland and Arctic Canada were between 11,000 and 15,000 during 1977-80, exceeding the allowances in 1979 and 1980 (Tables 4 and 5).

3. Hooded Seals

a) Review of fishery

Preliminary statistics suggest a total catch of approximately 10,000 hooded seals in 1982 from a quota of 15,000. Uncertain economic conditions resulted in premature termination of the hunt.

b) Research in 1982

Jaws of about 250 females were collected at the Front in 1982 for age determination by Canada and Norway. Pups tagged in the Gulf of St. Lawrence were approximately 150, which appeared to represent most of production in the Gulf in 1982. Two adult females with tags were seen in 1982, their ages being determined as 4 and 5 years, the periods since they were tagged as pups. In future, searches should be made for tags in the Gulf and in other whelping areas of hooded seals, in order to test for dispersal of animals from the Gulf as well as to validate age at first whelping.

c) Population assessment

Assessments using the most recent catch-at-age data are in progress. However, there were no new data available at this time to improve past assessments of the hooded seal stock which is hunted in the Northwest Atlantic.

IV. FLEMISH CAP PROJECT

1. Introduction

The *ad hoc* Working Group on the Flemish Cap Project was convened by J. T. Anderson (Canada) at the Holiday Inn, Dartmouth, Canada, on 4-5 June 1982, with G. R. Lilly (Canada) as rapporteur. Representatives attended from Canada, EEC, Portugal and USSR. Recommendations from the September 1981 Meeting were reviewed (*NAFO Sci. Coun. Rep.* 1981, pages 92-93). It was noted that there were no specific proposals for investigations on Flemish Cap in 1982 and that high priority should be placed on redefining the Project's research objectives under present conditions (see SCR Doc. 82/VI/2). Canadian research activity in 1982 was limited to the annual groundfish survey carried out in January-February and an ichthyoplankton-oceanographic survey planned for July-August. The annual USSR survey for groundfish, ichthyoplankton and oceanography were carried out over several months in the first half of 1982.

2. Review of Recent Analyses (SCR Doc. 82/VI/4, 16, 17, 35, 36, 37, 38, 39, 40, 42, 45, 46)

a) Oceanography

Weekly synoptic sea-surface temperature charts, prepared from data provided in weather reports by "ships of opportunity" during 1962-81, were used to extract temperatures for Flemish Cap (SCR Doc. 82/VI/4). The annual sea-surface temperature cycle was described and deviations of annual, seasonal and monthly means from normal were provided. This is a time series of oceanographic variability not previously available. Sea-surface temperatures on Flemish Cap were more highly correlated with those at locations to the north and west, which are under the influence of the Labrador Current, than to those at locations to the south and east, which are under the influence of the North Atlantic Current.

Observations in 1981 by USSR on standard oceanographic sections (SCR Doc. 82/VI/16) revealed negative anomalies in the 0-200 m and 200-500 m layers in the Flemish Cap Channel in April-June and October. In the 0-200 m layer over the western slope of Flemish Cap, temperatures were above normal in April-May and near-normal in June and October.

Geostrophic current patterns, calculated from USSR data for the spring and summer of 1981 (SCR Doc. 82/VI/17), indicated a stable anticyclonic flow on Flemish Cap. This was thought to be favorable for the retention of plankton on Flemish Cap and for the production of an abundant cod year-class in 1981. This was in contrast to conditions in 1980 when non-stationary meanders, which could remove a considerable portion of ichthyoplankton, were observed. Regarding possible annual comparisons of the strength and stability of the anticyclonic gyre, USSR scientists agreed to generate and provide a quantitative index from past data which could be compared with measures of year-class success.

Techniques based on empirical orthogonal functions and cluster analysis were used to discern regional differences in water types in the region of Flemish Cap (SCR Doc. 82/VI/42). From all available temperature and salinity data for April-May, it was possible to detect six different regions. The region directly west of Flemish Cap and east of Flemish Pass appeared to be one of mixed water types. The technique seemed very promising for further study in discerning water types.

It was noted that a prediction of the tidal signal at any position and time in the Northwest Atlantic was now obtainable from the Marine Environmental Data Service (MEDS), Department of Fisheries and Oceans, Ottawa, Canada.

b) Ichthyoplankton

Atlantic cod larvae were present in ichthyoplankton surveys in significant numbers in 1981 (SCR Doc. 82/VI/37) for the first time since the beginning of the Flemish Cap Project in 1978. Abundance decreased from 350×10^8 larvae in early May to 4.8×10^8 larvae in the first week of August. These abundance estimates for cod larvae were less than 1% of those for redfish larvae (*Sebastes* sp.). There was no immediate explanation for the increased abundance of cod larvae in 1981 relative to estimates for preceding years.

Abundance of larval redfish during May 1981 was very similar to estimates for preceding years, but the estimate for July 1981 was the lowest recorded since 1978, indicating higher mortality during June and July 1981 than in previous years (SCR Doc. 82/VI/37). Mortality of redfish larvae increased from 0.04 to 0.09 per day throughout the period. Early growth rates during May 1981, estimated by otolith analysis (SCR Doc. 82/VI/40) and by changes in length frequencies (SCR Doc. 82/VI/37), were about 0.08 mm per day, this being less than 60% of the rate estimated for the same period in 1980. However, the growth rates during the period from the end of May to late July 1981 were virtually the same as in 1979 and 1980. Thus, growth and abundance of redfish larvae in 1981 were near or below the levels of previous years. The greater abundance of cod larvae in 1981 than previously raises several questions. For example, was there increased survival specific to cod eggs and larvae, or was there an increase in the number of cod eggs spawned in 1981?

Studies on size and condition of redfish larvae sampled in April and May 1980 indicated that early larvae were in poor condition and did not survive through to May (SCR Doc. 82/VI/38). Over 60% of the variation in size and condition of these larvae during May was attributable to surface water temperature effects. The spatial distribution of masses of warm water containing larvae in good condition ranged from <750 km^2 to about 2,000 km^2. The absence of any relationship between abundance and either size or condition indicates that survival rates calculated for the population of redfish larvae as a whole may be misleading. If higher survival is associated with water masses less than 2,000 km^2, the abundance and mortality within these patches of larvae may be important with respect to the ultimate strength of the year-class.

Preliminary examination of vertebral counts, anal fin-ray counts, numbers of sub-caudal melanophores, and size at onset of flexion in redfish larvae indicated that the second spawning peak of redfish on Flemish Cap in 1981 belonged to *S. fasciatus* (SCR Doc. 82/VI/39). By inference, the April-May spawning probably comprised *S. marinus* and *S. mentella*. This observation contrasts with earlier estimates that the April-May spawning comprised *S. mentella* alone. Work is continuing on species characteristics in redfish larvae to verify these initial results.

c) Juvenile redfish and cod

The distribution and abundance of juvenile redfish in January-February 1982 were determined from a Canadian bottom-trawl survey and from recovery of redfish in cod stomachs caught at that time (SCR Doc. 82/VI/35). Two modes in the juvenile redfish length frequency (7-8 cm and 11-12 cm) were assumed to represent 1- and 2-year-old fish respectively, but the ageing remains uncertain. Both year-classes were found primarily in depths of 200-300 m, with a major concentration on the southern slope of the bank and a smaller one to the north. The 1978 year-class, which in 1979 appeared to be abundant in cod stomachs and moderately abundant in trawl catches, was very weak in 1980 and 1981, indicating that mortality of juvenile redfish can be high, possibly due to cod predation. The 1980 and 1981 year-classes, which appear stronger than the 1978 year-class, have been noted as strong in other divisions of Subarea 3 and may provide the first successful recruitment of redfish since the early 1970's.

The frequency of occurrence of cannibalism in cod during Canadian surveys in January-February was much higher in 1982 (3.3%) than in 1977-81 (<1%) (SCR Doc. 82/VI/36), supporting the indication from the trawl survey in early 1982 that the 1981 year-class is strong. Most cannibalism involved predation on age-group 1, but older cod were also eaten by large cod. Incidences of cannibalism were widely scattered throughout Flemish Cap in depths less than 300 m.

d) Adult cod

Data on sex, maturity, meristics, and various body measurements, as well as fish weights and volumes, from a sample of Flemish Cap cod in January-February 1982 were noted (SCR Doc. 82/VI/45). The relationship between fork length and both whole and gutted weight were provided for 53 samples of cod collected at various times in several NAFO divisions, 9 samples being from the Flemish Cap (SCR Doc. 82/VI/46). The slopes of the log-log regression lines were generally greater than 3. It was noted that these data might be useful in formulating an equation for estimating condition factors. Preliminary information on cod age and length composition from a recent research bottom-trawl survey in 1982 was also made available for discussion.

3. Environmental Variability *versus* Recruitment for Cod (SCR Doc. 82/VI/41)

No significant correlation could be found between year-class strength and stock size, sea-surface temperature, salinity or combinations of these (SCR Doc. 82/VI/41), although a tendency was noted for good year-classes to be associated with the occurrence of relatively warm low-salinity water in April-May. Better results were obtained when year-class size was correlated with wind direction and frequency by 2-week intervals, with 64% of year-class variance being negatively related to south winds in late March. A significant portion (87%) of variance in year-class strength was accounted for by a model using three variables: late March south wind, early March north wind, and age 5+ stock biomass. A discussion of possible mechanisms for such early, large-scale meteorological effects indicated support for the hypothesis concerning loss of eggs and larvae southeastward off the Flemish Cap.

4. Calibration of Ichthyoplankton and Groundfish Sampling Techniques

USSR scientists reported that data from a comparison of Canadian and USSR sampling gear, carried out on board the USSR research vessel *Gemma* in 1981, had been forwarded to Canadian scientists for examination, following the receipt of which a report will be prepared for presentation at a future meeting of STACFIS. USSR scientists also reported that the research vessel *Suloy* had carried out a series of bottom-trawl tows on Flemish Cap in the spring of 1982 to compare estimates of groundfish abundance based on fixed-station and stratified-random surveys, and that the results will be reported at the September 1982 Meeting.

It was noted that both Canadian and USSR scientists have time series of ichthyoplankton and bottom-trawl observations for the Flemish Cap. Consequently, it was suggested that collaboration between Canadian and USSR scientists should be intensified in an effort to calibrate and integrate the two data sets as soon as possible.

5. Future Research Prospects (SCR Doc. 82/VI/2)

The original objective of the Flemish Cap Project was to study the causes and mechanisms controlling year-class strength of demersal fishes, particularly cod, and this was examined in the light of the results from recent investigations, which indicate that the cod stock is presently at a record low level and apparently still declining. It was pointed out that such biological characteristics as growth, maturity and fecundity of fish stocks would likely change significantly at low levels of abundance (SCR Doc. 82/VI/2). Changes in mature biomass and fecundity would alter the number of eggs spawned annually, and this may lead to significant changes in recruitment. Noting the importance of monitoring changes in biological characteristics and related parameters, STACFIS

recommends

i) that growth, maturity and fecundity of the parent cod stock on Flemish Cap be investigated during the spawning period from February to April;

ii) that attempts be made to relate estimates of eggs spawned by the cod stock to estimates of egg abundance measured during ichthyoplankton surveys;

iii) that studies on food and feeding and condition of the cod stock be continued; and

iv) that the distribution and abundance of cod eggs and early larvae be monitored during the spring to provide mortality estimates.

Observations on eggs and larvae should be made before, during, and after peak spawning, and it was agreed that a joint Canada-USSR sampling program for 1983 was necessary. The sampling schedule would ideally extend from February to early May, with high priority being given to sampling adult cod. This would involve extensive trawl sampling during February for estimates of stock size, distribution, maturity and fecundity (Table 6). Similar samples would be taken during the 2nd and 4th weeks of March throughout the Flemish Cap area, but with reduced sampling effort. A few samples should also be taken in April to confirm the end or decrease of spawning activities. Interspersed with the trawl sampling, standard ichthyoplankton surveys should be carried out during the 3rd week in March, the 2nd week in April and again in early May (Table 6).

Table 6. Proposed sampling schedule on Flemish Cap, Feb-May 1983.

Month	Time	Survey	Country
February	3 weeks	Research bottom-trawl	Canada
March	2nd week	Research bottom-trawl	Canada
	3rd week	Standard ichthyoplankton	Canada
	4th week	Research bottom-trawl	USSR
April	2nd week	Standard ichthyoplankton	USSR
May	1st week	Standard ichthyoplankton	USSR

It was proposed that the above research and schedule of work be carried out in early 1983, and that the survey results be reported to STACFIS as soon as possible after the surveys are completed, to facilitate the planning of future investigations. It was suggested that coordination of the work in 1983 might be initiated with USSR scientists aboard the R/V *Suloy* in June 1982 and final plans formulated during the September 1982 Meeting of the Scientific Council. STACFIS therefore

recommends

that the ad-hoc Working Group on the Flemish Cap Project convene during the September 1982 Meeting of the Scientific Council to formulate research plans for the spring of 1983, and to consider any other available research information.

The Committee noted that the persistence of the currently low cod stock levels in the future would severely constrain the on-going and proposed research from attaining the long-term objectives of the Flemish Cap Project.

V. SQUID RESEARCH

1. Introduction

As agreed at the September 1981 Meeting (*NAFO Sci. Coun. Rep.* 1981, page 83), the *ad hoc* Working Group on Squid Research was convened by T. W. Rowell (Canada) at the Holiday Inn, Dartmouth, Nova Scotia, during 2-5 June 1982, to review the currently available information on squid biology and distribution and the preliminary results of the coordinated surveys conducted in early 1982 for the purpose of determining the spawning, larval and juvenile distribution of the short-finned squid (*Illex-illecebrosus*) in the Northwest Atlantic. Scientists participated from Canada, EEC (France), Japan, Portugal, USSR and USA.

2. Fishery and Abundance Trends (SCR Doc. 82/VI/19, 20, 22, 23, 27, 29, 33, 34, 37)

a) Fishery trends

Nominal catches in Subareas 2 to 4 increased rapidly from an annual average of 4,500 tons in 1970-74 to a peak of 153,000 tons in 1979 and then declined in 1980 and 1981 to about 70,000 and 33,000 tons respectively (Table 7).

In Subarea 3, the inshore catch at Newfoundland was only 17,300 tons in 1981, a 47% decrease from that in 1980. Following the high abundance observed in July and August, squid availability to the inshore gears decreased sharply (SCR Doc. 82/VI/27). The French inshore fishery around St. Pierre and Miquelon showed the same trend which began 2 weeks earlier, and only 314 tons were taken in 1981 compared with 1,885 tons in 1980 (SCR Doc. 82/VI/19). In both reports, the abnormally high temperatures in coastal waters after mid-August and during September were noted to coincide with the sharp decline in squid availability.

In Subarea 4, both the Canadian inshore and offshore catches and the catches by the distant-water fleets on the Scotian Shelf declined significantly, the overall decrease from 1980 to 1981 being 58% (Table 7). The decline in catches was attributable to lower availability of squid in 1981, particularly after September, and a consequent diminuation of fishing effort directed toward squid (SCR Doc. 82/VI/23, 29).

b) Catch rates in 1981

The catch rate in the French inshore fishery in Subdiv. 3Ps declined sharply from 37.7 tons per dory during the season in 1980 to 6.3 tons in 1981, although the catch rate in July was about

Table 7. Nominal catches by subarea and TACs (tons) for squid-*Illex*, 1972-81.

Year	SA 2	SA 3	SA 4	Total	TAC
1972	-	26	1,842	1,868	-
1973	2	620	9,255	9,877	-
1974	31	17	389	437	-
1975	-	3,751	13,993	17,744	25,000[1]
1976	-	11,257	30,510	41,767	25,000[1]
1977	6	32,748	50,726	83,480	25,000[1]
1978	-	40,697	51,987	92,684	100,000
1979	-	81,820	71,279	153,099	120,000
1980	1	34,779	34,826	69,606	150,000
1981[2]	-	18,020	14,521	32,541	150,000

[1] Countries without specific allocations could each take up to 3,000 tons.
[2] Provisional data.

three times higher in 1981 than in 1980 (SCR Doc. 82/VI/19). In Subarea 4, the overall catch rate of the distant-water fleet on the Scotian Shelf was about 27% higher in 1981 than in 1980, but this may have resulted from highly localized abundance in time and space combined with the fishing strategy of fleets involved, the latter being influenced by the viability of the fishery. Catch rates of the distant-water fleets declined considerably in late September and this was followed by a sharp decline in fishing effort by mid-October (SCR Doc. 82/VI/29). In 1981, the catch rate for the Japanese fishery declined from 11.2 tons per day in September to 4.7 tons per day in October (SCR Doc. 82/VI/23), in contrast to a rate of 9.5 tons per day in November 1980.

c) Abundance indices

i) Stratified-random surveys

A Canadian bottom-trawl survey was conducted in June 1981, consisting of 66 tows, 55 of which were made along the edge of the Scotian Shelf and the remaining 9 in the Emerald and LaHave Basin areas (SCR Doc. 81/IX/100). The minimum trawlable biomass between the depth contours of 87.5 m and 262.5 m along the edge of the shelf was estimated by the areal expansion of catch to be 527.8 tons. This represents approximately 8.5 million squid, if the average weight is assumed to be 62.3 g.

A French bottom-trawl survey was conducted on the Scotian Shelf (Div. 4VWX) in August-September 1981, consisting of 96 tows made randomly in 22 strata at depths of 92-366 m (SCR Doc. 82/VI/20). Estimates of minimum trawlable biomass, by the areal expansion method assuming that all squid in the path of the trawl were caught, were 39,300 tons (167 million squid) for depths of 92-183 m and 14,000 tons (55 million squid) for depths of 183-366 m. The total biomass estimate of 53,300 tons (222 million squid) in 1981 was 65% lower than the estimate for 1980. The mean catch per 30-min tow, over the entire survey was 123 squid, 68% below the 1980 value. Canadian catch rates obtained in the same area and in the same manner from July surveys during 1970-80 ranged from 10 to 338 squid per 30-min tow (SCR Doc. 81/VI/34).

ii) Areal expansion of commercial catch rates

Estimates of minimum trawlable biomass of squid along the edge of the Scotian Shelf from the Japanese fishery in September of 1978 to 1981 were reported in SCR Doc. 82/VI/22. Coverage and method of estimation were as outlined previously (*NAFO Sci. Coun. Rep.* 1981, page 56). Using only the catches during daylight, biomass estimates were 233,000 tons, 667,000 tons, 69,000 tons and 49,000 tons for 1978 to 1981 respectively (see Table 8).

iii) Trends in abundance

Various abundance indices for the short-finned squid in Subareas 3 to 6, based on stratified-random trawl surveys and commercial catch rates, are listed in Table 8, together with the sources of information. The relative abundance indices for some of the series are listed in Table 9. All abundance indices show a substantial decline from 1980 to 1981 except for that

Table 8. Abundance indices for *Illex illecebrosus* in Subareas 3 to 6, based on (A) stratified-random trawl surveys and (B) commercial catch rates.

	Country	Area	Period	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	Source
A.	Canada[1]	4VWX	July	40.7	14.4	14.4	25.1	52.5	337.9	80.8	30.9	152.2	26.6	...	SCR 81/34
	France[2]	4VWX	Aug-Sep	-	-	-	-	-	-	-	-	-	665	222	SCR 82/20
	USA[1]	5Z+6	Sep-Nov	1.9	3.5	1.3	0.3	12.4	28.7	15.8	28.4	32.1	17.0	...	SCR 81/33
B.	France[3]	3Ps	Jun-Oct	(inshore)		-	-	-	-	-	-	36.9	37.7	6.3	SCR 82/19
	France[5]	3P+4VW	Aug-Oct	(offshore)		-	-	-	-	-	-	17.0	5.5	...	SCR 81/37
	Japan[4]	4VWX	Sep	-	-	-	-	-	-	-	233	667	69	49	SCR 82/22
	International[5]	4VWX	Jul-Sep	-	-	-	-	-	-	14.6	9.0	17.5	11.3	15.7	SCR 82/29
			(Effort, days)							1921	2274	1619	1703	626	

[1] Mean number per tow
[2] Abundance estimates (millions of animals)
[3] Rons per dory during the season.
[4] Biomass estimates (000 tons)
[5] Tons per day fishing

Table 9. Relative abundance indices for *Illex illecebrosus* in Subareas 3 to 6, based on (A) stratified-random trawl surveys and (B) areal expansion of commercial fishery data.

	Country	Area	Period	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	Source
A.	Canada	4VWX	July	1.53	0.54	0.54	0.94	1.97	12.70	3.04	1.16	5.68	1.00	...	SCR 81/34
	France	4VWX	Aug-Sep	-	-	-	-	-	-	-	-	-	1.00	0.33	SCR 82/20
	USA	5Z+6	Sep-Nov	0.11	0.21	0.08	0.02	0.73	1.69	0.93	1.67	1.89	1.00	...	SCR 81/33
B.	Japan[1]	4VWX	Sep	-	-	-	-	-	-	-	3.28	6.21	1.00	0.71	SCR 82/22

[1] Based on abundance in 183-256 m depth zone.

of the distant-water (international) fleets which actually increased. The difference between the July-September index for the international fleet and the September index for the Japanese fleet reflects the decline in late-season abundance and/or availability (Table 8). It is important to note the decrease in fishing effort from 1980 to 1981 which reflects a diversion from the squid fishery.

3. Distribution (SCR Doc. 82/VI/5, 24, 25, 26, 32, 34)

a) Oceanographic considerations in larval and juvenile distribution

The role played by physical oceanography in determining the distribution of larval and small juvenile squid is examined in SCR Doc. 82/VI/24. Based on the information reported in SCR Doc. 81/VI/29, the paper is developed on the assumption that squid spawn only on the bottom and where the temperature exceeds 13°C, although recent laboratory observations indicate that spawning may occur pelagically (SCR Doc. 82/VI/5). It is inferred that larvae and small juveniles found in the vicinity of the Gulf Stream-Slope Water boundary (50-70°W) could have reached the area through advection by the Gulf Stream system.

On the assumption that larvae and small juveniles behave similarly to neutrally-buoyant passive drifters, a model was developed to examine the dispersion of larvae/juveniles from a point source in the vicinity of Cape Hatteras near the northern edge of the Gulf Stream. The results of the model of dispersion from an instantaneous point source, in a region of lateral current shear, show that the diffusing "patch" becomes elongated or stretched in the direction of mean flow. In the case of a source located at the northern edge of the Gulf Stream, a region of extremely high current shear, the patch length increases with time and may, after 20 days, extend to 1,500-2,000 km with a length to width ratio in the range of 30-40.

The model result for a continuous point-source release indicates that the cross-sectional distribution of larvae/juveniles becomes progressively skewed at increasing distances from the source to the side where the velocity is lower. In terms of mode in age-frequency distribution, at any given cross-section normal to the mean flow, the oldest animals are found at the northernmost point (in Slope Water) and the youngest at the southernmost point (in the Gulf Stream). Although the model does not deal with Gulf Stream rings or eddies, it is inferred that the highest concentration of squid should be found in the periphery of warm-core eddies and in the interior region of cold-core eddies. It is pointed out in SCR Doc. 82/VI/24 that, in reality, the system is much more complex than that considered in the model and that warm-core eddies appear likely to provide a major transport mechanism from the Gulf Stream-Slope Water boundary zone into the central part of the Slope Water area. It was noted that the major features displayed in the entrainment-dispersion model are in general accord with the larval/juvenile distribution observed in the most recent surveys (SCR Doc. 82/VI/25, 32, 34). However, the most critical evaluation of the model would come from survey data taken in the shelf-slope area in the region south of Chesapeake Bay in the mid-November to mid-January period. To date, no specific effort with respect to locating *Illex* spawning areas has been directed in this time and space domain.

b) Patterns of distribution and migration

i) Coordinated survey cruises in early 1981

Surveys conducted from 16 January to 30 April 1982 covered an area between 74°W and 38°28'W in water masses extending from the shelf edge to the Sargasso Sea (SCR Doc. 82/VI/25, 32, 34). These studies, along with additional data on *Illex* larvae (SCR Doc. 82/VI/26), have provided further elaboration of the life cycle and distribution, outlined in (ii) and (iii) below. The results of three of the four cruises were reported and discussed.

RV *Kaiyo Maru*, 16 January-5 March 1982 (SCR Doc. 82/VI/32). During the first part of the cruise (16 January-5 February), 35 stations were occupied along seven transects that traversed the offshelf area between 56°W and 74°W, including the northern boundary of the Sargasso Sea. Station positions were established daily with the intention of occupying the various waters masses in the region. Station operations consisted of complete oceanographic observations, bongo net tows for larvae and midwater trawl tows for juveniles and adults. Large numbers of *Illex* larvae of the rhynchoteuthion and transition stages were caught in the bongo tows. The second part of the cruise (11 February-5 March) consisted of occupying 37 stations along 5 transects between 56°W and 68°W in the same manner as noted previously. Except for a large catch in mid-February, very few larvae were encountered. Large numbers of juveniles were caught during both parts of the cruise, but no adults were taken.

RV *Lady Hammond*, 2-25 February 1982 (SCR Doc. 82/VI/34). The survey encompassed the area between the Scotian Shelf and the Sargasso Sea with stations at 30-mile intervals along north-south transects at 63°, 62°, 61° and 60°W. Station operations consisted of complete oceanographic observations, bongo net tows for larvae and midwater trawl tows for juveniles. When a large number of *Illex* was encountered, a fine resolution survey was conducted around the station. A large number of juveniles and some larvae were caught, but data on the latter were not available for this report. No adults were encountered.

RV *Eurika*, 4 February-30 April 1982 (SCR Doc. 82/VI/25). The total survey, in four cruises, extended from 66°30'W to 38°28'W to include all water masses from shelf waters to the Sargasso Sea. The studies, and consequently the methodology, varied during each cruise, depending on interests in different water masses. In general, however, station operations included oceanographic observations, bongo-net tows for larvae and midwater trawl tows for juveniles. A large number of *Illex* juveniles and some larvae were caught, but data on the latter were not considered in the analysis. No adults were encountered.

ii) Summary of data on larvae

Reported captures of *Illex* larvae have been in waters extending from central Florida, where the minimum size was 1.1 mm in a survey during 12-22 February 1969, to approximately 55°W, where the minimum size was 2.4 mm in a survey during 22 February-7 March 1981. In the Florida-Cape Hatteras area, the smallest larvae are generally captured in close proximity to the shelf edge traversed by the Florida Current-Gulf Stream system. In the area to the northeast (Subareas 5, 4 and 3), larvae are taken in the Gulf Stream and the Gulf Stream-Slope Water frontal zone, the largest catches being in the latter water mass. The only catches of larvae south of the Gulf Stream were associated with a cold-core eddy. In the Gulf Stream-Slope Water frontal zone, larvae occurred in areas of well-defined thermocline (usually the upper 100 m) where temperatures ranged from 15° to 21°C.

Previously-reported laboratory evidence indicates that egg fertilization does not occur when the water temperature is below 7°C and that temperatures above 10°C are required for embryonic development. Thus, the warm-water areas to the southwest are probable spawning areas if spawning occurs on the bottom. However, off-bottom spawning, as observed in the laboratory (SCR Doc. 82/VI/5), may be possible farther northeastward in the warm Gulf Stream-Slope Water frontal zone. Nevertheless, the finding of the smallest larvae to the southwest in February, the capture of large larvae in the northeasterly-moving water masses, and the decline in abundance from southwest to northeast during late February to early March indicate the possible geographical and temporal patterns of larval distribution (SCR Doc. 82/VI/32).

iii) Summary of data on small juveniles

Small juvenile *Illex* have been captured in waters from northern Florida (survey during 12-22 February 1969) to about 38°W (survey during 16-30 April 1982). In Subareas 3, 4 and 5, juveniles are found in the area between the Shelf Water-Slope Water frontal zone and Slope Water-Gulf Stream frontal zone. The smallest juveniles are usually found in close proximity to the Gulf Stream and in the periphery of warm-core eddies, and, as the season progresses, there is a shoreward (northward) progression of the concentrations as the size of juveniles increases. Few juveniles have been found south of the Gulf Stream. Size distribution in the north-south axis showed that the smallest juveniles occurred in water of 16-19°C along the northern edge of the Gulf Stream and in the Gulf Stream-Slope Water frontal zone, whereas the larger juveniles occurred closer to the Slope Water-Shelf Water frontal zone in water of 10-14°C.

4. Biological Characteristics (SCR Doc. 82/VI/5, 15, 17, 19, 20, 21, 26, 27, 28, 29, 30, 32, 34, 43)

a) Sex composition and growth

A wide range of sizes of *Illex* have been reported, including larvae as small as 1.1 mm (hatching size) collected in February 1969 south of Cape Hatteras near the southern extremity of the range of *Illex illecebrosus*. Species identification of larvae in this area is uncertain because it is also within the range of distribution of *Illex oxygonius* (SCR Doc. 81/VI/26). The minimum size of larvae taken in Subareas 3, 4 and 5 was 2.0 mm, and the general trend toward an increase in size from southwest to northwest indicates that they may be transported from the southwest (SCR Doc. 82/VI/32).

Along the Gulf Stream-Slope Water frontal zone, there was no evidence of growth of juveniles (6-8 mm mantle length) in the southwest to northwest direction (SCR Doc. 82/VI/26, 32, 34). However, growth of juveniles was apparent from the northern edge of the Gulf Stream shoreward to Shelf Water where they were as large as 11.5 cm. Juveniles captured in the periphery of warm-core eddies were similar in size to those found in the Gulf Stream-Slope Water frontal zone. The large juveniles (5-11 cm) which appeared on the Scotian Shelf in September (SCR Doc. 82/VI/20) probably resulted from spawning in late spring-early summer. Squid sampled from the USSR fishery on the Scotian Shelf in 1981 averaged 13.7 cm (55 g) in late May and 20.4 cm (156 g) in late July (SCR Doc. 82/VI/15). It was noted that the average sizes of squid in early June 1981 (14.1 cm for males and 15.0 cm for females) were smaller than during the same time in 1980 (SCR Doc. 82/VI/29). In a French survey of the Scotian Shelf (28 August-22 September 1981), three modal groups were evident in the length compositions. The largest modal group (88% of the squid) was comprised of 18-26 cm males (mean 22 cm) and 18-29 cm females (mean 23 cm). The remainder of the catch comprised two smaller modal groups (5-11 cm and 12-17 cm), the low numbers being due to trawl selectivity.

In a survey of the southwest slopes of Grand Bank and St. Pierre Bank (Div. 3O and 3Ps) in June, the squid were considerably larger in 1981 than in 1978-80, the mean lengths being 16.4 cm for males and 16.7 cm for females (SCR Doc. 82/VI/27). Similarly, squid taken at Holyrood, Newfoundland, during early July were larger in 1981 than in the previous 3 years, mean lengths being 18.6 cm for males and 19.0 cm for females. However, growth from mid-July to mid-September was much less than during the same period in 1978-80. The length distributions were unimodal.

In the French fishery around St. Pierre and Miquelon (SCR Doc. 82/VI/19), the first arrivals of squid in 1981 were smaller in size than in 1979 and 1980, but summer growth in length was about 50% higher. In contrast, the first arrivals at Holyrood were larger. Coincidental with these differences in size and growth of squid, the proportion of males at St. Pierre and Miquelon was lower than in 1979 and 1980 (SCR Doc. 82/VI/19), whereas the proportions of males and females at Holyrood were approximately equal (SCR Doc. 82/VI/27). At Holyrood, there was no marked decline in the proportion of males, as was observed in the previous years. Length-weight relationships indicated that males were heavier than females for similar lengths on the Scotian Shelf (SCR Doc. 82/VI/29), but that this was only true for squid greater than 18 cm at St. Pierre and Miquelon (SCR Doc. 82/VI/19).

Another aspect of growth consisted of examination of relative changes in morphology of squid from the post-rhynchoteuthion stage to about 25 cm in length (SCR Doc. 82/VI/28). This study, which included examination of the statoliths and gladius, found that relationships between the various morphological characteristics were not always constant through growth.

b) Maturation and spawning

No mature squid were captured during the offshore surveys in January-April 1982. From the first arrival of juveniles on the Scotian Shelf in late May, maturation generally advanced to Stage III by September (SCR Doc. 82/VI/29), the pattern of development in both males and females being similiar to that in 1978 and 1979. Six relatively small (19-24 cm) mature females were taken in September 1981 (one of which had mated) (SCR Doc. 82/VI/20). Since these appeared to be isolated cases, the overall population is considered to have maintained the pattern of reaching maturity in winter.

At St. Pierre and Miquelon, the relationship between sexual maturation and mantle length in 1981 was noted to be similar to that observed in previous years (SCR Doc. 82/VI/29). Advanced stages of maturation in males taken inshore at Newfoundland were evident only in squid larger than 20 cm. The approximate equality of sexes at Holyrood until 15 September may have been related to slow growth and consequent reduced rate of maturation and offshore migration of males (SCR Doc. 82/VI/27). However, the late-season unavailability of squid in inshore areas limited observations on squid in advanced stages of maturation.

From histological studies, gametogenisis was described for males and females and the observed phases of maturation were compared with the standard stages assigned on the basis of macroscopic morphological criteria (SCR Doc. 82/VI/30). Good correspondance was found for females, but the relationship was not as close for males because progression from Stage I to II is not readily detectable using macroscopic criteria. It was noted that the maturation process in males is gradual, whereas it occurs more rapidly in the later stages of females, implying that the production of egg masses probably takes place over a restricted period of time.

Fecundity estimates for six maturing or mature females (one of which had mated), captured on the Scotian Shelf in September 1981 (SCR Doc. 82/VI/17), were similar to previously reported estimates from field samples but were lower than those reported for females which matured under laboratory conditions. The numbers of eggs ranged from 13,470 to 71,458 for females weighing 120-210 g. This represents about 100-500 eggs per gram of body weight, in contrast to about 1,000 eggs per gram from laboratory observations.

The existence of maturing males (15-23 cm) and females (16-29 cm) in Subarea 3 during November-April was noted (SCR Doc. 82/VI/21). As the distribution of maturity stages was similar to that observed on St. Pierre Bank in October, it was concluded that these squid were spawned during the previous winter and would themselves spawn at an age of approximately 18 months during late spring or early summer.

In the laboratory, a female was observed to spawn off bottom (SCR Doc. 82/VI/5), indicating that *Illex illecebrosus* may spawn pelagically. It was also noted that egg masses may be neutrally buoyant at densities encountered in nature.

c) Trophic relationships and mortality

The effect of predation on squid by cod, pollock, haddock and silver hake was studied from the results of a French survey on the Scotian Shelf during 22 August-22 September 1981 (SCR Doc. 82/VI/43). Cod and pollock, probably due to their large size, preyed on squid more heavily than the other species. The length distribution of squid consumed by the two largest predators was generally representative of the overall squid population, whereas smaller squid were eaten by haddock and silver hake. Predation on squid increased with predator size, the greatest amounts being consumed by predators larger than 30 cm and none by predators less than 35 cm. The estimated instantaneous natural mortality of squid due to predation was 0.22 per month. It was noted that this high mortality rate, due to predation alone, would result in the removal of an unrealistically high proportion of the population throughout the season. Limited seasonal sampling and variation in predation on squid was considered to be major sources of bias in arriving at such a high mortality rate.

A 4-year study of squid as a predator on the Scotian Shelf indicates that there is a general decrease in the numbers of squid with food in their stomachs as the season progresses. Crustaceans generally represented the major prey type by weight. The next most important prey type was fish in 1980 and 1981 but squid (cannibalism) in 1978 and 1979. The estimated total amount of food consumed by 1,000 g of squid during their residency on the Scotian Shelf ranged from 1,015 g in 1978 to 487 g in 1981.

5. Review of Survey Results in Relation to Life-cycle Hypotheses

After reviewing the available documentation in relation to the hypotheses developed at the September 1980 Meeting (*NAFO Sci. Coun. Rep.* 1979-80, pages 129-130), the following scenario appears to provide a useful framework to guide future studies: "*Most adult Illex in the northern part of the area of distribution in the Northwest Atlantic move southwestward in autumn from the continental shelf and slope to at least the Chesapeake Bay-Cape Hatteras area. Spawning, although protracted, occurs mainly in the late autumn-early winter period, may be either demersal or pelagic, occurs on or off the continental shelf as far as the Gulf Stream, and is principally confined to areas south of Chesapeake Bay. The Gulf Stream system provides a key transport mechanism for larvae and juveniles*".

6. Conclusions

a) The total catch and total effort in the squid fishery of Subareas 3 and 4 were considerably lower in 1981 than in 1980.

b) Although early-season abundance of squid appeared to be high, mid-season estimates indicated that the biomass in Subareas 3 and 4 was considerably lower in 1981 than in 1980, and the population was markedly reduced by late season.

c) As previously noted (*NAFO Sci. Coun. Rep.* 1981, page 60), biomass estimates of recruited squid stocks do not yet provide an adequate basis for projection of future stock levels. A time-series of such estimates are, however, likely to be necessary for the development of a relationship between off-shelf abundance of juveniles and subsequent recruited biomass.

d) Considerable new information has been collected concerning the general distribution and related abiotic factors for *Illex* larvae and early juveniles in the off-shelf areas of Subareas 3, 4, 5 and 6. Subareas 5 and 6 and areas farther southward appear to be important for study if the biology, distribution and life-cycle of *Illex* are to be fully understood, and future coordinated research surveys should give priority to these southern areas.

e) Surveys of juvenile abundance in the off-shelf parts of Subareas 3 and 4 continue to offer the most likely possibility of developing a pre-season index of abundance for the fishing areas.

7. Future Research Requirements

a) In view of the progress being made in understanding the life history, distribution and migration of *Illex*, national and cooperative research efforts should continue to focus on elucidation of the spawning, larval and early juvenile stages as the basis for future stock predictions.

b) Although significant progress was made in early 1982 through studies on larval and juvenile distribution, no significant information has yet been provided on spawning distribution; future studies should be directed toward the larval and spawning stages of the life cycle.

c) In addition to continuing the studies on larval and juvenile distribution in Subareas 3 and 4, increased effort should be applied in Subareas 5 and 6 and farther southward with a view to elucidating the spawning distribution of *Illex*.

d) In view of the importance of tagging studies, research should be directed towards the development of offshore tagging techniques. It was also suggested that tagging over a wider geographical range would have potential for determining migratory patterns.

e) Because oceanographic processes appear to be of fundamental importance in determining the transport and distribution of larval and juvenile *Illex* in the Gulf Stream-Slope Water frontal zone, increased emphasis should be placed on studies which will increase understanding of these processes.

f) The importance of feeding and stomach analysis studies of squid as a predator and prey to the understanding of trophic relationships was emphasized, and it was recommended that such studies should be continued.

g) The value of random-stratified bottom-trawl surveys to develop a reliable time series of abundance indices for recruited squid was noted. These are considered important because abundance indices based on commercial catch rates may be biased by changes in fishing strategy necessitated by non-biological considerations (e.g. economic).

h) Because of the importance of information on egg-mass distribution to the study of early life stages of *Illex*, further effort should be made to evaluate sampling techniques and to examine currently available and future plankton collections for *Illex* eggs.

8. Coordination of Squid Research for 1983

a) Research objectives

The research objectives developed at the September 1980 Meeting (*NAFO Sci. Coun. Rep.* 1979-80, pages 139-141) were reviewed in the light of results to date. It was concluded that they remain appropriate and that emphasis in 1983 should continue to focus on elaboration of the life cycle, particularly the spawning and early larval stages and the physical and biological factors influencing them. The objectives are given below, with comments on particular goals for 1983.

i) *To elaborate that portion of the life cycle of Illex from maturity to spawning and through the larval and juvenile stages to recruitment, with emphasis on (1) timing and location of spawning and its possible relationship to physical and biological factors, and (2) distribution and abundance of larvae and juveniles in relation to the same factors.*

Considerable data have been collected on the distribution of juveniles in Subareas 3, 4, and 5, with more limited information on larvae in Subareas 4, 5 and 6. These data, coupled with oceanographic data and current knowledge of oceanographic processes, strongly indicate that spawning may occur in the vicinity of Chesapeake Bank and areas farther southward. The Gulf Stream appears to be significant to the northeasterly transport of eggs, larvae and juveniles. For these reasons, the primary goal for 1983 should be the study of spawning, egg and early larvae stages in and south of Subarea 6 and the biotic and abiotic factors influencing their distribution.

ii) *To develop an estimate of pre-recruit abundance as a necessary step toward the definition of a recruitment index.*

This objective is considered to be a long-term one, requiring a substantial data series for both the off-shelf abundance of juveniles and the subsequent abundance of recruits to the fishing areas. Studies related to the development of such an index should be continued in 1983.

b) Proposed program for 1983

The cooperative research program for 1983 will broaden the area of coverage to include an extensive survey of the southern part of Subarea 6 and the area farther southward (Cape Hatteras to northern Florida). Work in this area will focus on the spawning, egg and early larval distribution of *Illex* and on the physical factors which influence this as well as the transport of egg and early larval stages. Details of survey design have yet to be determined but they will include sampling of bottom and near-bottom shelf waters and at discrete depth intervals to the extent of vessel and gear capability in both on-shelf and off-shelf waters extending through the Gulf Stream system into Sargasso Sea water. A Canadian vessel has been identified for use in these surveys during January and February 1983, and a USSR vessel will conduct larval and juvenile surveys in the off-shelf region of Subareas 3 and 4 (and possibly Subarea 5) during February and March. These surveys will be conducted using a survey design similar to that used during the cooperative Canada-USSR research program in 1981 and 1982.

c) Data collection, exchange and reporting

Participating scientists from different countries will ensure that data formats and exchange arrangements are mutually acceptable. Analysis and reporting arrangements are left for mutual agreement between actively participating scientists.

9. Future Consideration of Squid Research

STACFIS thanked the Convener (T. W. Rowell) and members of the *ad hoc* Working Group for the intensive reviews of squid biology and distribution and the coordination of survey plans during the past 3 years. The Committee considers that the Working Group has achieved its primary function of organizing the squid research program and agreed that future aspects of coordination should be undertaken by STACREC and aspects of biology and assessments be undertaken directly by STACFIS. In view of the large volume of information that has been collected during the past 3 years, STACFIS

recommends

that the Scientific Council should consider "Squid Biology and Distribution" as a possible theme for its September 1983 Annual Meeting.

VI. ENVIRONMENTAL RESEARCH

1. Introduction

At its September 1981 Meeting, the Scientific Council unanimously agreed to establish the Subcommittee on Environmental Research within the framework of STACFIS, in order to provide a clear focus for discussing environmental matters on a regular basis (*NAFO Sci. Coun. Rep.* 1981, page 81), and Dr. R. W. Trites was appointed Chairman. The first meeting of the Subcommittee was held during 7-8 June 1982, and a brief summary of matters considered follows. The detailed report of the Subcommittee is at Annex 1.

2. General Consideration (SCR Doc. 82/VI/44)

STACFIS noted that more than 20 research documents were reviewed and discussed by the Subcommittee. The importance of environmental studies to the *ad hoc* Working Groups on the Flemish Cap Project and Squid Research is particularly noteworthy. Additionally, the question of how an annual overview of environmental conditions for the previous year can be made more pertinent and timely was discussed in some detail. It was agreed that MEDS should continue to give highest priority to processing data from NAFO Standard Sections, and that an attempt should be made to incorporate other time-series of environmental data, such as temperatures and salinities from Station 27, sea-surface temperatures collected daily at Halifax, St. Andrews and Boothbay Harbor, surface temperatures from ships of opportunity, and satellite imagery of fronts and eddy locations. The inclusion of such information would enable the Subcommittee to provide an expanded overview of environmental conditions at future meetings.

Although the Committee is aware of the general size and scope of the oceanographic data base for the NAFO Area, it should be noted that no signle data center has all of the data in its possession. MEDS, as the oceanographic data center for NAFO, is continuing in its quest to acquire the outstanding data, and national representatives are requested to consult the MEDS report (SCR Doc. 82/VI/44) and assist, whenever possible, in this endeavor. The importance of the historical data to the establishment of meaningful base-period environmental conditions, as recommended previously (*ICNAF Redbook* 1976, page 150), cannot be overemphasized. Valid comparisons of one year's environmental conditions with the average are dependent on a good historical data base.

STACFIS hopes that, at future meetings of the Subcommittee, not only will the production of environmental research documents be maintained at least at the existing level but that an increased number of physical oceanographic researchers will be able to attend and participate in the meetings of the Subcommittee.

VII. GEAR AND SELECTIVITY

1. Silver Hake Selection (SCR Doc. 82/VI/74)

A selectivity study on silver hake in Div. 4VW was carried out during 20-29 May 1982 on board a Cuban commercial vessel, using the "alternate haul" method with a 60-mm mesh codend and a similar codend equipped with a 30-mm mesh liner. The selection factor of 4.23 was within the range of values reported in previous studies (2.9-4.5). The girth-total length relationship derived from a sample of silver hake was also similar to those previously reported.

2. Other Selection Studies (SCR Doc. 82/VI/14)

The Committee noted the results of mesh selection studies on various species, including redfish, Greenland halibut, roundnose grenadier, yellowtail flounder, and American plaice, mainly in Subareas 2 and 3. It was pointed out that the most recent paper (SCR Doc. 82/VI/14) incorporates information reported previously in SCR Doc. 81/IX/87, 88 and 89). The "covered codend" method was used during these studies and selectivity parameters obtained for the different species. Based on immediate losses in yield, different mesh sizes were indicated as optimum for the different species. However, since no assessment of the long-term effects of such changes in mesh size were available, the Committee agreed to wait for further analysis before providing advice on this topic. The Committee also noted that USSR scientists were undertaking in 1982 a study on survival of fish escaping through the codend meshes.

VIII. AGEING TECHNIQUES

1. Report of Shrimp (*Pandalus borealis*) Ageing Workshop, Quebec City, Quebec, 11-14 May 1981, and Dartmouth, Nova Scotia, 20-21 November 1981 (SCS Doc. 82/VI/14)

The Committee noted that participants at the Workshop came to general agreement on numerous points concerning the collection of length frequency data, including sample size, precision of length interval, smoothing of data, planning of surveys, and weighing of samples. Additional information on age composition from length frequencies was found in observations on discards from commercial vessels, weight distributions and biological characteristics, and by separating stages in sexual development. It was further agreed that ageing data obtained from the methods discussed can be useful to monitor growth, evaluate recruitment and determine mortality in shrimp stocks. The Committee also noted that interpretation of the length frequency data can be adversely affected by selectivity and availability of smaller shrimp, and that there was confusion concerning the interpretation of biological characteristics and determination of the age of the smallest size-group. It was agreed that additional research should be done on moulting sequence and interpretation of age, reflected in various stages of sexual development, and that another workshop concerning these problems should be held in the near future.

STACFIS agreed that the report of the Shrimp Ageing Workshop should be published and referred the matter to STACPUB for consideration.

2. Otolith Analysis of Age and Growth of Larval Redfish (SCR Doc. 82/VI/40)

The Committee reviewed a paper on the use of daily growth increments in otoliths of redfish larvae from Flemish Cap as a method of determining instantaneous growth rates of both pre- and post-extrusion larvae. Although some problems still exist with the technique, the Committee felt that it held promise and encourages continued work in this area.

3. Cod in Division 3M

Taking into consideration the discrepancies observed in the age compositions of cod in Div. 3M between Canadian and USSR survey data, there appeared to be a possible bias in otolith readings. It was agreed between the scientists of these two countries to exchange cod otolith samples in order to compare the interpretations and achieve an agreement on age determination for this stock before the end of 1982.

4. Silver hake on the Scotian Shelf

The Committee noted that there are still some discrepancies in the age determination of this species in Div. 4VWX, even after a workshop on this matter had been held a few years ago. It was agreed that these discrepancies have to be considered and, if possible, resolved because of their implications on stock assessments.

IX. REVIEW OF SCIENTIFIC PAPERS

1. Calculation of $F_{0.1}$ and Discussion on its Standardization (SCR Doc. 82/VI/64)

The subject of how $F_{0.1}$ is calculated in the NAFO assessments was addressed. The effect of using different age spans in the calculations of $F_{0.1}$ was examined for 3 levels of M. As age span increases, the calcualted $F_{0.1}$ decreases asymptotically. For example, if M = 0.2, an age span of only 8 years produces estimates of $F_{0.1}$ which may be twice as great as those obtained using an age span of 15 years. The age spans used for a given level of M vary greatly in the NAFO assessments, and calculated $F_{0.1}$ values therefore have different meanings in the assessments.

The author of the paper proposed that a standard age span be used in the calculation of $F_{0.1}$ according to the level of M, corresponding to the number of years required for recruitment to be reduced to 5% of its original level. The initial age for the age span was suggested to be the youngest age which is 50% recruited. The method presented did not address the situation when partial recruitment declines at older ages (e.g. Greenland halibut in Subarea 2 and Div. 3KL).

STACFIS noted that the problem of calculating $F_{0.1}$ had been discussed in ICES working groups and will be addressed by the ICES Advisory Committee for Fisheries Management in July 1982 and at the Statutory Meeting of ICES in October 1982. STACFIS also noted the inconsistency associated with the calculation of $F_{0.1}$ and urges scientists to carefully consider both the actual levels of M (when it is constant with age) and the proper age span in the calculation of $F_{0.1}$ in future assessments. The Committee, however, agreed to await the results of the deliberations on this matter by ICES before considering a method of standardizing $F_{0.1}$ calculations for NAFO assessments.

2. Spawning Efficiency of Silver Hake (SCR Doc. 82/VI/33)

Results of studies on spawning efficiency of silver hake on the Scotian Shelf were presented. The abundance and distribution of silver hake eggs, larvae and fry, as well as food zooplankton, were considered in connection with abiotic and biotic environmental factors. Very favourable feeding conditions for silver hake were observed in 1978. The abundance of the 1978 year-class appeared to be higher than the average. This correlation may indicate that year-class strength is also determined by feeding conditions for larvae and juveniles.

3. Ichthyoplankton (SCR Doc. 82/VI/3, 31)

Two papers on this general subject were considered. SCR Doc. 82/VI/3 dealt with distribution of ichthyoplankton in the autumn-winter period in the Gulf Stream area along the Canadian coast in 1974. The ichthyoplankton was represented by 23 families. Comparison of larval distribution with the Gulf Stream current structure during the survey period indicated that most of the larvae were caught in a Gulf Stream meander with axis along 62°W. The second paper (SCR Doc. 82/VI/31) presented a key for identification of the ichthyoplankton in Northwest Atlantic. It was noted that this work was an attempt to alleviate the problems of ichthyoplankton identification in the Grand Bank, Labrador Shelf and Davis Strait regions. The key provides descriptions of eggs, larvae and juveniles for 58 species. STACFIS agreed to refer this paper to STACPUB for possible publication.

4. Eelpouts in the Newfoundland and Labrador Areas (SCR Doc. 82/VI/71)

The distribution of three species of eelpout was noted in relation to depth and water temperature. Cold-water Arctic eelpout (*Lycodes reticulatus*) appeared to be abundant in shallower and colder water than the warm-water Vahl's eelpout (*L. vahlii*). Esmark's eelpout (*L. esmarki*) seemed to prefer intermediate temperature conditions.

5. Feeding of Wolffishes (SCR Doc. 82/VI/69)

Analysis of stomach contents of three species of wolffish in the Northwest Atlantic showed similiarity in feeding behavior of Atlantic Wolffish (*Anarhichas lupus*) and spotted wolffish (*A. minor*). Northern wolffish (*A. denticulatus*) feeds mostly on bathypelagic organisms, and its feeding spectrum is slightly different from that of the other two species. The most common food items of wolffishes are Echinoderma, mainly Ophiura. Intensive feeding of wolffishes seems to occur in the spring-summer period.

6. Growth Rate of Witch Flounder in Div. 3K (SCR Doc. 82/VI/71)

The growth rate of witch flounder was determined by back calculation from scales. It was found that the greatest linear growth occurred during the first 5 years of life. During this period, males grew faster than females, but the reverse occurred in older fish. The growth rate of different generations varies from year to year, depending on environmental conditions.

7. Age and Growth of Silver Hake on the Scotian Shelf (SCR Doc. 81/XI/85)

From four samples of otoliths collected during 1977-80 by Cuban observers on board commercial vessels, age-length keys were determined. The von Bertalanffy growth equation was subsequently used to describe the growth by sex. However, the asymptotic lengths from these growth curves were greater than previously reported, due possibly to the lack of older individuals in the samples.

8. Mortality Rates for 0-Group Silver Hake on the Scotian Shelf (SCR 81/XI/86)

The value of $M = 0.4$ used in silver hake assessments was found not to be applicable for 0-group fish. The mortality rate of the 0-group was estimated from fecundity-at-age data and age-specific probabilities of survival derived from virtual population analysis, assuming equilibrium and non-equilibrium conditions for the stock. A value of $M_0 = 12.4$ was calculated.

X. OTHER MATTERS

1. Maximization of Yield per Recruit for Cod and Redfish in Division 3M

At its 1980 Annual Meeting the Fisheries Commission of NAFO asked the Scientific Council for advice on the mesh size which would maximize yield per recruit at the $F_{0.1}$ level for cod and redfish in Div. 3M and on the implications of adopting such a mesh size on changes in long-term yield, irrespective of net material (FC Doc. 80/IX/16 revised). During its June 1981 Meeting, the Scientific Council addressed the problem of mesh assessment of redfish and cod in Div. 3M (*NAFO Sci. Coun. Rep.* 1981, pages 49-50). It was noted that increases in yield-per-recruit of cod are indicated for mesh sizes up to at least 6 inches (152 mm) in manila codends. Results for redfish were more variable and uncertain, and it was not possible to advise on the mesh size which would give maximum yield-per-recruit. However, the implication from the analyses was that the optimum mesh size for redfish could very well be less than that for cod. The Committee therefore expressed concern about the by-catch of cod in the directed redfish fishery and the by-catch of redfish in the directed cod fishery. The information available to the Committee at the time was not sufficient to evaluate the impact of changes in mesh size on the interacting fisheries for cod and redfish on Flemish Cap, and it was recommended that the deficiencies in the data base be clearly defined at the September 1981 Meeting. Data were still not available at that meeting and the subject was deferred to the June 1982 meeting. The data were still not available at the present meeting. The implication to the cod stock in Div. 3M of fishing with codends with a mesh size smaller than that presently in force (130 mm) is even more critical now, considering the advice that the TAC in Div. 3M should be zero for 1983. STACFIS therefore

recommends

that, at the September 1982 Annual Meeting of the Scientific Council, countries with historical commercial data series present analyses on by-catch of cod in directed redfish fisheries and by-catch of redfish in directed cod fisheries for Div. 3M.

STACFIS proposed that, if such data are not forthcoming at the September 1982 Meeting, the Fisheries Commission should be informed that data are not available to provide further advice on this question and that this item should be removed from the agenda until such time as the appropriate data become available.

2. Acknowledgements

There being no further business, the Chairman of STACFIS expressed his thanks to all participants for their friendly cooperation at this meeting and their constructive input to the discussions. He also acknowledged the support provided by those scientists responsible for carrying out the work assigned to the Environmental Subcommittee (R. W. Trites) and the three working groups (A. W. Mansfield, T. Rowell and J. T. Anderson). The Chairman also thanked Moller Jensen for his efficiency in conducting the work of STACFIS during some sessions in his absence. The Chairman also acknowledged the NAFO Secretariat staff for their constant support and efficiency.

ANNEX 1. REPORT OF SUBCOMMITTEE ON ENVIRONMENTAL RESEARCH

Chairman: R. W. Trites Rapporteur: W. B. Bailey

The Subcommittee met at the Holiday Inn, Dartmouth, Nova Scotia, on 7-8 June 1982, to consider and report on the various matters referred to it by STACFIS (see Agenda in Part C, this volume). Scientists attended from Canada, EEC (Denmark, Federal Republic of Germany, and France), Japan, Portugal, Spain, USSR and USA.

The Subcommittee reviewed the following documents: SCR 82/VI/4, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 19, 20, 24, 25, 32, 38, 41, 42, 44; SCS 82/VI/8 and 12. Documents not available at the time of the meeting but containing relevant environmental data include SCS 82/VI/15 and 16.

1. MEDS Report for 1981/82 (SCR Doc. 82/VI/44)

The Subcommittee reviewed the report of the Marine Environmental Data Service (MEDS) in its capacity as the designated data center for the NAFO Area. Significant highlights of the report are outlined below.

a) Inventory of expected data collections in 1981

It was noted that observations from about 4,700 hydrographic stations were made within the NAFO Area in 1981 (SCR Doc. 82/VI/44, table 1), compared with an estimated 6,000 stations in 1980. The table was prepared by the Canadian Marine Data Inventory (CAMDI) which became functional in 1981. Because the CAMDI system has a wider community of users than NAFO, a modified set of geographical codes, based on the International Hydrographic Bureau (IHB) set of codes, was used. The relationship between the NAFO and IHB zones is shown in fig. 1 of the MEDS Report. The MEDS representative agreed to investigate the possibility of reporting data in 1983 by NAFO zones.

The Subcommittee was informed that a large volume of data is being collected off Labrador in connection with oil exploration activity. Most of these data will not be available for public use for several years, but they will be archived by MEDS as soon as they become available.

b) Data received and processed in 1981

The data received by MEDS from collections in the NAFO Area are listed in SCR 82/VI/44 (table 2). The number of hydro-casts (1,431) and bathythermograph casts (824) archived in 1981 was approximately 50% of that archived in 1980. Although there were apparently fewer data collected in 1981 than in 1980, proportionately less data have been received by MEDS (30% of 1981 data, in comparison with 45% of 1980 data at the same time last year).

c) Historical data acquisition

MEDS reported that it was difficult to estimate the number of cruises identified as "outstanding" in its report to the June 1981 Meeting (SCR Doc. 81/VI/82) for which data have been received subsequently for processing. For years prior to 1981, MEDS received about 4,000 stations, 75% of which were 1980 data collections. In total, data for 2,100 stations were supplied by Canada, 1,600 by USSR, 268 by USA, 76 by Federal Republic of Germany, and 55 by Denmark. Almost all of these data remain to be processed. The Subcommittee noted the slow progress in incorporating the NAFO physical oceanographic data into the MEDS data bank and discussed ways of improving the acquisition and archiving of the data.

As agreed previously, MEDS undertook a review of existing ICNAF and NAFO documents as part of a search for outstanding oceanographic data. The review concentrated on identifying material suitable for inclusion in CAMDI and resulted in the addition of about 100 entries (SCR Doc. 82/VI/44, table 3). The contents of the first version of CAMDI have not been integrated with the MEDS data bases, but some of the entries in the list may be in MEDS although a manual check was made to try to eliminate this possibility. The list is presented in the MEDS report to allow national representatives to consult their data holdings and to inform MEDS of outstanding data or to forward the data directly to MEDS.

d) IGOSS messages

The Subcommittee noted that, according to SCR Doc. 82/VI/44 (table 1), 970 BT and TESAC observations were taken in the NAFO Area in 1981. However, information in SCR Doc. 82/VI/6 (table 2) indicate that an average of 4.3 BT observations per day (1,570 for 1981) were received in 1981 for an area only slightly different from the NAFO Area. The Subcommittee agreed that MEDS should review its system of collecting IGOSS data to ensure that all data being transmitted by this system are actually reaching MEDS.

2. National Representatives for Data Exchange

The Subcommittee was informed that there were no changes in the national representatives responsible for submitting data to MEDS. The current list is as follows: Canada (J. R. Keeley), Cuba (J. Gomez), Denmark (P. Kanneworff), France (G. Stanislas), Federal Republic of Germany (D. Kohnke), German Democratic Republic (B. Schreiber), Japan (H. Hatanaka), Norway (R. Leinebo), Poland (S. Grimm), USSR (V. Ponomarenko), United Kingdom (P. Edwards), and USA (R. Ochinero).

3. Review of Environmental Conditions

In providing an environmental assessment, the Subcommittee reaffirmed the need for a standard or base-period to which conditions for a given year can be compared (*ICNAF Redbook* 1976, page 150), noting that as yet most comparisons were not being made on a single base period.

The continuing inability to produce, for the June Meeting of the Council, a review of environmental conditions in the previous calendar year was noted. In addition to reaffirming that MEDS should give highest priority to reporting the data for standard sections, the Subcommittee noted that other time-series of data which are normally available shortly after the end of the calendar year should be considered for incorporation into the environmental overview. The time series that could be considered include: Station 27 observations, sea-surface temperatures at Halifax, St. Andrews and Boothbay Harbor, sea-surface temperatures from "ships of opportunity", positions of shelf-slope and slope-Gulf Stream fronts, and warm-core eddies. It was agreed that the use of these data would greatly enhance the value of the report on environmental conditions, but it was recognized that greatly increased effort would be involved and there would be a need for someone to coordinate the activities. On a one-year test-of-feasibility basis, W. B. Bailey (Canada) agreed to investigate the task and produce an initial report prior to the June 1983 Meeting of the Subcommittee, incorporating some of these additional data sets.

4. Review of Environmental Studies in 1981

a) Subareas 0 to 3 (SCR Doc. 82/VI/4, 16, 17, 19, 25, 38, 41, 42; SCS Doc. 82/VI/8, 12)

The representative of the Federal Republic of Germany noted that four standard sections off West Greenland were occupied in spring and one was repeated in late autumn. He also noted that a series of new standard sections was introduced off East Greenland and occupied for the first time in autumn 1981. Hydrographic observations including one standard section were obtained in Div. 2J in late autumn. The R/V *Anton Dohrn* carried out 90 hydrographic observations in the Hamilton Bank area, all measurements being obtained by "Multisonde" (STD).

The representative of Denmark reviewed the work of the Greenland Fisheries Investigations and noted that two major surveys were undertaken in 1981 by the R/V *Adolf Jensen*, one in July and one in November. In addition to the standard NAFO sections normally occupied off West Greenland, a grid of stations around Disko Island (Div. 1A) was occupied. Additional observations at some stations included current measurements and light measurements. A notable feature of the 1981 oceanographic condition in Subarea 1 was the lack of a well-developed thermocline. In the Godthaab section, water temperatures in June were 0.3°C lower than the temperature (1.8°C) considered to be the lower limit for good survival of cod eggs.

The USSR representatives provided a brief overview of surveys by R/V *Gemma, Protsion, Persey III* and *Nikolai Kononov*, which occupied a number of USSR standard sections in the area from southern Labrador to southern Grand Bank. On the basis of a 4-year periodicity of water temperature fluctuations (SCS Doc. 82/VI/12), it should be expected that the recurrent cooling of water masses to the level of that in moderately-cold years will occur in 1982 and 1983.

In general, the temperate of the 0–50 m layer of the Labrador Current in 1981 corresponded to the level in a moderately warm year. Negative anomalies were registered in April-July 1981 in the 0–200 and 200–500 m layers on the northeast slope of Grand Bank and in Flemish Cap Pass, whereas positive anomalies were registered over the eastern edge of Grand Bank and the western slope of Flemish Cap. Temperatures close to or higher than normal were registered over Hamilton Bank and the southeast and southern slopes of Grand Bank. The surface geostrophic circulation over Flemish Cap in spring-summer 1981 had a stable anticyclonic character which is considered a sign of favorable conditions for ichthyoplankton production and survival (SCR Doc. 82/VI/17). Other investigations into water conditions on Flemish Cap included statistical analysis of a 20-year series of sea-surface temperatures (SCR Doc. 82/VI/41) and the study of regional water types in the Flemish Cap area (SCR Doc. 82/VI/42). It was noted that these types of analyses might be useful for other areas.

The representative of France reported on oceanographic observations in winter off Labrador south of 53°N (Div. 2J), Ritu Bank (Div. 3K), northeastern slope of Grand Bank (Div. 3L) and St. Pierre Bank (Subdiv. 3Ps). In general, lower temperatures were encountered in winter 1981 in Div. 3K and 3L than in the previous winter. In Subdiv. 3Ps, the structure of the intermediate layer (60-115 m) was complex and apparently different from that observed in the previous 4 years, autumn temperatures being generally higher than those observed in 1980. Sea-surface temperatures at the entrance to St. Pierre Harbor were abnormally high in summer, reaching 3.5°C above the average (SCR Doc. 82/VI/19).

The Subcommittee noted with interest two studies which attempted to relate biological parameters with environmental variability. There appeared to be a high correlation of temperature and salinity with size and condition of larval redfish (*Sebastes* sp.) in Div. 3M (SCR Doc. 82/VI/38). The direct relationship of temperature with larval size and condition indicates the importance of the physical oceanographic regime in determining growth and hence survival of *Sebastes* larvae. Average temperatures in the surface layer explained more than 60% of the variation in larval size and condition. The second study involved the correlation between cod year-class strength on Flemish Cap and environmental variables (SCR Doc. 82/VI/41). The highest correlation (r = -0.79) was indicated for southerly winds in late March. The mechanism that would satisfactory explain the high correlation between winds and cod year-class strength is yet to be found.

b) Subareas 4 to 6 (SCR Doc. 82/VI/7, 8, 9, 10, 11, 12, 13, 19, 20, 24, 25, 32; SCS Doc. 82/VI/8)

The representatives of France reported observations taken in the eastern Gulf of St. Lawrence (Div. 4R) in January 1982 in association with a bottom-trawl survey for cod. In August-September, about 100 XBT observations were taken on the Scotian Shelf in relation to a survey on squid distribution and abundance (SCR Doc. 82/VI/20).

Several papers on environmental conditions off northeastern United States were reviewed. During 1981, seven warm-core Gulf Stream rings formed off the coast (SCR Doc. 82/VI/10), a lower number than usually occurred in previous years. The longevity of rings formed in 1981 varied from 21 to 195 days. The weighted mean cold-pool temperatures in the New York Bight were higher in June 1981 than in June 1977-80 (SCR Doc. 82/VI/9). The Slope Water bottom temperatures were higher than 8°C in late August, an event that did not occur until late September in 1978-80 but in late July of 1977. Several intrusions of Slope Water (13-15°C) occurred on the bottom at the edge of the shelf (130-230 m) in 1981, whereas water as warm as this was observed only once in 1979 (SCR Doc. 82/VI/8).

Monthly maps of sea-surface temperature (SST) anomalies for the southern part of the NAFO Area show a continuation through May of the cold conditions which began in November 1980 (SCR Doc. 82/VI/12). The negative anomalies were most intense and persistent in the Middle Atlantic Bight (Subarea 6), ranging to -4°C off the southern New Jersey coast in January. In June, the negative anomalies were replaced by a positive pattern which persisted through October, when the pattern became negative again and remained so through December. In the Gulf of Maine-Scotian Shelf area, however, the negative anomaly pattern began to break down in February and was replaced by a positive anomaly pattern in April, which weakened in July but persisted in variable strength until autumn. During October-December, the anomaly pattern in this area was not strongly positive or negative. Average SST anomalies grouped for the entire area north of 35°N and west of 60°W were negative in all months except April-July when they were weakly positive. The anomalies, either positive or negative, were considerably less than the standard deviation of the 1948-67 reference period in all months.

The Subcommittee noted that satellite imagery is playing an increasing role in the provision of oceanographic data. One of the prominent features displayed in infrared imagery is the boundary between water masses, as shown in a study of the location of the Shelf Water-Slope Water front in 1981 for four representative transects in Subareas 5 and 6 relative to the long-term mean positions from June 1973 to December 1977 (SCR Doc. 82/VI/8). In general, north of Cape Henry, the front is typically positioned farther offshore during the first half of the year and more shoreward during most of the latter half of the year; normal positions are reversed in the area from Cape Romain to Albermarle Sound. In 1981, the front generally followed the seasonal pattern south of Albermarle Sound, but north of the Sound the front was only rarely shoreward of the long-term monthly mean positions. Most of the seaward excursions of shelf-water north of Albermarle Sound corresponded to the passage of warm-core eddies in the Slope Water.

Bottom temperatures in the Slope Water area of the 71°W transect south of New England were strongly influenced by the passage of Gulf Stream rings (SCR Doc. 82/VI/9). In 1981, three warm-core rings passed through the Slope Water with a cumulative duration of 3.5 months. These warm-core rings frequently cause minimum bottom temperatures on the continental slope to increase beyond 13°C. In February 1975, for example, the bottom temperature at 120 m increased briefly to greater than 17°C as a ring passed southward. In 1981, the maximum bottom temperatures in the area of warm upper Slope Water ranged from about 10.5°C (mid-April to end of May) to 13°C (January and August). The observed annual maximum slope bottom temperature was 13.2°C in January in 95-125 m. The bottom Slope Water reached 13°C again only in August for a brief period during the passage of a warm-core ring (No. 81-C).

Results from the larval-juvenile squid surveys continue to reveal the close association between physical oceanographic features in the offshore areas of Subareas 4, 5 and 6 and the distribution of larvae and juveniles (SCR Doc. 82/VI/25, 32). Modelling of the distributions of larvae and early juveniles in relation to oceanographic diffusion and transport mechanisms indicates that the most probable area and time to locate the spawning adults, eggs and young larvae of the short-finned squid (*Illex illecebrosus*) are in the shelf-slope region southwest of Chesapeake Bay in the December-January period. The Gulf Stream system appears to provide a key mechanism for the northeastward transport of larvae and juveniles, and warm-core eddies appear to be important in transporting juveniles into the Slope Water region north of the Gulf Stream (SCR Doc. 82/VI/24). With respect to the squid fishery, abnormally high sea-surface temperatures in the coastal waters of Subarea 3 after mid-August and during September were noted to coincide with a sharp decline in squid availability (SCR Doc. 82/VI/19, 27).

5. Remote Sensing Activities

The Committee was informed that the Narragansett Laboratory of the Northeast Fisheries Center has undertaken a major fishery oceanography investigation, one aspect of which is the study of the entrainment of Shelf Water by warm-core Gulf Stream rings. Once cruise (22 September-6 October 1981) surveyed the entrainment feature associated with Ring 81-D in coordination with a multi-ship National Science Foundation study of the same ring. The joint work will continue with four cruises in 1982. In addition, the USSR research vessel *Stvor*, in cooperation with the Northeast Fisheries Center, performed two hydrographic surveys of the Slope Water region from Georges Bank to Chesapeake Bay during 28 August-26 October 1981 to characterize the region into which Ring 81-D subsequently moved.

The Subcommittee was given a description of the services provided by the National Environmental Satellite Service (NESS) of the U.S. Weather Service. This service includes both GOES and polar-orbiting satellites and the sea-surface temperature analysis charts.

A brief description was provided of the work of the Atlantic Environmental Group and the U.S. Environmental Protection Agency at Narragansett in developing digital composites from GOES data. The composites are derived from the thermal infrared channel (10.5-12.6 μm) of the Visible Infrared Spin Scan Radiometer, with a special resolution of about 7 km. Although the composite does not show actual temperatures, the relative temperature information is helpful in determining the positions of various oceanographic features, such as the shelf-slope front, the Gulf Stream-Slope Water front, and warm-core and cold-core rings. A program to contour the composites is under development.

The Subcommittee learned of the establishment of NEARSS (Northeast Area Remote Sensing System) to further the distribution of remotely-sensed data within the community (New England). At present, 15 universities, laboratories and government agencies in 8 locations make up the initial network of users. The area covered is envisioned as 35°-50°N and 50°-80°W. It is proposed that the American Science and Technology Corporation establish a satellite data reception and distribution site at the University of Massachusetts to supply the NEARSS community with real-time digital data in an operational environment.

6. Synoptic Sea-surface Temperature Charts (SCR Doc. 82/VI/6)

The Subcommittee was informed of the development of synoptic sea-surface temperature charts from the early 1950's to the present together with the nature and amount of data that contributed to producing them. Examples of five such charts were examined. These included hand-contoured SST data provided in weather messages from "ships of opportunity", contoured frontal and eddy features based on satellite imagery, and a map of sea-surface temperatues generated completely by a computerized system. It was noted that, despite the major advances in satellite imagery and computer technology, a large amount of "ground-truth" data is a continuing requisite to the production of accurate maps.

7. Environmental Data Products Available Aboard Ship

The Subcommittee briefly considered this matter, noting the difficulty for a user to quickly identify the various products available in a given area, together with the broadcasts schedules, frequencies, etc. The view was expressed that there was a need to collate the information in a paper, oriented specifically for users operating in the NAFO Area. Mr. W. B. Bailey (Canada) agreed to undertake the task of producing such a document, including sample maps of the various products, for the next meeting of the Subcommittee.

8. Publication Status of Symposia Held in September 1981

The Assistant Executive Secretary reported that the contributions to the Special Session on Remote Sensing (*NAFO Scientific Council Studies*, No. 4) was expected to be published in August 1982, and that the editing of the contributions to the Environmental Symposium (*NAFO Scientific Council Studies*, No. 5) was progressing well, with publication expected in November 1982.

9. Other Matters

The Subcommittee was informed of the disbandment of the U.S. Coast Guard Oceanographic Unit, Washington, D.C. It was noted that the data and publications of the Oceanographic Unit had make an important contribution to knowledge of the oceanographic regime of the Labrador Sea in general and the Grand Bank region in particular. The disbanding of this unit was considered as being unfortunate for NAFO, and the MEDS representative (R. J. Keeley) agreed to inquire about the future of oceanographic programs of the U.S. Coast Guard International Ice Patrol.

10. Acknowledgements

The Chairman expressed his gratitide to the rapporteur and participants for their interest and cooperation in making this first meeting of the Subcommittee a successful one.

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

Chairman: T. K. Pitt

Rapporteurs: Various

The Committee met at the Holiday Inn, Dartmouth, Nova Scotia, Canada, during 16-17 June 1982, to consider and report on matters referred to it by the Scientific Council (see Part C, this volume). Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France, and the Commission of the European Communities), Japan, Portugal, Spain, USSR and USA. The Assistant Executive Secretary and several participants contributed to the preparation of the initial drafts for various sections of this report.

I. STATISTICS AND SAMPLING

1. CWP Activities Relevant to NAFO (SCS Doc. 82/VI/10)

The Assistant Executive Secretary briefly reviewed the report on NAFO's statistical program, publications and data-processing, which he had prepared for the 11th Session of the CWP to be held in Luxembourg during 21-28 July 1982. In addition to providing a summary of NAFO's involvement in the STATLANT Program and its automatic data-processing procedures, the report outlined actions taken by the Scientific Council at its meetings in September 1980 and June 1981 regarding the implementation of certain recommendations from the 10th Session of the CWP. The CWP was also informed of recent Scientific Council decisions on statistical matters (e.g. new format for Table 5 of NAFO Statistical Bulletin, and certain amendments to the NAFO list of species items) and the Council's concern about the deterioration in national reporting of fishery statistics and the continued reporting of large unspecified catches of finfish species.

As agreed at the June 1981 Meeting of the Scientific Council, the Committee noted that NAFO representation at the 11th Session would be as follows: Chairman of STACREC (T. K. Pitt), Country Representative (J. G. Boavida, Portugal), and NAFO Secretariat Representative (V. M. Hodder).

2. Fishery Statistics

a) STATLANT 21A reports

These reports, with a 15 April deadline, consist of provisional nominal catch statistics by species and division and are designed to provide the Scientific Council with reasonably complete annual statistics of fishing activity in the NAFO Area during the preceding year for use at its Regular Meeting in June. At the start of this June 1982 Meeting, despite the clearly designated deadline, STATLANT 21A reports were available for only about half of the countries (or country components). Some reports were received during the meeting, but the data available were too incomplete for use in preparing the "Fishery Trends" section for inclusion in the Report of Standing Committee on Fishery Science (see preceding Appendix I).

b) STATLANT 21B reports

These reports, with a 30 June deadline, contain detailed nominal catch and effort data by gear, tonnage class of vessel, main species, division and month. These data are extremely valuable for assessment purposes and are used as the final statistics for publication in the NAFO Statistical Bulletin.

i) Statistical Bulletin, Vol. 29 for 1979

This volume, which should have been issued in December 1980, was not published until July 1981, about 7 months behind schedule. The major problem was the difficulty in obtaining STATLANT 21B reports from some countries despite repeated requests to national statistical offices and to Scientific Council representatives, in the case of NAFO Contracting Parties.

ii) Statistical Bulletin, Vol. 30 for 1980

The publication of this volume has also been significantly delayed for the same reason noted above. However, nearly all of the 1980 data are now in hand, and it is anticipated that Vol. 30 will be printed in July 1982 and distributed in August. Meanwhile, computer listings of the available catch and effort data for 1980 were supplied upon request to scientists involved in stock assessments for this June 1982 Meeting.

iii) STATLANT 21B reports for 1981

The deadline for the submission of these detailed catch and effort reports for 1981 is presently 30 June 1982. Six of these reports have already been received, and early receipt of the remainder could result in publication of *Statistical Bulletin* Vol. 31 before the end of 1982 or in early 1983, well in advance of the June 1983 Meeting.

c) Adequacy of current deadlines for STATLANT 21A and 21B reports

In past years, several countries, which now neglect to forward their STATLANT 21A and 21B reports in accordance with the indicated deadlines, have demonstrated their ability to prepare and submit their reports well in advance of the June Meeting. In fact, some countries forward their STATLANT 21B reports at the same time that the 21A reports are sent. In view of the need for detailed catch and effort data for assessment purposes, the deadline of 30 June for STATLANT 21B reports is ineffective in making the data available for the June Meeting of STACFIS. Scientific Council representatives of countries, which are persistently delinquent in providing their fishery statistics for assessment purposes, are encouraged to take an active role in ensuring that the national statistical officers give priority to the preparation and submission of the required reports. STACREC agreed not to alter the deadline for the submission of STATLANT 21A and 21B reports.

d) Historical catches for 1971-80 (SCS Doc. 82/VI/2)

As requested at the June 1980 Meeting (*NAFO Sci. Coun. Rep.* 1979-80, page 92), the Secretariat has continued the preparation of a summary document giving 10-year tabulations of catches of selected species by stock area and country. A total of 71 species-stocks are currently included in the list.

e) Changes in format of Statistical Bulletin

The first NAFO Statistical Bulletin (Vol. 29) was issued after the June 1981 Meeting of the Scientific Council. It contained the new format for Table 5 which was adopted at the September 1980 Meeting of the Council (*NAFO Sci. Coun. Rep.* 1979-80, page 127). This new Table 5 replaced Tables 5 and 6 of the previous ICNAF Statistical Bulletin. Volume 29 also introduced the use of new country abbreviations (used in tables where space is limited), which were proposed by the CWP and adopted at the September 1980 Meeting of the Scientific Council. The abbreviations for EEC member states are prefixed by the letter "E" for convenience in listing them consecutively as a group.

A suggestion regarding the possible reinstatement of a summary table similar to Table 6 in the previous ICNAF Statistical Bulletin was discussed. It was pointed out that missing effort for some catch entries in the data base would require that effort related and non-effort related entries be identified and summed separately for each gear and tonnage category. Also, the arbitrary selection of data for a few individual species and the grouping of data for others were not considered prudent, as computer programs would have to be changed each time there was a request to separate other species from the groups. The Assistant Executive Secretary indicated that a table without arbitrary grouping of species could readily be compiled but that it was not possible at this time to estimate the increase in the size of Statistical Bulletin, if such a table were included. STACREC requested the Secretariat to prepare such a table for consideration at the June 1983 Meeting.

3. Sampling

a) Acquisition and processing of data

In accordance with the previously adopted procedure for the reporting of length frequencies and age-length keys on the new sampling forms (CFS-1 and CFS-2) or in a similar format on computer tape, the Secretariat has modified its procedure for processing the more detailed data. Although the data base is still very incomplete, the Secretariat has computerized all available data for 1979 and 1980. The 1979 data, including data collected through the Scientific Observer Program and reported by Canada (Nfld), were listed for the June 1981 Meeting in SCS Doc. 81/VI/16. Little additional data have been added since last year, and no Canada (Maritimes) observer data have yet been received, although these were expected to be reported to the Secretariat before the end of 1981.

b) Sampling data for 1980 (SCS Doc. 82/VI/17)

Summarized lists of the sampling data reported for 1980 are given in SCS Doc. 82/VI/17. These lists include a large volume of data collected through the Scientific Observer Program and reported by Canada (Nfld).

c) Status of Sampling Yearbooks

When the publication of actual sampling data was discontinued with the issue of *ICNAF Sampling Yearbook*, Vol. 18 for 1973, lists of the data were compiled annually and issued in *ICNAF Sampling Yearbook*, Vol. 19 for 1974 to Vol. 23 for 1978. The first NAFO issue of Sampling Yearbook (Vol.

24 for 1979) have not yet been compiled for printing. One reason is that there exists a large volume of sampling data for 1979 not yet reported to the Secretariat, and the other relates to the degree of summarization that should be carried out, in the light of the large volume of individual samples currently available for listing. The matter was further considered in (e) below.

d) Age-length keys

Except for data collected and reported by Canada (Nfld) both nationally and through the Scientific Observer Program, very few age-length keys for 1979 and 1980 have been reported on sampling form CFS-2.

e) Need for guidelines on extending the sampling data base

The Assistant Executive Secretary noted that all length and age sampling data for the 1968-78 period have been computerized for rapid retrieval in a standard format based on the previous arrangement of providing monthly length compositions, quarterly age-length keys, and calculated monthly age compositions and mean length-at-age. In view of the change in reporting procedures for 1979 and subsequent years, guidelines are needed to enable the Secretariat to undertake some summarization of the data, if the existing data base is to be extended and suitable lists compiled for inclusion in the Sampling Yearbook series. To examine the implications resulting from the recent change in sampling requirements, STACREC agreed to establish a small *ad hoc* working group, consisting of scientists from five research institutes and the Assistant Executive Secretary. The Secretariat was requested to provide the members of the group with all relevant information as soon as possible after this meeting, and it was agreed that the group should meet during the September 1982 Annual Meeting and report to STACREC at the June 1983 Meeting. Pending the designation of the working group members, the Secretariat was requested to communicate with Mr A. T. Pinhorn (St. John's, Canada), Mr A. Forest (St. Pierre and Miquelon, France), Dr J. Messtorff (Bremerhavn, Federal Republic of Germany), Mr Sv. Aa. Horsted (Copenhagen, Denmark) and Dr I. Lukag (Director of PINRO, Murmansk, USSR).

4. International Scientific Observer Scheme

Canada reported that bilateral agreements on the International Scientific Observer Scheme were finalized with German Democratic Republic, Norway, Faroe Islands, Japan and Cuba in 1981. A few technical details remain before implementation of an agreement with USSR. Coverage in 1981 amounted to only 78 days under the scheme. For the most part, coverage in 1981 was not extensive because of the timing of the agreements, but coverage to date in 1982 is also very low. USSR reported that an agreement has been established with the German Democratic Republic.

5. List of Fishing Vessels for 1980 - Progress Report

The Committee noted that the *List of Fishing Vessels* for 1980, which was scheduled for publication in early 1981, has not yet been published because data from Bulgaria, France (M), Romania and USA have not been received. The USA Observer reported that the USA list would be available within the next 30 days, and France (M) representative indicated that he will make a special effort to see that the list for that country is sent forward. Again STACREC urged that the outstanding lists be forwarded to the Secretariat as soon as possible.

Various member of the Committee noted the usefulness of the List of Fishing Vessels, and STACREC agreed that the Secretariat should proceed with the acquisition of data for the compilation of the *NAFO List of Fishing Vessels* for 1983.

6. Tagging Activities in 1981 (SCS Doc. 82/VI/4)

Tagging activities in the Northwest Atlantic during 1980, as reported to the Secretariat, were reviewed and the usefulness of the information was discussed. It was agreed that the program should be continued.

7. Other Statistical Matters

a) Catch statistics for Hudson Strait

Canada reported that a fishery for *Pandalus montaguii* had developed in the past 3 years in the area adjacent to, but west of, NAFO Division 0B with some catches within Div. 0B. For 1980 and 1981, these catches have been included with *Pandalus borealis* catches and reported as if all were taken in Div. 0B. It was not considered practical to separate catches across the Div. 0B boundary, and Canada proposed to continue to report all *P. montaguii* catches as being from Div. 0B with a note indicating that part of these catches were taken immediately adjacent to but outside the Convention area. It was noted that the CWP might be interested with respect to the implications regarding reported catches in FAO's Arctic Fishing Area 18. Nevertheless, STACREC agreed to the proposal and

recommends

i) that the shrimp Pandalus montaguii be added to the NAFO List of Species Items, and

ii) that nominal catches of P. montaguii taken immediately to the west of Div. 0B in Hudson Strait be included under Div. 0B for statistical purposes with an appropriate footnote indicating that part of the catches was taken adjacent to but outside the Convention Area.

b) Level of biological sampling appropriate for the International Scientific Observer Scheme

Canada requested advice on the level of biological sampling that would be appropriate to the activities of scientific observers, particularly for stocks where catches do not reach the level specified in the NAFO minimum guideline of one sample/1000 tons/quarter/gear/division/country. It was pointed out that the NAFO guideline was intended to indicate the minimum level of sampling, and that a higher sampling level was not precluded. Indeed, it was recognized generally that a higher level was desirable and that as many samples as possible would be useful for stocks where sampling was normally difficult. The problem involved two aspects: (i) the question of a basic minimum, and (ii) a technical evaluation of sample size requirements on the basis of variance. It was noted that information might exist for further study of the second aspect, but that, in the meantime, it would be desirable to address the first one now. STACREC therefore

recommends

that countries should collect at least one sample per 1,000 tons of catch per quarter per year per division, but as a minimum five samples per stock per year should be collected and distributed as far as possible throughout the fishery season.

STACREC noted that the International Observer Scheme might be valuable in assisting countries to achieve this target, since fisheries for stocks that do not yield 1,000 tons per quarter are usually of too short duration to justify the flag state placing a scientist or technician on board its vessels.

II. BIOLOGICAL SURVEYS

1. Review of Survey Activity in 1981

The Committee noted that the following documents contained material relevant to biological surveys in 1981: SCR Doc. 81/IX/95; SCR Doc. 82/VI/7, 13, 14, 16, 20, 25, 32, 33, 34, 43, 51, 54, 61, 62; SCS Doc. 82/VI/8, 12, 15, 16. Most of these documents contained the results of investigations previously considered by STACFIS, except for SCR Doc. 82/VI/51 which contained new information on gear experiments (see Section 5(a) below). Survey activity in the NAFO Area, provided by participants from various member countries, enabled the compilation of the list of surveys in 1980 (Table 1).

2. Survey Plans for 1982 and 1983

Survey plans for 1982 and early 1983 are listed in Table 2. The Committee noted the renewed interest in gear experiments undertaken by the Federal Republic of Germany, and was informed that Canada (Nfld) plans an experimental gear cruise in 1982.

3. Publication of Manual on Groundfish Surveys

The Committee noted that the Manual on Groundfish Surveys in the Northwest Atlantic (*NAFO Scientific Council Studies* No. 2) was published in December 1981. The organization of this manual was initiated in 1975 by the ICNAF Subcommittee on Biological Surveys and continued to its completion by an editorial group chaired by Dr W. G. Doubleday who also acted as editor. The Committee expressed its thanks to the many contributors to the manual and to Dr Doubleday. The Committee noted that additional information on survey methodology, techniques for analyses, and changes and improvements in stratification charts would be welcomed for inclusion in possible future updated versions of the Manual.

4. Review of Stratification Schemes

The Committee noted that no change in the stratification schemes used in random-stratified surveys in the Northwest Atlantic were reported in 1981-82. The only major gap remains in Div. 2G and 2H, because accurate navigational charts have not yet been received. However, when these become available, stratification of Div. 2G and 2H will be completed and the charts made available to interested scientists and presumably also for publication as a supplement to the Manual.

Table 1. Inventory of biological surveys conducted in the NAFO Area during 1981.

Sub-area	Div.	Country	Months	Type of survey	No. of sets
A. Stratified-random surveys					
E.Green.		DEU	11-12	Groundfish	78
1	ABC	GRL	7-8	Shrimp (photo)	18
2	GH	CAN-N	10-11	Groundfish	138
	J	CAN-N	11-12	"	115
		DEU	11-12	"	70
		FRA	1-2	Cod	16
3	K	CAN-N	11-12	Groundfish	133
	KL	FRA	1-2	Cod	60
	LNO	CAN-N	4-5	Groundfish	158
		"	9-10	"	172
	M	CAN-N	1-2	"	154
	Pn	CAN-N	1-3	"	25
		FRA	2	Cod	10
	Ps	CAN-N	2-3	Groundfish	71
		FRA	2-3	"	109
		"	10-11	"	94
4	R	FRA	1-2	Cod	46
	RST	CAN-N	1	Groundfish	131
	T	CAN-SF	9	"	70
	VWX	CAN-SF	3	"	119
		"	7	"	148
		"	9-10	"	138
		FRA	8-9	Squid	100
	X	USA	3-5	Groundfish	29
		"	5-6	"	11
		"	10-11	"	55
B. Other surveys					
E.Green.		DEU	3	Groundfish	15
Rockall		DEU	6-8	Calibration of standard survey trawls used in Northwest Atlantic	
0+1	-	GRL	3	Marine mammals (aerial)	-
1	AB	GRL	7-8	Groundfish and shrimp	17
		"	3-5,7,10	Groundfish & shrimp (com.)	67
		"	7	Plankton	48
	CD	GRL	2-5,10-12	Groundfish and shrimp	24
		"	2,3,10	Groundfish & shrimp (com.)	40
		"	3,7	Plankton	17
	D	GRL	8,9	Salmon	77
	E	GRL	4	Groundfish and shrimp	4
	CDEF	GRL	2-3	Groundfish	63
		"	12	"	24
2	GHJ	USSR	1-3	G. halibut trawl survey	105
	HJ	CAN-N	7-9	Inshore cod tagging	-
		"	7	Shrimp survey	150
		"	9-10	Capelin	-
		DEU	11	Groundfish	11
	J	CAN-N	3	Cod tagging	50
2+3		CAN-N	4	Seal surveys	-
3	K	CAN-N	3	Cod tagging	53
		"	5-6	Salmon	-
		"	7	Shrimp survey	25
		"	10	Herring	-
	KL	CAN-N	6-7,9	Capelin	-
	KLM	"	7-8	Hydrography, plankton	-
	KLMNO	USSR	4-8	Bottom trawl survey	241
	L	CAN-N	1	Cod tagging	50
3	L	CAN-N	3	Crab tagging	-
		"	4	Cod food and feeding	50
		"	3-5,9,11	Crab surveys	-
		"	5	Herring	-
	LNO	CAN-N	6	Capelin and sand lance	-
		USSR	3-7	Ichthyoplankton	61
		"	6	Capelin survey (acoustic)	101
	LMNO	CAN-N	4-5	Ecosystem studies	66
		USSR	8-12	Ichthyoplankton, hydrology	78
	M	CAN-N	5-7	Plankton, fish larvae	-
	N	CAN-N	8	Juvenile flatfish	67
	NO	CAN-N	2-3	Squid surveys	19
	OP	CAN-N	6	Squid survey	82
	Ps	CAN-N	2,6-8,10-12	Herring	-
		"	4-6	Shrimp	-
		"	6	Capelin	-
		"	10	Juvenile flatfish	35
		FRA	11	Scallops	100
4	RS	CAN-N	4-5	Capelin acoustics	-
		"	4-5,11	Herring	-
		"	6-8	Scallops	-
		"	7-8	Shrimp, redfish	149
		"	8-9	Redfish (acoustics)	-
	T	CAN-SF	6	Mackerel eggs	4
		"	8	Juvenile herring	-
		"	10-11	Herring	-
	V	CAN-N	2-3	Squid	52
		CAN-SF	5	Cod tagging	88
		"	9	Shrimp	-
	VWX	CAN-SF	1-2	Ichthyoplankton	156
		"	3	"	109
		"	4	Shrimp	-
		"	6	Squid	70
		USSR	8-9	Ichthyoplankton	79
		"	9-10	"	99
		"	10-11	Trawl survey (silver hake)	98
	W	CAN-SF	1	Juvenile silver hake	6
		"	5	0-group gadoids	49
		"	8	Juvenile haddock	53
		"	9	Cod tagging	45
		"	12	Pollock	-
	WX	CAN-SF	9	Silver hake	41
		"	10-11	Juvenile silver hake	62
	X	CAN-SF	3	Larval herring	300
		"	7	Herring	-
		"	8	Larval herring	133
		USA	11-12	Ichthyoplankton	7
4-5	VWXZ	CAN-SF	7-8	Scallops	-
4-6	-	USSR	2-3	Squid, ichthyoplankton	27
		"	3-5	" "	99
		"	5-6	" "	65
5	YZ	USA	3-4	Ichthyoplankton	37
		"	4-5	"	21
		"	5	"	70
		"	5-6	"	35
		"	6	Scallops	109
		"	8-9	Clams	74
		"	11-12	Ichthyoplankton	89
		"	12	Food habits	61
5-6	ZAB	USSR	8-9	Ichthyoplankton	80
		"	9-10	"	66
6	ABC	USA	3-4	Ichthyoplankton	62
		"	6	Scallops	203
		"	8	Clams	188

Table 2. Biological surveys planned for the NAFO Area in 1982 and early 1983.

Country	Area	Type of survey	Dates
A. Surveys in 1982			
CAN-N	OAB	Shrimp	Sep 9-27
	1ABCDE	Salmon	Aug 18-Sep 14
	2GHJ	Shrimp	Jul 7-27
		Cod tagging inshore	Jul-Aug
	2HJ	Salmon tagging	Jul 18-Aug 13
	2J+3KL	Capelin survey	Sep 30-Oct 27
	2J+3	Annual oceanographic	Jul 21-Aug 9
		Gear experiments	Sep 30-Oct 18
	3K	Crabs	May 17-27
	3KL	Herring	Sep 29-Oct 15
		Cod tagging	Sep 8-30
		Mackerel tagging	Sep 3-16
	3L	Groundfish	Oct 29-Dec 10
		Groundfish seasonal survey	Nov 5-Dec 16
		Shrimp	Apr 10-20
		Capelin	Apr 2-21
		"	Apr 26-May 12
		"	Jun 2-29
		Capelin and herring	Aug 16-31
		" " "	Oct 4-15
		" " "	Nov 24-Dec 10
		Crab tagging	Mar 30-Apr 20
		" "	May 3-12
		" "	Aug 20-Sep 3
		Herring	Apr 13-28
	3LN	Juvenile capelin	Oct 21-Nov 2
	3LNO	Groundfish (strat.-random)	May 13-Jun 21
		Capelin acoustics	Jun 16-Jul 5
		Fishery ecosystem studies	Jun 28-Jul 19
	3LPs	Herring and capelin	Jun 1-Jul 28
	3M	Groundfish (strat.-random)	Jan-Feb
	3NO	Groundfish seasonal studies	Apr 1-30
		Squid survey	May 25-Jun 14
		Squid tagging	Jul 15-30
		Juvenile flatfish	Sep 17-Oct 5
	4R	Scallops	Jul 5-25
		Redfish acoustics	Sep
CAN-G	4RS	Shrimp and redfish	Aug-Sep
	4S	Herring distribution	May (21 days)
	4T	Crab larvae (5 cruises)	Apr 26-Jul 21
		Crab-cod interactions	May,Jul,Sep
		Crab (photo. abundance)	May 25-Jun 4
		Herring juveniles	Aug (30 days)
		Herring tagging	Sep (10 days)
		Scallop surveys	May-Jul, Sep
		Salmon smolts	Jul (10 days)
CAN-SF	4T	Crabs	May 25-Jun 4
		Mackerel eggs	Jun 7-Jul 9
		Groundfish annual survey	Sep 7-Oct 1
	4VW	Redfish	Nov 15-Dec 13
	4VWX	Ichthyoplankton	Jan 5-29
		"	May 3-21
		"	Jul 12-Aug 6
		Plankton	Apr 26-May 7
		Groundfish survey	Mar 2-25
		" "	Jul 5-30
		" "	Sep 22-Oct 29
		Squid (larvae & juveniles)	Feb 2-25
		Squid	May 31-Jun 11
	4W	Herring	Jan 5-29
		Parasites and disease	Mar 1-5
		Acoustics	Oct 4-24
	4WX	Juvenile gadoids	Apr 12-23
		Silver hake	May 10-28
		Silver hake and squid	Aug 16-Sep 3
		Pollock	Nov 15-Dec 3
		Shrimp	Apr 19-30
		"	Nov 15-26
		Benthos	Sep 13-24
		Acoustics	Feb 15-26
		"	Aug 2-13
	4X	Larval herring	Mar 9-25
		" "	Oct 25-Nov 12
	4X+5Z	Scallops	Mar 29-Apr 8
		"	Aug 9-Sep 3
DEU	E.G.	Groundfish	Mar 24-Apr 29
		"	Jul 14-Aug 9
		Groundfish (strat.-random)	Sep 14-Oct 29
	1C-F	" " "	Nov 10-Dec 17
	2J	" " "	Oct 19-Nov 26
FRA	1B-F	Cod (stratified-random)	Jun 1-28
	2J+3KL	" " "	
	3P+4R	" " "	Jan 8-Mar 8
	3Ps	Groundfish (strat.-random)	Mar 14-Apr 3
		" " "	
		Cod tagging	Oct-Nov
		Scallops	Nov
	4VWX	Squid (strat.-random)	Aug 18-Sep 22
GRL	0+1	Marine mammals (aerial)	Mar
	1AB	Shrimp (photo)	Jul-Aug
		" (commercial)	Jan-Dec
	1A-C	"	Jul-Aug
	1A-D	Plankton	Jul
	1A-E	Whales (sightings)	Jul-Aug
	1C-E	Shrimp and groundfish	Jan-Dec
	1C-F	Cod (commercial)	Jan-Dec
USSR	2-3	Bottom trawl surveys	Mar-Jun
		Capelin acoustic surveys	May-Jun
	4VWX	Silver hake, ichthyoplankton	Aug-Nov
	4+5	Squid-*Illex*, ichthyoplankton (midwater trawling)	Aug-Nov
USA	4X	Groundfish survey	Apr 12-May 12
		" "	Oct 4-Nov 12
	4-6	Ichthyoplankton	Feb 16-Mar 25
		"	May 17-Jun 11
		"	Nov 15-Dec 22
	5YZ	Groundfish survey	Jan 18-Feb 12
		" "	Mar 30-May 8
		" "	Oct 4-Nov 12
	5Z	Gear testing	Oct 18-29
		Scallop assessment	Jul 12-Aug 6
	5Z+6	Clam assessment	Jul 27-Sep 2
	6	Scallop assessment	Jun 1-11
B. Surveys planned for 1983			
CAN-N	2J+3KL	Cod tagging	Mar 16-30
	3L	Groundfish survey	Feb 11-Mar 25
		Herring and capelin	Feb 1-18
		Herring	Mar 16-31
	3LN	Groundfish (feeding studies)	Jan 28-Feb 8
	3LNO	Salmon tagging	Jan 6-25
	3M	Groundfish	Feb 2-23
		Fishery ecosystem studies	Feb 25-Mar 15
	3P	Groundfish survey	Mar 11-Apr 1
	3Ps	Herring	Jan 6-Feb 17
	4Vs	Squid	Feb 18-Mar 8
CAN-G	3Pn+4R	Cod survey	Jan (21 days)
CAN-SF	3-6	Squid (larvae)	Jan 24-Mar 4
	4V	Redfish	Mar 29-Apr 8
	4VWX	Mackerel	Jan 3-21
		Ichthyoplankton	Jan 3-Mar 18
		Groundfish (seasonal)	Mar 7-31
	4W	Acoustics	Feb 14-25
	4WX	Shrimp	Jan 31-Feb 11
	4X	Larval herring	Mar 14-Apr 1
USA	4-6	Ichthyoplankton	Jan 31-Mar 18
		"	May 25-Jun 29
	4X-6	Groundfish survey	Mar 7-May 6
	5YZ	" "	Feb 14-26
	5Z+6	Scallop assessment	Aug 3-Sep 2
		Clam assessment	Jul 25-Sep 2

5. Other Matters

a) Gear experiments (SCR Doc. 82/VI/51)

The Committee noted the renewed interest in experiments designed to study the performance of trawls, because the reliability of biomass estimates from research vessel surveys is, besides other parameters, dependent on the validity of the data defining the area swept by a given trawl. Preliminary results of field experiments concerning the calibration of standard trawls used by the Federal Republic of Germany for stratified-random trawl surveys in the NAFO area were presented in SCR Doc. 82/VI/51.

A first set of field experiments aimed at the determination of the influence of different vessel speeds and fishing depths (or warp lengths) on trawl headline height and wind spread was carried out by R/V *Walther Herwig* in the Rockall area (Northeast Atlantic) in August 1981. Since the chosen area was known to provide good trawling grounds to a depth of 700 m and the season was selected when weather conditions could be expected to be relatively stable, external conditions for the experiment could be considered as quasi-steady within a set of measurements.

The amount of data so far collected has not yet been fully analyzed. However, some preliminary conclusions seem to be obvious: the trawl parameters are relatively stable at all speed levels employed (3.0-5.0 km) for warp lengths of 700-850 m, but the variation of headline height and wing spread increases at the lower speeds with warp lengths greater than 1,450 m. It may therefore be assumed that warp length contributes to the variance, at least in a critical speed range and at greater fishing depths. In order to keep trawl height and wing spread relatively stable in all fishing depths, it was concluded that the trawling speed of R/V *Walther Herwig* should be about 4.5 ± 0.5 knots. Field studies to further evaluate the operational characteristics of the standard survey trawl are planned to be carried out in 1982.

b) Importance of groundfish surveys

The Committee noted the extensive survey work carried out in recent years by member countries. Research results have been increasingly useful as independent measures of stock status. Commercial catch and effort measures have, on the other hand, tended to become less valid indicators of stock status, as fishery regulations with respect to factors such as area, time, catch and by-catch limitations, which have likely altered the fishing patterns of the commercial fleets.

Although survey results have been useful and, indeed, are essential for the assessment of the status of certain stocks, the survey data are often not consistent with information from the commercial fisheries on other stocks. Such discrepancies are not unexpected when variation in survey results, due to fish behaviour, trawl performance, synopticity, and intensity and timing of sampling, are taken into account. The Committee noted that greater efficiency may be possible through better coordination of surveys, especially in the case of large stocks such as cod in Div. 2J, 3K and 3L. The Committee noted that the proceedings of a Canadian workshop on bottom-trawl surveys, held in Ottawa, Canada, in November 1980, had been published (*Can. Spec. Publ. Fish. and Aquatic Sci.*, No. 58, 273 p., 1981).

The Committee encourages continuing the critical review of biomass surveys with respect to the performance of the gear and calibration of research and commercial indices of abundance. The Committee noted with interest the development of catchability coefficient values by USSR and recommended that a detailed review of their derivation be presented at the June 1983 meeting by USSR colleagues. Other countries are encouraged to perform similar analyses and present the results at the June 1983 Meeting.

c) Other Surveys

The Committee noted that emphasis in recent years has been on groundfish surveys, but other types of biological surveys have become significant in research programs discussed and coordinated under the aegis of the Scientific Council. In particular, the surveys associated with the Squid Research Program have yielded much valuable information during the past three years, and acoustic surveys for capelin have been carried on for some time. The proposal of STACFIS concerning future coordination of surveys related to the squid research program was noted, and it was agreed that this was an appropriate task for STACREC in future years.

III. OTHER MATTERS

1. Acknowledgements

There being no other matters to consider, the Chairmen thanked the various scientists who assisted in the initial drafting of the report and expressed his appreciation to all participants for their co-operation during the meeting and to the Secretariat for their usual efficient work.

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

Chairman: V. A. Rikhter Rapporteur: R. G. Halliday

The Committee met at the Holiday Inn, Dartmouth, Nova Scotia, on 9 and 17 June 1982, to consider and report on various matters referred to it by the Scientific Council (see Part C, this volume). In attendance were V. A. Rikhter (Chairman), J. Messtorff and J. P. Minet (EEC), H. Hatanaka (Japan), R. G. Halliday and A. T. Pinhorn (Canada). T. K. Pitt substituted for A. T. Pinhorn on 9 June. The Chairman of the Scientific Council (R. Wells), the Executive Secretary (Capt. J. C. E. Cardoso) and the Assistant Executive Secretary (V. M. Hodder) also attended the sessions.

1. Review of Scientific Publications since September 1981

a) Statistical Bulletin, Vol. 30 for 1980

Production of Vol. 30 is well in hand and publication in July 1982 is anticipated.

b) Journal of Northwest Atlantic Fishery Science

Volume 2 of the Journal was published in October 1981 as anticipated. Volume 3, issue No. 1, containing 7 papers (91 pages), has recently been distributed. Several suitable papers have been received for Vol. 3, No. 2, and publication of this second issue is planned for autumn of 1982.

c) Scientific Council Studies

Studies No. 2, containing the NAFO Manual on Groundfish Surveys, was published in December 1981, and Studies No. 3, containing miscellaneous selected papers, was published in April 1982. Studies No. 4, which will contain the contributions to the Remote Sensing Symposium held at the September 1981 Annual Meeting, is progressing well with most papers being in the galley proof stage. Publication in August 1982 is expected. Studies No. 5, which will contain the contributions to the Environmental Symposium held at the September 1981 Annual Meeting, is still at an early stage with many papers not yet available to the Editor. Every effort will be made to have this number published before the end of 1982.

d) List of Fishing Vessels for 1980

Publication of the list still awaits submission from Bulgaria, France (M), Romania and the USA. It is hoped that these will be received later this year, allowing publication soon thereafter.

2. Journal Reprints

As requested, reprints from Journal Vol. 2 were produced in folded, and folded with cover, form. It was agreed that these were of good quality, meeting the desires of STACPUB to see the reprints upgraded. The Executive Secretary reported that the incremental cost of producing this, rather than the previous form of reprint, appeared to be within the 10% estimate given in September 1981, although exact figures can only be given at the end of the fiscal year. STACPUB

recommends

that reprints from future Journal issues continue to be produced in the format adopted for those from Volume 2.

3. Editorial Board for the Journal

STACPUB noted the successful establishment of the Editorial Board but learned with regret that Dr. W. Templeman had informed the Editor that he found himself unable to continue to serve as Associate Editor for Vertebrate Fisheries Biology. The Committee asked the Editor to convey this regret to Dr. Templeman along with their thanks for his contributions since appointment last autumn.

A list of possible replacements for Dr. Templeman in this Associate Editorship position was drawn up and the Editor was asked to approach those listed to determine their willingness to serve. On receipt of the Editor's report, STACPUB will propose a nominee for the Council's approval at the Annual Meeting in September 1982.

4. Abstracting of Documents and Periodicals

STACPUB concluded that abstracting of Scientific Council research documents by abstracting services was inappropriate, due to their sub-publication status, and undesirable, as much of the material of long-term interest is subsequently published in revised form in NAFO or other publications.

The Editor reported that the Council's Journal and Studies are being abstracted in the FAO ASFA 1 series as desired by the Committee. Although Biological Abstracts have not responded to requests for inclusion of the Council's publications, the Editor was requested to check recent issues to determine whether they were being included. Other possibilities for bringing the Council's publications to the attention of the scientific community are also under consideration.

5. Distribution of the Journal

National distribution lists were circulated to Council Representatives and a revised distribution list for the Journal has been established as agreed at the last meeting. It was confirmed that this should be repeated on an annual basis. Noting the Committee's request for routine reports on Journal costs, revenues and distribution statistics, the Executive Secretary reported that this information for the first full fiscal year (1982) would be available for consideration at the June 1983 Meeting and could be circulated in document form prior to the meeting. It was noted that the revised Journal mailing list for 1982 was approximately 500. As this substantially less than the historical average of 800 copies distributed under the ICNAF system, no need to propose restriction of the free distribution to scientists of member governments was seen at this time.

6. Promotion of the Journal

The Executive Secretary reported that he had taken out paid advertisements for the Journal in various information enterprises such as the EBSCO Subscription Service. Increase in subscription was slow, but it is too soon to judge the results of actions taken. He noted that, invarious countries, there was little market outside the fisheries institutes which already benefit from free distribution, and this is a basic limitation to expansion of subscriptions outside the North American market.

7. Papers Nominated for Possible Publication

The Committee reviewed the research documents presented to the Scientific Council meetings of November 1981 and June 1982 and requested that the Editor invite the authors of the following documents to submit suitably revised manuscripts for possible publication in the Journal or Studies series: SCR Doc. 81/148, 159, 160, 162, 163, 164; SCR Doc. 82/5, 24, 26, 28, 40, 69 and 71. It was also agreed that the report of the shrimp ageing workshop (SCS Doc. 82/14) should be published in the Studies series. A document on ichthyoplankton identification (SCR Doc. 82/31) was referred to the *ad hoc* Working Group on the Production of Ichthyoplankton Manuals for their review and consideration. It was agreed that the results of the USSR-Canada squid survey (SCR Doc. 82/VI/25) would be considered for publication at the September 1982 Meeting.

8. Ichthyoplankton Identification Manuals

The Committee was pleased to learn that the Secretariat had received a manuscript on ichthyoplankton identification in the area from Cape Hatteras to the Scotian Shelf and that this was recently sent out for scientific review. Given the quality of the manuscript and the extensive refereeing to which it is being subjected, the Committee agreed that a special issue of the Journal be dedicated to production of this manual.

The Committee agreed that it would be worthwhile to have the *ad hoc* Working Group on the Production of Ichthyoplankton Manuals meet again during the Annual Meeting in September 1982 to further this important work. The Editor was asked to schedule, in consultation with the Working Group chairman Dr. D. F. Markle, a session of the Working Group at that time, adequate advance notice to be given so that appropriate experts will be able to arrange their attendance.

9. Utilization of Microfiche/Microfilm for Storage, Retrieval and Distribution of Scientific Council Documents and Publications

The Executive Secretary reported that an agreement had been concluded in March with a commercial enterprise which will produce and sell microfiche copies to Statistical Bulletins and Scientific Council Reports. The enterprise is also interested in the List of Fishing Vessels. The agreement is valid to 31 December 1983.

It was noted, however, that the greatest potential benefits for utilization of this technology forseen by fisheries libraries and individual scientists related to the unpublished document series, particularly research documents, and no progress had been made in this regard. It was agreed that the Council be asked about the availability of microfiche equipment in their laboratories, i.e., about their capability to handle microfiche material. The Executive Secretary was requested to provide technical information microfiche production and the degree of compatability between the systems in use in various countries.

10. Coordination of Research Information for the NAFO Area

No further action on this matter is proposed at this time.

11. Acknowledgements

There being no further business, the Chairman thanked the participants for their interest and cooperation during the course of this meeting.

PART B

REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, September 1982

CONTENTS

REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, September 1982

Chairman: R. Wells — Rapporteur: V. M. Hodder

The Scientific Council and its Standing Committees on Fishery Science (STACFIS) and Publications (STACPUB) met at the Bedford Institute of Oceanography, Dartmouth, during 8-13 September and at the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, during 15-16 September 1982 to consider and report on the various matters listed in the Agenda (see Part C, this volume). Representatives attended from Canada, Cuba, European Economic Community (Denmark, Federal Republic of Germany, and France), Japan, Portugal, and Union of Soviet Socialist Republics (USSR), and observers were present from Spain and United States of America (USA) (see Part C, this volume). The participants included several scientists who were invited to present papers at the Special Session on Stock Discrimination in Marine Fishes and Invertebrates of the Northwest Atlantic on 8-10 September 1982.

The reports of the Standing Committees, as adopted by the Council at this meeting, are given in Appendix I (STACFIS) and in Appendix II (STACPUB). Lists of research and summary documents are given in Part C of this volume. Brief summaries of the committee reports and other matters considered by the Council are given below.

I. FISHERY SCIENCE (APP. I)

1. Special Session on Stock Discrimination in Marine Fishes and Invertebrates

The Council noted that the Special Session took place on 8-10 September 1982, with T. D. Iles (Canada) as Convener. The purpose of the session was to focus on identification of exploited fish stocks and its application to fishery management. Discussion centered mainly on the biological nature of stocks, the degress of variation in stock-unit separation, the need for a multidisplinary approach towards stock discrimination studies, and the importance of a proper balance between biological insight and the application of standard statistical procedures in analysis of data.

2. Assessment of the Cod Stock in Divisions 2J, 3K and 3L

The Council reviewed the state of this cod stock, on which the provision of scientific advice was deferred from the June 1982 Meeting (see Part A, this volume) to allow for analysis of additional information from research vessel surveys and the commercial fishery. The new material was considered and the assessment was carried out on the basis of the Canadian request for scientific advice. The results of this assessment are present in the Report of STACFIS (Appendix I). The Council endorsed the conclusions of STACFIS which involve three options of catch for 1983 at different levels of spawning stock biomass aimed at for 1984.

3. Flemish Cap Project

The Council noted that STACFIS had reviewed the 1983 research plans that were proposed at the June 1982 Meeting, involving sampling by Canadian and USSR research vessels during February-May 1983, coordination of methodology and sampling strategy, and the possible exchange of scientists during the surveys. The Council endorsed the 1983 survey plans outlined by STACFIS (see Appendix I). The Council also noted the concern of STACFIS that substantial data collected in recent years have not yet been made available for consideration, and endorsed the recommendation that a special effort be made by all participants in the Flemish Cap Project to analyze all previously-collected data and to present the results at the June 1983 Meeting.

4. Report of *ad hoc* Working Group on Herring Tagging

The Council noted that, although the Working Group had met on 12-14 January 1982, the report of its meeting was not available at the June 1982 and September 1982 Meetings of the Council. The Council therefore endorsed the recommendation of STACFIS that this report should be completed and distributed to Working Group participants by mid-October 1982 and presented to STACFIS at the June 1983 Meeting.

5. Evaluation of the Impact of Changes in Mesh Size on the Interacting Fisheries for Cod and Redfish in Division 3M

Since no new data were presented on this matter, the Council agreed with STACFIS that this item will not be placed on future agenda until such time as the appropriate data become available.

6. Review of Scientific Papers

The Council noted that 36 scientific contributions were presented at this meeting, most of which were considered during the Special Session on Stock Discrimination, with four of them being deferred to the June 1983 Meeting.

II. PUBLICATIONS (APP. II)

1. Editorial Policy Regarding Scientific Council Publications

The Council was very pleased to adopt the recommendation of STACPUB that Mr. Basil Parrish (UK) be invited to serve on the Editorial Board for the *Journal of Northwest Atlantic Fishery Science* as Associate Editor for Vertebrate Fisheries Biology.

The Council noted that efforts to increase the number of subscribers to the Journal have met with some success, especially in North America, and endorsed the recommendation of STACPUB concerning the further steps necessary to promote the Journal. The Council also noted that STACPUB had a preliminary discussion on promotion and distribution of *NAFO Scientific Council Studies* and had agreed to defer the matter for further consideration to the June 1983 Meeting.

2. Ichthyoplankton Identification Manuals

The Council noted the intended publication of "A Guide to the Early Stages of Marine Fishes Occurring in the Western North Atlantic Ocean (Cape Hatteras to the Nova Scotian Shelf)" by M. P. Fahey, and adopted the recommendation of STACPUB regarding the printing and distribution of this special volume. The Council further noted that two other manuscripts on ichthyoplankton identification have been submitted for publication in the Journal, one of which was recommended for publication. The Council accepted the recommendations of STACPUB on the future work of the *ad hoc* Working Group on Ichthyoplankton Manuals and on the need for research on ichthyoplankton taxonomy.

3. Papers for Possible Publication

The Council noted that STACPUB had reviewed the scientific papers presented to this meeting and had recommended 18 papers relevant to the Special Session on Stock Discrimination and 3 others for possible publication in one of the Council's publication series, subject to revision by the authors and acceptance by the Editor. The Council agreed with these actions, noting that a final decision on the production of a special issue of Studies for the Stock Discrimination papers was deferred to the June 1983 Meeting when the number of papers available for inclusion in such an issue would be known.

4. Utilization of Microfiche

The Council concurred with the conclusions and proposals of STACPUB regarding the possible utilization of microfiche for storage, retrieval and distribution of scientific council documents and publications.

III. RULES OF PROCEDURE

1. Amendment to Rule 3.1 Regarding Election of Officers

In the absence of the quorum required for voting at the June 1982 Meeting of the Scientific Council, the Executive Secretary was requested to conduct a vote on the proposed amendment (see this volume, pages 12-13) and to report the results of the vote at the September 1982 Annual Meeting. In a letter dated 23 June 1982, the Scientific Council representatives of all Contracting Parties were required to vote on the proposed amendment. "Yes" votes were received from the following: Canada, Cuba, EEC, Iceland, Japan, Norway, Poland, Portugal, Romania and USSR. There were no negative votes.

The Council, noting that more than two-thirds of the Contracting Parties had expressed approval of the proposed amendment, agreed that Rule 3.1 of the Rules of Procedure for the Scientific Council, as revised on 13 June 1980 (*NAFO Sci. Coun. Rep.* 1979-80, page 109), shall be replaced by the following:

> "The Chairman and Vice-Chairman shall take office at the conclusion of an annual meeting. Election of these officers shall take place at such annual meeting or at the special meeting held immediately preceding such annual meeting."

IV. FUTURE SCIENTIFIC MEETINGS

1. Mid-term Meeting for Assessment of the Seal Stocks

The Council noted that STACFIS, at the June 1982 Meeting (this volume, page 9), did not adequately deal with the Canadian request for advice on the Northwest Atlantic harp and hooded seal stocks, and agreed to meet at NAFO Headquarters, Dartmouth, Nova Scotia, during 12-17 November 1982, to further consider this matter. It was pointed out that most of the biologists involved in research on the North Atlantic seal population would likely be attending the ICES *ad hoc* Meeting on seals during 4-7 October 1982.

2. Mid-term Meeting for Assessment of the Shrimp Stocks

Regarding the Canadian and EEC requests for scientific advice on management in 1983 of the shrimp stocks in Subareas 0 and 1 and the EEC request for advice on shrimp off East Greenland, the Council considered that it would be extremely difficult for analysis of the large volume of research data collected in 1982, particularly the photographic survey material, to be completed and ready for presentation before early 1983, and therefore proposes that a meeting of 5 days early in 1983 would be most appropriate for this purpose.

3. Possible Further Assessment of Capelin Stocks

The Council agreed that, if more precise scientific advice on management of the capelin stocks in 1983 than that provided at the June 1982 Meeting (this volume, page 35) is required, a meeting early in 1983 would allow the analysis and presentation of data collected during 1982.

4. Main Scientific Meeting in June 1983

As agreed at the June 1982 Meeting, the Main Scientific Meeting of the Scientific Council, together with its Standing Committees, Subcommittes and Working Groups will be held at NAFO Headquarters, Dartmouth, Nova Scotia, during 8-23 June 1983.

5. Annual Meeting in September 1983

The Scientific Council, noting that the 1983 Annual Meeting will be held at Leningrad, USSR, with meetings of the General Council and the Fisheries Commission during 19-23 September 1983, agreed provisionally to meeting during 13-19 September 1983, the final dates to be confirmed at the June 1983 Meeting.

The Council endorsed the proposal of STACFIS regarding the theme for a special session at the 1983 Annual Meeting, as follows: "Trophic relationships in marine species relevant to fisheries management in the Northwest Atlantic". Dr. V. A. Rikhter (USSR) was nominated as Convener for the Special Session in September 1983, and he agreed to work in collaboration with a Canadian scientist (to be nominated)[1] and the NAFO Secretariat regarding organizational arrangements for the Special Session.

6. Theme for Special Session at the 1984 Annual Meeting

The Council agreed that themes for special sessions at annual meetings should be made known at least two years in advance, and therefore endorsed the proposal of STACFIS regarding the theme for a special session in September 1984, as follows: "Biology and ecology of the squids, *Illex illecebrosus* and *Loligo pealei*, in the Northwest Atlantic".

The Secretariat was requested to circulate widely, in an appropriate form (posters), announcements of the themes for the special sessions as soon as they are known.

V. OTHER MATTERS

1. Provisional Report of the June 1982 Meeting

The Council noted that the continued absence of certain 1981 fisheries statistics had prevented the Secretariat from completing the "Fishery Trends" sections for inclusion in the Report of the June 1982 Meeting. Upon being informed that the outstanding statistics were on route to the Secretariat, the Council requested the Assistant Executive Secretary to compile and circulate the relevant sections to the Scientific Council members for comments and approval prior to publication in *NAFO Scientific Council Reports* for 1982.

2. *Ad hoc* Working Group on Sampling Guidelines

The Council was informed that time was insufficient for the Secretariat to compile and circulate to members of the Working Group, which was established at the June 1982 Meeting, all of the relevant material required for examination prior to this September 1982 Meeting. Noting that the material will be dispatched to the designated scientists soon after this meeting, the Council agreed that the Working Group should meet and report to STACREC at the June 1983 Meeting.

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[1] Dr. G. R. Lilly (Canada) was subsequently nominated as Co-convener.

3. Concern About the Cod Stocks in Divisions 3M and 3NO

The Council reiterated the problem of obtaining sampling data for stocks where catches may be below the level specified in the minimum sampling guidelines (this volume, page 11), and urgently requests any country participating in the fishery for cod in Div. 3M and 3NO to intensify sampling of its catches. This is particularly important for Div. 3M, where the Fisheries Commission has adopted a TAC for the cod stock in 1983, although the Scientific Council advised that there should be no directed fishery.

4. Communication Between the Scientific Council and the Other NAFO Bodies

The Executive Committee of the Scientific Council is requested to investigate the mechanism by which information is communicated between the Scientific Council, General Council, Fisheries Commission and coastal states, and to report its conclusions to the Scientific Council in June 1983.

5. Presence of Experts Required During Presentation of Reports

The Council emphasizes that participants in meetings of working groups, subcommittees and committees of the Council should make every effort to be present at the meeting of the parent body when the report of such working group, subcommittee or committee is being presented for approval. Participants are therefore requested to arrange their travel and accommodation in order to achieve this objective.

VI. ADJOURNMENT

The Chairman expressed his thanks to the chairpersons and rapporteurs of STACFIS and STACPUB and the various working groups, including the Special Session on Stock Discrimination, and to all participants for their cooperation and support during the course of this meeting. He also thanked the Secretariat staff for their usual assistance and efficiency. The meeting was adjourned at 1700 hours on 16 September 1982.

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

Chairman: J. P. Minet   Rapporteurs: Various

The Committee met at Dartmouth, Nova Scotia, Canada, during 8-13 September 1982 to consider and report on various matters referred to it by the Scientific Council (see Part C, this volume), relating specifically to the Special Session on Stock Discrimination in Marine Fishes and Invertebrates of the Northwest Atlantic, the assessment of the cod stock in Div. 2J+3KL which was deferred from the June 1982 Meeting, and the *ad hoc* Working Group on the Flemish Cap Project. The Report of the *ad hoc* Working Group on Herring Tagging, which met in January 1982, was not available for consideration. The conveners of the various groups acted as rapporteurs in summarizing the results of the discussions at their respective sessions for consideration by STACFIS. Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, and France), Japan, Portugal, Spain, USSR and USA.

I. SPECIAL SESSION ON STOCK DISCRIMINATION IN MARINE FISHES AND INVERTEBRATES OF THE NORTHWEST ATLANTIC

1. Introduction

The Special Session, convened by T. D. Iles (Canada), was held at the Bedford Institute of Oceanography on 8-10 September 1982 during which period 28 contributed papers and two oral reports on research were presented. Two of the papers were keynote presentations: Dr. W. Templeman (Canada) on the general issue of stock discrimination and identity, and Dr. C. J. Sindermann (USA) on parasitological methodology. The papers were presented in four sessions during 8-9 September and a summary-discussion session was held on the morning of 10 September. Attendance was at least 50 at each of the sessions and a high level of interest was maintained throughout. The species dealt with included several fishes (Atlantic cod, haddock, silver hake, Atlantic redfishes, American plaice, Greenland halibut, Atlantic herring and Atlantic saury) and invertebrates (short-finned squid, scallops, queen crab and blue mussel). Several of the papers dealt with methodology of data analysis, with particular reference to the validity of statistical procedures in discrimination studies.

2. General Considerations

There was considerable discussion on the biological nature of fish stocks, and it was generally agreed that the important criteria were genetic isolation, geographical distribution, and the self-sustaining capacity of the stocks. These criteria were considered important to management, in that individual stock units of commercial species could be vulnerable to the effects of exploitation quite independently of other stock units and that stocks should therefore be the units for resource protection and conservation. The corollary of this is that exploitation patterns for a particular species should take into account its stock structure and the degree of intermixture in fishing areas. This also led to a conclusion of major importance to future research programs that stock discrimination studies should be directed more towards spawning concentrations, that is, at the time of reproductive isolation when stock units are segregated from each other.

There was little doubt that most commercially-exploited marine species are subdivided into stock units, but the degree to which this occurs varies greatly from species to species. At one extreme, there is the Atlantic saury (and possibly others) which apparently constitutes a single unit throughout its range; at the other extreme, Atlantic herring is divided into a large number of stock units. There are a number of instances where the degree and even the kind of subdivision of a population (or species group) is in doubt. This is perhaps particularly true for invertebrate species, and it was generally agreed that the development of a general theory of marine "fish" stocks should account for invertebrates as well, since the common biological factor is the existence of the larval stage in both. It was generally agreed that the dynamics of larval dispersal, aggregation and retention must be more thoroughly understood if a general stock theory is to emerge.

The contributions to the meeting illustrated many different areas of expertize, and it was clear, in some instances, that conclusions derived from one methodology needed support from other independent sources to carry conviction. This emphasized the need for a multidisciplinary approach toward stock discrimination studies, particularly the involvement of population geneticists.

It became obvious early in the discussion that a proper balance between biological insight and the application of standard ("packaged") statistical procedures should be aimed at in the analysis of data, but that this was not always achieved up to now. Following a review of the question by Dr. R. Misra (Canada), it became apparent that a suitable paper on this subject should be prepared and included with the other contributions in any publication arising from the meeting.

The Committee generally agreed that the contributions, taken together, were such as to make up a valuable compendium of current information and opinion on stock discrimination in marine commercial species, and therefore recommends

that STACPUB consider the matter of publication of the contributions to the Special Session on Stock Discrimination.

3. Papers Presented

The following documents were considered at the Stock Discrimination Symposium (see Part C, this volume, for titles and authors): SCR Doc. 82/IX/75, 76, 78-98, 102, 104, 107, 108 and 112.

II. ASSESSMENT OF THE COD STOCK IN DIVISIONS 2J, 3K and 3L

1. Introduction

The *ad hoc* Working Group on Assessment of the Cod Stock in Div. 2J+3KL was convened by J. P. Minet (EEC) at the Bedford Institute of Oceanography during 8-10 September 1982 to complete the assessment which was initiated at the June 1982 Meeting (Part A, this volume).

2. Fishery trends

Nominal catches were as high as 800,000 tons in 1968 but declined to a low level of 139,000 tons in 1978, corresponding closely to the TAC. The decline in catch over this period was coincident with a decline in catch rates; however, from 1979 onward the catch rate has increased. The 1981 catch was less than the TAC mainly due to a lower-than-expected catch by inshore gears. This decline in inshore catch, mainly in the codtrap fishery, was probably the result of unusual environmental conditions. Recent management strategy has been to limit catches to a level associated with fishing at or below the $F_{0.1}$ level. Recent TACs and nominal catches are as follows:

	1974	1975	1976	1977	1978	1979	1980	1981	1982
TAC (000 tons)	657	554	300	160	135	180	180	200	237
Catch (000 tons)	373	288	214	173	139	167	175	160[1]	

[1] Provisional data.

3. Assessment (SCR Doc. 82/IX/77, 99, 111)

a) Age composition of 1982 catches

Age composition data available for the offshore fishery during the first half of 1982 from Canada (N), Faroe Islands, Federal Republic of Germany, Portugal, and Norway indicated that removals were mainly from the relatively strong 1973-75 year-classes. In the Canadian offshore otter-trawl fishery, the 1976 and 1977 year-classes were poorly represented. Data from the inshore fishery for July 1982 in Div. 3K and 3L indicated a similar pattern of year-classes in the catch but with the 1978 year-class being very abundant in the codtrap fishery.

b) Research vessel surveys

Surveys conducted in Div. 2J by the Federal Republic of Germany from 1972 to 1981 and by Canada (N) from 1978 to 1981 were adjusted on the basis of area surveyed and were averaged to produce an index of weight caught per tow (Table 1). The combined index showed a general increase in recent years. Surveys conducted in Div. 2J by France were not combined with those by Canada (N) and Federal Republic of Germany, because of the relatively small number of sets, but the age composition data from all surveys indicated that the 1978 year-class was relatively strong.

In Div. 3K, the Canada (N) surveys, which were conducted over a period of 4 years, showed no trend, but large fluctation in terms of mean weight per tow was evident. The surveys by USSR also showed a great deal of fluctation in mean weight per tow. The extent of coverage by French surveys in Div. 3K once again limited their reliability as an index of abundance. Age composition data from the Canada (N) and French survey catches indicated that the 1978 year-class was relatively strong.

An index of mean weight caught per tow in Div. 3L from the Canada (N) surveys was obtained by combining strata by depth zone (Table 1). The value for 1982 was lower than that for 1981 but similar to that for 1980. The 1978 year-class was found to be strong in the 1982 surveys of this area by Canada (N), France and USSR.

Table 1. Abundance indices for the cod stock in Div. 2J+3KL from commercial catch rates and research vessel survey data and biomass calculated from cohort analysis with F = 0.15 for 1981.

Year	Abundance indices: Commercial catch rate[1]	From surveys: Div. 2J	From surveys: Div. 3L	Mid-year biomass (000 tons): Age 4+	Mid-year biomass (000 tons): Exploitable
1962	1.000	-	-	2,180	1,380
1963	1.126	-	-	2,039	1,562
1964	0.997	-	-	1,864	1,310
1965	0.869	-	-	1,727	953
1966	0.988	-	-	1,756	1,134
1967	1.044	-	-	1,860	1,087
1968	0.997	-	-	1,731	1,295
1969	0.824	-	-	1,446	862
1970	0.712	-	-	1,291	918
1971	0.568	-	-	1,277	1,005
1972	0.496	178.37	29.07	1,183	953
1973	0.502	103.97	37.18	964	714
1974	0.612	46.48	23.64	673	478
1975	0.525	41.28	20.12	423	291
1976	0.437	36.19	43.79	336	206
1977	0.268	36.98	24.88	548	323
1978	0.311	78.25[2]	31.57	725	350
1979	0.531	133.38[2]	42.68	1,047	500
1980	0.638	120.54[2]	55.24	1,265	947
1981	0.753	170.47[2]	74.78	1,368	968
1982	0.780		50.92		

1 Index standardized to 1962.

2 Index derived from the average results of Canada (N) and Federal Republic of Germany surveys.

c) Commercial catch rates

Catch rates, based on catch and effort data, reported in the NAFO (ICNAF) Statistical Bulletins 1962-79 for Portuguese otter trawlers (tonnage classes 6 and 7) and for Canada (N) otter trawlers (tonnage class 5) were standardized with respect to country-gear type, month and division. Catch rates for the same country-gear types in 1979-82, obtained from the Canadian Observer Program and the Economics Branch of the Canadian Department of Fisheries and Oceans, were similarly standardized and subsequently combined with the first series by scaling the indices to a common factor for 1979. The Portuguese, Spanish and Canadian fleets have taken the major part of the directed offshore catch of cod in these years. The Spanish data were not included in the standardization because pair trawlers exhibited a different seasonal pattern than otter trawlers. Alternate methods of combining the Spanish series with the standardized series were not explored, since catches by the Spanish fleet were not as large as catches by the Portuguese fleet in earlier years and data for the Spanish fleet were not available for recent years. The resultant catch-rate index (Table 1) indicates a general decline through the 1960's and early 1970's, reaching the lowest value in 1977, after which it increased consistently. Recent values of the catch-rate index are close to the level observed in 1969.

d) Cohort analysis: estimation of F for 1981

The catch-rate and research-survey indices (Table 1) were compared with mid-year exploitable biomass and age 4+ biomass respectively, which values were obtained from cohort analyses using a range of values of terminal fishing mortality (F_T = 0.10 to 0.20) for fully-recruited age groups (age 8+) in 1981. Regression analyses, using the catch-rate index, indicated that F in 1981 was close to 0.15 (Tables 2 and 3). The analysis, using the research survey index for Div. 2J (Table 1), indicated that F in 1981 was between 0.15 and 0.20, whereas the analysis using the index for Div. 2J pointed to a 1981 value of F lower than 0.15 (Table 4). The Committee concluded that a 1981 value of F = 0.15 gave the best overall agreement between the abundance indices and population size from cohort analysis.

The partial recruitment and average weight-at-age values, together with the catch and population vectors for 1981 for F = 0.15, are listed in Table 5. Due to differences in the mean weight-at-age values for 1980 and 1981, the averages of the 1980 and 1981 values were used for projections, as there was no basis for distinguishing whether the differences represented real changes in these parameters or sampling variability.

Table 2. Regression analysis of mid-year exploitable biomass and catch-rate index for cod in Div. 2J+3KL, 1962-81 (excluding 1974-76).

F-Values (1981)	0.10	0.15	0.20
Correlation (r^2)	0.63	0.80	0.78
Intercept	253	102	27
Slope	10,403	11,501	12,051
Residual - 1979	-142	-213	-249
- 1980	432	111	-49
- 1981	417	0	-208

Table 3. Regression analysis of mid-year exploitable biomass and catch rate index for cod in Div. 2J+3KL, 1962-78 (excluding 1974-76).

F-Values (1981)		0.10	0.15	0.20
Correlation (r^2)	0.81			
Intercept	135			
Slope	11,167			
Residual - 1979	(728)[1]	-65	-229	-310
- 1980	(848)[1]	500	99	-101
- 1981	(976)[1]	476	-8	-250

[1] The biomasses (000 tons) predicted for 1979-81 from this regression are compared with those implied from various terminal F-values in 1981.

Table 4. Regression analyses of age + mid-year biomass and survey catch rate (Table 1) for 1972-81 Div. 2J and for 1972-82 (excluding 1976 and 1981) in Div. 3L.

Parameter	Div. 2J (1972-81 surveys)				Div. 3L (1976-82 surveys)		
	0.10	0.15	0.17	0.20	0.10	0.12	0.15
Correlation (r^2)	0.71	0.87	0.88	0.85	0.80	0.80	0.71
Slope	8.74	6.16	5.55	4.88	47.80	37.03	27.07
Intercept	226.70	271.10	280.90	292.00	-533.90	-237.84	-30.30

Table 5. Parameters used in cohort analyses and catch projections for cod in Div. 2J+3KL.

Age (yr)	Partial recruitment	Av. weight (kg)		1981 numbers (10^5)	
		1981	1980-81	Catch	Population
4	0.18	0.76	0.77	65	2,691
5	0.48	1.15	1.16	118	1,872
6	0.70	1.63	1.68	218	2,409
7	0.85	2.21	2.30	191	1,757
8	1.00	2.87	3.23	105	830
9	1.00	3.82	4.43	29	229
10	1.00	5.31	5.45	7	55
11	1.00	6.34	6.54	3	24
12	1.00	7.12	7.51	2	16
13	1.00	7.48	8.11	1	8

e) Projections of catch and spawning stock biomass

Using the population numbers in 1981 and other parameters noted above, together with the assumption that the TAC for 1982 will be fully utilized, projections at three levels of fishing mortality (for fully recruited age-groups) in 1983 are presented to cover a range of fishing morality of $F_{0.1}$ = 0.20 and lower (Table 6), consistent with the strategy to rebuild the spawning biomass faster than that associated with fishing at $F_{0.1}$, the target spawning biomass being in the range of 1.2-1.8 million tons (*ICNAF Redbook*, 1977, page 54). The specific values of fishing mortality used are those presented for this stock in previous years.

Table 6. Catch and spawning stock biomass projections (000 tons) for cod in Div. 2J+3KL, using the TAC for 1982 and three levels of fishing mortality in 1983. (Spawning biomass refers to age 7+ fish at the beginning of the indicated years.)

1981			1982			1983			1984
Spawning biomass	F	Catch	Spawning biomass	F	TAC	Spawning biomass	F	Projected catch	Spawning biomass
720	0.15	151	1,040	0.19	237	1,160	0.10	155	1,380
							0.16	242	1,300
							0.20	300	1,250

It was not possible to derive satisfactory regressions between survey and cohort analysis estimates of year-class size. Recruitment estimates at age 4, however, based on comparisons of the relative strengths of the 1978 and 1979 year-classes with those of the 1973-75 year-classes in Div. 2J and 3L from research vessel surveys, were about 500 million fish. This value, which corresponds approximately to the geometric mean of population numbers at age 4 from cohort analysis of data for 1962-81, was used as the strength of the 1978 and 1979 year-classes at age 4 in the projections. The large contribution of the 1978 year-class to several components of the 1982 fishery indicates that the size of this year-class may be underestimated.

It was noted that recruitment estimates for the 1978 and 1979 year-classes are subject to a high uncertainty, but these are responsible for only about 17% of the projected 1983 catches. Variance in mean weights has potentially greater impact on the projections, and the Committee strongly urged that this variance to investigated in detail prior to the June 1983 Meeting.

III. FLEMISH CAP PROJECT

1. Introduction

The *ad hoc* Working Group on the Flemish Cap Project was convened by J. T. Anderson (Canada) at the Bedford Institute of Oceanography on 10 September 1982, with scientists from Canada, EEC and USSR in attendance. The primary purpose of this meeting was to discuss the 1983 research plan that were proposed at the June 1982 Meeting of the Scientific Council and to review any new information available.

2. Research Plans for 1983

The general plan of research initially discussed at the June 1982 Meeting (this volume, page 40) was reviewed along with the proposed sampling schedule. No change in the plans were proposed. It was noted that sampling on the Flemish Cap in 1983 would be carried out by a Canadian research vessel during February and March and by the USSR research vessel *Suloy* during April and May.

Discussion of sampling strategies confirmed that research bottom-trawl surveys and standard ichthyoplankton surveys would be carried out following past procedures used for the Flemish Cap Project. In addition, USSR scientists indicated that they will conduct a comparative research trawl study on Flemish Cap during April-May 1983. This will involve two survey techniques, one based on fixed-station methodology used by the USSR and a second based on the random-stratified method used by Canada. Each survey will be carried out over the entire Flemish Cap region.

Ichthyoplankton sampling will be carried out using 61-cm Bongo samplers fitted with 0.333 mm mesh nets. This equipment will be supplied by Canada to the *Suloy* during a port call in St. John's prior to April-May sampling. In addition, oceanographic observations will be made at plankton stations on the Flemish Cap grid.

The biological data to be collected during routine trawl surveys were discussed. It was agreed that information routinely collected would adequately sample most features of cod spawning, as previously discussed at the June 1983 Meeting. However, it was agreed that material for fecundity estimation should also be collected during the February-March period, immediately prior to spawning. The collection of fecundity samples will therefore be made during the Canadian research surveys.

An exchange of USSR and Canadian scientists during respective research cruises by the two countries was discussed as being most beneficial to this cooperative sampling program planned for 1983. While representatives at the meeting agreed to this exchange in principle, it was pointed out that details would have to be finalized by participants at a later date.

3. Available Research Information

No additional research information was presented at this meeting. It was pointed out, however, that considerable information collected during recent years has not yet been made available to the Committee. Specifically, this includes USSR ichthyoplankton data collected since 1979 on Flemish Cap and other data collected by both Canada and the USSR, including oceanographic data, zooplankton data, and detailed data on cod biology. STACFIS therefore

recommends

that a consciencious effort be made by all participants in the Flemish Cap Project to analyze outstanding data previously collected and to present the results of such analyses at the June 1983 Meeting of the Committee.

Finally, STACFIS would welcome the active participation of other countries in the Flemish Cap Project.

IV. HERRING TAGGING

1. Report of *ad hoc* Working Group on Herring Tagging

Following the recommendation of STACFIS at its September 1981 Meeting (*NAFO Sci. Coun. Rep.* 1981, page 89) the Working Group was convened in Quebec city during 12-14 January 1982 by W. T. Stobo (Canada), (a) to summarize all Canadian and USA tag releases and recoveries relevant to the herring stocks in Subareas 4, 5 and 6 and (b) to review analyses related to movements of adults and juveniles, stock identification and mortality rates. The topic was placed on the agenda for the June 1982 Meeting of the Scientific Council, but the report of the Working Group was not available for consideration at that time, and the item was deferred to the September Meeting. At the present meeting, the Committe was again informed that the report was not ready for presentation but that it would be circulated for comments to the participants of the *ad hoc* Working Group by mid-October 1982. Considering that the results of the study undertaken by the Working Group will greatly enhance knowledge of herring stock movements and identification in the NAFO Area, STACFIS

recommends

that the report of the ad hoc Working Group on Herring Tagging should be completed and distributed by mid-October 1982 to Working Group participants, and presented at the June 1983 Meeting of the Scientific Council.

V. OTHER MATTERS

1. Evaluation of the Impact of Changes in Mesh Size on the Interacting Fisheries for Cod and Redfish in Division 3M.

The Committee noted that this item was considered in some detail at the June 1981 Meeting (*NAFO Sci. Coun. Rep.* 1981, pages 49-50) and that a more comprehensive evaluation would require the acquisition and presentation of additional data. The recommendation relevant to the presentation of such data was reiterated at the June 1982 Meeting (this volume, page 51). Since no new data were presented on this matter, STACFIS, consistent with the Scientific Council's decision at the June 1982 Meeting,

recommends

that the Council inform the Fisheries Commission that data are not available to provide further advice on "Impact of changes in mesh size on the interacting fisheries for cod and redfish in Division 3M", and that this item be dropped from the Council agenda until such time as the appropriate data become available.

2. Review of Scientific Papers

a) Herring spawning and bottom temperature in Subarea 5 (SCR Doc. 82/VI/103)

The distribution of newly hatched larval herring was examined for 30 ICNAF larval herring surveys covering the September-December periods of 1971-77. Sampling was conducted on standard grids of Bongo-net stations at intervals of 3-4 weeks throughout the autumn. Concentrated abundances of small larvae (<8 mm SL) were used to delineate spawning areas and correlated with bottom temperatures at the stations to describe thermal spawning and hatching conditions. Delay of spawning on Georges Bank after 1973 was found to be associated with the warming trend. Large volumes of very warm (14-15°C) water on the top of Georges Bank during autumn surveys since 1971 could have affected herring spawning and/or egg and larval survival. The decline in abundance of the Georges Bank herring stock and the virtual disappearance of signs of spawning on the traditional fishing grounds after 1975 are discussed in conjunction with both the catch history and the continued spawning in the Nantucket Shoals area, where the mean bottom temperatures were much lower than those on Georges Bank.

b) Other papers

Of the 36 scientific papers available to STACFIS at the present meeting, 31 were considered in connection with the Special Session on Stock Discrimination and the assessment of the cod stock in Div. 2J+3KL, and one is considered above. The remaining 4 contributions, in view of their connection with matters to be discussed at the June 1983 Meeting, were deferred for review at that time; these are SCR 82/VI/100, 105, 109, and 110.

3. Proposed Themes for Special Sessions at the Annual Meetings in 1983 and 1984

The Committee agreed that more advance notice should be provided in proposing themes for future annual meetings. Consequently, STACFIS proposes the following themes for the September 1983 and the September 1984 Meetings of the Scientific Council:

a) September 1983. Trophic relationships in marine species relevant to fisheries management in the Northwest Atlantic.

b) September 1984. Biology and ecology of squids, *Illex* and *Loligo*, in the Northwest Atlantic.

4. Acknowledgements

The Chairman of STACFIS expressed his appreciation to T. D. Iles who convened the Special Session on Stock Discrimination in Marine Fishes and Invertebrates, to J. T. Anderson who convened the Flemish Cap Working Group, to the rapporteurs and participants for their keen interest and cooperation during the various sessions. The Chairman also acknowledged the Secretariat for their usual efficient work both in preparing for and during this meeting.

APPENDIX II. REPORT OF STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chairman: V. A. Rikhter   Rapporteur: A. T. Pinhorn

The Committee met at NAFO Headquarters, Dartmouth, on 11 September and at the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, on 16 September 1982. In attendance were V. A. Rikhter (Chairman), J. Messtorff and J. P. Minet (EEC), H. Hatanaka (Japan), R. G. Halliday and A. T. Pinhorn (Canada). The Chairman of the Scientific Council (R. Wells), the Executive Secretary (Capt. J. C. E. Cardoso) and the Assistant Executive Secretary (V. M. Hodder) also attended the sessions.

1. Editorial Policy Regarding NAFO Scientific Council Publications

a) Editorial Board for the Journal

It was reported at the June 1982 Meeting that Dr. W. Templeman found himself unable to continue to serve as Associate Editor for Vertebrate Fisheries Biology and that both the regrets and thanks of the Scientific Council have been conveyed to him by the Editor. Mr. Basil Parrish (UK) was approached by the Editor on behalf of STACPUB and has indicated his willingness to serve as Associate Editor for Vertebrate Fisheries Biology. STACPUB is very pleased to

recommend

that Mr. Basil Parrish (UK) be invited to serve on the Editorial Board for the Journal of Northwest Atlantic Fishery Science as Associate Editor for Vertebrate Fisheries Biology.

b) Abstracting documents and periodicals

As far as can be determined from letters written and a preliminary check of recent issues, the NAFO scientific publications are being abstracted in FAO ASFA1 but not in Biological Abstracts. It was decided not to consider this matter further.

c) Promotion and distribution of the Journal

Subscriptions have been solicited through various means and some increase in number of subscribers has taken place in North America but little progress has been made elsewhere. Special efforts should continue to promote the Journal as widely as possible, especially in countries outside of North America. To further the promotion of the Journal, STACPUB

recommends

i) that advertisements be placed by the Executive Secretary in the main fisheries journals;

ii) that Scientific Council representatives provide to the Executive Secretary, at the time of their annual review of their country's free distribution list, a list for their country of institutions which are potential subscribers to the Journal so that the Executive Secretary can canvass these for subscriptions; and

iii) that Scientific Council representatives themselves undertake and encourage scientists in their countries to distribute advertisements of the Council's publications at all appropriate scientific meetings and conferences attended during the next 12 months. (Such advertisements are available from the NAFO Secretariat.)

d) Promotion and distribution of NAFO Scientific Council Studies

The Editor reported that the present policy and procedure for promotion and distribution of Studies are similar to those for the Journal. STACPUB held a preliminary discussion on the subject and decided to defer further discussion to the June 1983 Meeting.

2. Review of Progress on Ichthyoplankton Identification Guides

The *ad hoc* Working Group on Ichthyoplankton Guides met on 10 September 1982 and the report of the Working Group was reviewed and accepted by STACPUB. The relevant points of the report and STACPUB's subsequent recommendation are presented below.

a) Guide to the early stages of marine fishes, by M. P. Fahay

This has received peer-review and has been recommended for publication in the *Journal of Northwest Atlantic Fishery Science*. The intended date of publication is April 1983 as Volume 4 (Number 1). STACPUB considered the potential demand for this issue, and recommends

i) that 2,000 copies of the Guide to the Early Stages of Marine Fishes be produced, with the author's copies being additional;

ii) that a limited number of copies should be produced with hard covers to prolong the useful life of the manual for those recipients anticipating its frequent use, the actual number issued with hard covers being left to the discretion of the Executive Secretary, but the maximum not to exceed 500;

iii) that the Editor send free copies to several journals for book review so as to further advertise the Journal as a means of expanding its readership and distribution; and

iv) that a complimentary copy be sent to each person who reviewed the guide for publication.

b) Other papers on Ichthyoplankton Identification

i) The manuscript by S. A. Evseenko, entitled "Ichthyoplankton of Slope and Gulf Stream Waters off Nova Scotia, Late Autumn 1974", was reviewed by the *ad hoc* Working Group and has been approved by the Editor, with revision, for publication in Volume 3 (No. 2) of the Journal.

ii) SCR Doc. 82/VI/31 was reviewed by the members of the *ad hoc* Working Group but was not recommended for publication, as various aspects of the manuscript made it unsuitable for a regional identification manual. STACPUB proposed that the Editor inform the author of this conclusion and the reasons for it, pointing out that, should the author wish to submit a revised manuscript, this would again be considered on its merits as to its suitability for publication as a regional manual.

c) Future work of *ad hoc* Working Group

The future activities of the Working Group will be determined by developments in ichthyoplankton taxonomy and in the preparation of ichthyoplankton guides for the Northwest Atlantic. STACPUB, however,

recommends

i) that the Scientific Council should continue to encourage its members to pursue the study of the taxonomy of fish eggs and larvae in the Northwest Atlantic; and

ii) that the ad hoc Working Group, although not necessarily required to meet each year, should continue to function as an advisory group for STACPUB regarding the publication of future ichthyoplankton papers.

3. Papers for Possible Publication

STACPUB reviewed the list of research (SCR) documents presented at this Annual Meeting and recommended 18 documents from the Stock Discrimination Symposium for possible inclusion in a special issue of *NAFO Scientific Council Studies* (SCR Doc. 82/75, 78, 79, 80, 81, 82, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 107 and 108). Three other papers were also nominated for publication in one of the NAFO series (SCR Doc. 82/103, 109 and 110). The Editor was requested to contact the authors of the Stock Discrimination papers nominated for publication, and, depending on the number of positive responses, a decision on a special issue of Studies will be taken at the June 1983 Meeting.

4. Other Matters

a) Utilization of microfiche for storage, retrieval and distribution of scientific documents and publications

The relative costs of in-house production versus contracting-out of microfiche conversion were presented by the Executive Secretary. The following conclusions evolved from the ensuing discussion:

i) Even with a microfiche system, members of the NAFO Scientific Council would still require printed copies of each year's current documents.

ii) Any requests that arose from other sources could be met either by a microfiche copy or, in isolated cases of requests for single documents, by a printed copy from a microfiche reader/printer.

iii) The possibility of a cost-sharing arrangement in the production of this microfiche file with Canadian Department of Fisheries and Oceans libraries should be investigated by the Executive Secretary.

iv) The Executive Secretary should investigate, with representatives of the Scientific Council, the interest in their respective countries regarding the purchase of microfiche copies of NAFO documents.

A recommendation on this matter will be made to the Scientific Council at the June 1983 Meeting, based on the responses received with regard to items (iii) and (iv) above.

5. Acknowledgement

There being no further business, the Chairman expressed his thanks to the rapporteur, the participants and the NAFO Secretariat.

PART C

MISCELLANEOUS

CONTENTS

I. AGENDA FOR SCIENTIFIC COUNCIL MEETINGS, 1982

A. MAIN SCIENTIFIC MEETING, JUNE 1982

1. Opening (Chairman: R. Wells)

   a) Appointment of rapporteur

   b) Adoption of agenda

   c) Plan of work

2. Fishery Science (STACFIS Chairman: J. P. Minet)

   a) General review of catches and fishing activity in 1982

   b) Assessment of finfish and invertebrate stocks
      i) Stocks lying completely outside the Canadian 200-mile fishery zone in Subarea 3, as required by the Fisheries Commission:
         - Cod (3M)
         - Redfish (3M)
         - American plaice (3M)
      ii) Stock lying within or partly within the Canadian 200-mile fishery zone in Subareas 2, 3 and 4, for which scientific advice on conservation measures in 1983 has been requested by Canada (Annex 1):
         - Cod (2J+3KL, 3NO)
         - Redfish (3LN)
         - Silver hake (4VWX)
         - American plaice (3LNO)
         - Witch flounder (3NO)
         - Yellowtail flounder (3LNO)
         - Greenland halibut (2+3KL)
         - Roundnose grenadier (2+3)
         - Capelin (2+3KL, 3LNO)
         - Squid-*Illex* (3+4)
      iii) Stocks within the EEC fishery zone in Subarea 1, for which scientific advice on conservation measures in 1983 was requested by the EEC (Annex 2):
         - Cod (1)
         - Redfish (1)
         - Wolffishes (1)
      iv) Stocks overlapping the Canadian and EEC fishery zones in Subareas 0 and 1, for which scientific advice on conservation measures in 1983 was requested by Canada and the EEC (Annexes 1 and 2):
         - Greenland halibut (0+1)
         - Roundnose grenadier (0+1)
         - Northern shrimp (*Pandalus borealis*) (0+1)
      v) Shrimp (*Pandalus*) stock at East Greenland, as requested by the EEC (Annex 2)

   c) Assessment of harp and hooded seal stocks, as requested by Canada (Annex 1) (Working Group Convener: A. W. Mansfield) (see NOTE 1)
      i) Review of fishery
      ii) Research in 1982
      iii) Population assessment
         - Current stock size and pup production, and trends in these parameters
         - Current replacement yield
         - Trends in population size
      iv) Trends in catches of harp seals in Arctic Canada (north of 60°N) and in Greenland

   d) Environmental research (Subcommittee Chairman: R. W. Trites)
      i) MEDS progress report for 1981/82
      ii) Review of environmental studies in 1981
      iii) Publication status of remote sensing and environmental symposia papers presented at the September 1981 Meeting
      iv) Remote sensing-update on relevant organizations, data products, etc.
      v) Synoptic sea-surface temperature maps
      vi) Environmental data products available onboard ship
      vii) Other matters

   e) Squid-*Illex* research (Working Group Convener: T. W. Rowell)
      i) Distribution and abundance
         - Fishery and abundance trends

- Physical and oceanographic considerations in larval and juvenile distribution
- Patterns of distribution and migration (larval, juvenile, adult)

ii) Biological characteristics
- Sex composition and growth
- Maturation, fecundity, spawning and larval development
- Food and feeding
- Mortality

iii) Conclusions and assessment of future research requirments

iv) Coordination of squid research in 1983
- Results of 1981 and 1982 surveys in relation to hypotheses examined
- Proposed program for 1983 (vessels, area, survey design, etc.)

f) Flemish Cap Project (Working Group Convener: J. T. Anderson)
i) Review of recent work on Flemish Cap
ii) Environmental variability and cod recruitment
iii) Comparative ichthyoplankton sampling
iv) Discussion of future cooperative work

g) Herring tagging (Working Group Convener: W. T. Stobo) (see NOTE 2)
i) Report of January 1982 Meeting of the *ad hoc* Working Group
ii) Review of relevant papers

h) Ageing techniques and validation studies
i) Report of Shrimp Ageing Workshop (Convener: J. Fréchette)
ii) Other species

i) Gear and selectivity studies

j) Mesh assessment - maximization of yield-per-recruit at $F_{0.1}$, for cod and redfish in Div. 3M (FC Doc. 80/IX/16 revised; *NAFO Sci. Coun. Rep.* 1981, pages 24 and 95)

k) Review of relevant fishery science papers

l) Other matters

3. Research Coordination (STACREC Chairman: T. K. Pitt)

a) Statistics and Sampling
i) CWP activities relevant to NAFO
ii) Fishery statistics
- Progress report for 1981/82
- Review of requirements
- Agequacy of national reporting

iii) Sampling program (acquisition and processing of data)
iv) Review of scientific observer program in 1981
v) List of fishing vessels for 1980 (progress report)
vi) Other matters (see Annex 1)
- Review of minimum sampling requirements
- Shrimp (*Pandalus montaguii*) statistics for Hudson Strait

b) Biological surveys
i) Review of survey activity in 1981
ii) Survey plans for 1982
iii) Publication of manual on groundfish surveys
iv) Review of stratification schemes
v) Review of relevant papers

c) Review of tagging activities reported in 1981

d) Other matters

4. Publications (STACPUB Chairman: V. A. Rikhter)

a) Publications and editorial policy
i) Progress report
ii) Other considerations

b) Proposed ichthyoplankton manuals

c) Coordination of research information for the NAFO Area

d) Papers nominated for possible publication

e) Other matters

5. Collaboration with Other Organizations

   a) Eleventh Session of CWP in July 1982

   b) Proposed NAFO/ICES study on redfish at Greenland

6. Adoption of Reports

   a) Report of Standing Committee on Fishery Science (STACFIS)

   b) Report of Standing Committee on Research Coordination (STACREC)

   c) Report of Standing Committee on Publications (STACPUB)

7. Proposed Amendment to Rules of Procedure

8. Future Scientific Council Meeting, 1982 and 1983

9. Other Business

10. Adjournment

NOTE: 1) It was unanimously agreed at the opening session of the Scientific Council that this item be added to its agenda for this meeting.

2) This item was deferred to the September 1982 Meeting because the Convener had not finalized the report.

B. ANNUAL MEETING - SEPTEMBER 1982

1. Opening (Chairman: R. Wells)

   a) Appointment of rapporteur

   b) Adoption of agenda

   c) Plan of work

2. Fishery Science (STACFIS Chairman: J. P. Minet)

   a) Special Session on Stock Discrimination in Marine fishes and Squid of the Northwest Atlantic (Convener: T. D. Iles)
      i) Overview of stock discrimination in marine fishes
      ii) Stock structure of some important marine fishes - case studies
      iii) Review of parasitological studies in relation to stock discrimination
      iv) Squid and other marine invertebrates
      v) Ecological and evolutionary implications
      vi) Other considerations

   b) Assessment of Fish Stocks (deferred from June 1982 Meeting)
      i) Cod in Div. 2J+3KL

   c) *Ad hoc* Working Group on Flemish Cap Project (Convener: J. T. Anderson)
      i) Review of available research information
      ii) Research plans for 1983

   d) Herring Tagging (deferred from June 1982 Meeting)
      i) Report of *ad hoc* Working Group Meeting in January 1982 (W. T. Stobo, Convener)
      ii) Other considerations

   e) Other Matters
      i) Evaluation of the impact of changes in mesh size on the interacting fisheries for cod and redfish in Div. 3M (maximization of yield per recruit at $F_{0.1}$ for cod and redfish). (See Report of the June 1982 Meeting.)
      ii) Adoption of outstanding section in STACFIS Report of the June 1982 Meeting.

3. Publications (STACPUB Chairman: V. A. Rikhter)

   a) Review of matters arising from previous reports

   b) Editorial policy re NAFO Scientific Council publications

c) Review of progress on ichthyoplankton identification manuals

d) Papers for possible publication

e) Other matters

4. Rules of Procedure

a) Proposal to amend Rule 3.1 of the Scientific Council Rules of Procedure (see Report of the June 1982 Meeting).

5. Adoption of Reports

a) Standing Committee on Fishery Science (STACFIS)

b) Standing Committee on Publications (STACPUB)

c) Provisional Report of the June 1982 Meeting of Scientific Council (SCS Doc. 82/VI/18)

6. Review of Future Meeting Arrangements

a) Assessment of shrimp stocks (deferred from June 1982 Meeting)

b) Further assessment of capelin stocks, if required

c) Further assessment of seal stocks (see NOTE below and Annex 3)

d) Main Scientific Meeting in June 1983

e) Special theme for September 1983 Annual Meeting

7. Other Matters

8. Adjournment

NOTE: The Chairman of the Scientific Council, noting the short period of time until the September 1982 Meeting, the incompleteness of statistics and other information required for the assessment, and the difficulty of finding sufficient time for STACFIS during the scheduled period for the September Meeting to adequately deal with the assessment, considers that the matter should be deferred to a meeting in mid-November 1982.

ANNEX 1. CANADIAN REQUEST FOR SCIENTIFIC ADVICE CONCERNING VARIOUS MATTERS

1. Advice on the Scientific Basis for Management in 1983 of Certain Stocks in Subareas 0 to 4.

   a) Canada requests that the Scientific Council, at its meeting in advance of the 1982 NAFO Annual Meeting, provide advice on the scientific basis for the managment of the following fish and invertebrate stocks in 1983:

      Cod (Div. 2J and 3KL; Div. 3N and 3O)
      Redfish (Div. 3L and 3N)
      American plaice (Div. 3L, 3N and 3O)
      Witch flounder (Div. 3N and 3O)
      Yellowtail flounder (Div. 3L, 3N and 3O)
      Greenland halibut (Subarea 2 and Div. 3KL)
      Roundnose grenadier (Subareas 2 and 3)
      Silver hake (Div. 4V, 4W and 4X)
      Capelin (Subarea 2 and Div. 3K; Div. 3LNO)
      Squid (Subareas 3 and 4)

   It is further suggested that, subject to the concurrence of the other coastal state concerned, the Scientific Council, prior to the 1982 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1983 of the following stocks:

      Shrimp (Subareas 0 and 1)
      Greenland halibut (Subareas 0 and 1)
      Roundnose grenadier (Subareas 0 and 1)

   b) Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for those stocks listed above and for the Flemish Cap (Div. 3M) stocks:

      i) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and management options evaluated in terms of their implications of fishable stock size in both the short and long term. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be evaluated in relation to spawning stock size. As a general reference point, the implications of continuing to fish at $F_{0.1}$ in 1983 and subsequent years should be evaluated. The present stock size should be described in relation to those observed historically and to those expected at the $F_{0.1}$ level. Management options for arriving at the latter stock size on a shorter time scale should be developed. Opinions of the Scientific Council should be expressed in regard to stock sizes, catch rates, and TACs implied by these management strategies for 1983 and the long term.

      ii) For those stocks subject to general production-type assessments, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference point should be the level of fishing effort (≡F) which is two-thirds that calculated to be required to take the MSY catch in the long term.

      iii) For those resources on which only general biological and/or catch data are available, no standard criteria on which to base advice can be established. The evidence on stock status should, however, be weighted against a strategy of optimum yield management and maintenance of stock biomass at levels of about two-thirds that of the virgin stock.

   c) At the request of Canada, the Scientific Council at a special meeting in November 1981 provided advice on the scientific basis for management in 1982 of stocks of harp seals and hooded seals within national fishery limits in NAFO Subareas 0, 1, 2, 3 and 4. At this meeting, a new computer simulation model was presented which provided substantially higher estimates of replacement yields for harp seals than were formerly advised by NAFO. The Council noted that insufficient time was available to study the model thoroughly at this meeting and advised that further critical review should be undertaken before the results be adopted as a basis for major revision of management schemes for 1982.

   Recognizing this advice, Canada requests that the Scientific Council reexamine the population status and dynamics of Northwest Atlantic harp seals, reviewing the model presented at the November 1981 meeting and commenting on:

      i) Current stock size and pup production and recent trends in these parameters.

ii) Current replacement yield and sustainable yield at present stock size and in the long term, under varying options of age compositions in the catch, including that recently occurring.

iii) Trends in population size based upon differing levels of total allowable catch which incorporate quota regulation of all removals except that by traditional hunting in the Canadian Arctic and at Greenland.

iv) Trends in catches of harp seals in Canada, north of 60° N Latitude and in Greenland.

2. Statistics and Sampling

a) Canada requests the Scientific Council to consider necessary alterations to statistical systems to permit the reporting of catches of the shrimp, *Pandalus montagui*, taken inside and to the west of NAFO Subarea 0.

b) Canada requests the Scientific Council to provide advice on the level of biological sampling that would be appropriate for the International Observer Scheme, particularly in regard to depressed stocks where catches do not meet the criterion of 1,000 tons per quarter of the year.

Dr. A. W. May
Assistant Deputy Minister for Atlantic Fisheries
Department of Fisheries and Oceans
Ottawa, Canada

ANNEX 2. EEC REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1983 OF CERTAIN STOCKS IN SUBAREAS 0 AND 1

1. The EEC requests the Scientific Council to provide advice for the following stocks, subject to the agreement of the other coastal state concerned in the case of joint stocks:

   a) Stocks occurring both in the EEC and Canadian Fishery Zones: Greenland halibut, Roundnose grenadier, and Shrimp in Subareas 0 and 1.

   b) Stocks occurring in the EEC Fishery Zone: Cod, Redfish and Catfish (Wolffish) in Subarea 1.

2. For the above-mentioned stocks, the present state of exploitation should be reviewed and options for management in 1983 given.

   Where possible, these should be expressed graphically in terms of catch in 1983 and the size of the spawning stock biomass on 1 January 1984 for a range of values of F which covers at least -50% to +25% of F in 1981.

   For cod in Subarea 1, it is requested that catches for each year up to and including 1985 and spawning stocks biomasses for each year up to and including 1986 are calculated for maintaining F at the following levels from 1983 onwards: $F = 0.1$, $F = 0.2$, $F = F_{0.1}$ $F = F_{max}$ and $F = 0.6$. For 1982, F will be that value needed to take the TAC of 50,000 tons. All values of F refer to that on the most heavily exploited age-groups. What will be the effects on the stocks of maintaining a TAC of 50,000 tons for the period 1982-1986?

3. Management options for shrimp at East Greenland should also be given.

Mr. R. Simonnet, Director
Directorate General for Fisheries
Commission for the European Communities
Brussels, Belgium

ANNEX 3. CANADIAN REQUEST FOR FURTHER ADVICE ON THE SEAL STOCKS

1. The following communication relevant to assessment of the seal stocks was received by the Executive Secretary from the Assistant Deputy Minister of the Canadian Department of Fisheries and Oceans on 8 July 1982:

"Dear Captain Cardoso:

On April 13th I wrote to you requesting that the Scientific Council provide scientific advice on various matters, including the management in 1983 of harp seals. In this request, I specified a number of areas on which Canada was seeking comment and these were circulated by you as SCS Document 82/VI/1. Specifically, I asked that the Scientific Council reexamine the population status and dynamics of Northwest Atlantic harp seals, reviewing the model presented at the November 1981 meeting and commenting on:

i) Current stock size and pup production and recent trends in these parameters.

ii) Current replacement yield and sustainable yield at present stock size and in the long term, under varying options of age compositions in the catch, including that recently occurring.

iii) Trends in population size based upon differing levels of total allowable catch which incorporate quota regulation of all removals except that by traditional hunting in the Canadian Arctic and at Greenland.

iv) Trends in catches of harp seals in Canada, north of 60°N latitude and in Greenland.

I understand that the advice provided by the Scientific Council does not provide answers to these questions nor any commentary that is of use in the consideration of the management of the harp seal stock.

I must, therefore, reiterate my request that the Scientific Council address the questions set out above. I note that the Council is scheduled to meet in September and would hope that this will offer a suitable opportunity for the Council to restructure its advice into the format requested. I realize, however, that the Council's meeting may conflict with consideration within ICES of the status of the harp and hooded seal populations, and I would, in this case, be prepared to wait until mid-November for a new report from the Scientific Council."

Mr. L. S. Parsons
Acting Assistant Deputy Minister
Dept. of Fisheries and Oceans
Ottawa, Canada

II. LIST OF RECOMMENDATIONS, 1982

III. LIST OF RESEARCH AND SUMMARY DOCUMENTS, 1982

RESEARCH DOCUMENTS, 1982

SCR Doc.	Serial	
82/VI/1	N482	RIKHTER, V. A., V. F. TUROK, and Yu. S. GRINKOV. Distribution of some groundfish species and short-finned squid on the Scotian Shelf during the 1981 fishing season, based on data from USSR observers. (12 pages)
82/VI/2	N483	ANDERSON, J. T. Prospectus on future research for the Flemish Cap Project. (14 pages)
82/VI/3	N488	EVSEENKO, S. A. Ichthyoplankton of the Canadian zone of the Gulf Stream in November-December 1974. (34 pages)
82/VI/4	N489	BAILEY, W. B. A time-series of sea-surface temperature on the Flemish Cap, 1962-81. (7 pages)
82/VI/5	N493	O'DOR, R. K., N. BALCH, and T. AMARATUNGA. Laboratory observations of midwater spawning by *Illex illecebrosus*. (7 pages)
82/VI/6	N494	BAILEY, W. B. Synoptic sea-surface temperature charts. (15 pages)
82/VI/7	N495	JOSSI, J. W., D. E. SMITH, and G. A. WHITE. Continuous plankton records: the sampling program of the U. S. National Marine Fisheries Service. (8 pages)
82/VI/8	N496	ARMSTRONG, R. S. Variation in the shelf water front position in 1981 from Georges Bank to Cape Romain. (8 pages)
82/VI/9	N497	CRIST, R. W. Bottom temperatures on the continental shelf and slope south of New England during 1981. (8 pages)
82/VI/10	N498	FITZGERALD, J. L., and J. L. CHAMBERLIN. Anticyclonic warm core Gulf Stream rings off the northeastern United States during 1981. (12 pages)
82/VI/11	N499	HUGHES, M. M., and S. K. COOK. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1981. (6 pages)
82/VI/12	N500	MCLAIN, D. R., and M. C. INGHAM. Sea-surface temperatures in the Northwestern Atlantic in 1981. (12 pages)
82/VI/13	N501	NOSKOV, A. S. Studies conducted by the USSR in NAFO Subarea 4 in 1981. (8 pages)
82/VI/14	N502	KONSTANTINOV, K. G., A. K. CHUMAKOV, K. N. NIKESHIN, and V. G. KOVALENKO. On validity of trawl mesh size used in fishing areas of the Northwest Atlantic. (30 pages)
82/VI/15	N503	KONOVALOV, E. I., and Ch. M. NIGMATULLIN. USSR Fishery for the shortfin squid in Subarea 4, 1981. (4 pages)
82/VI/16	N504	BURMAKIN, V. V. Water temperature in the Newfoundland and Labrador areas in 1981. (6 pages)
82/VI/17	N505	BOROVKOV, V. A., and B. P. KUDLO. Geostrophic circulation of water in the Labrador and Newfoundland areas in spring-summer 1981. (9 pages)
82/VI/18	N506	NAKASHIMA, B. S., and R. W. HARNUM. Summary of a logbook survey of the 1981 inshore capelin fishery in Divisions 3KL. (6 pages)
82/VI/19	N507	DUPOUY, H., and J. P. MINET. Catch, effort and biological characteristics of squid (*Illex illecebrosus*) in the French inshore fishery (Subdiv. 3Ps), in 1981. (6 pages)
82/VI/20	N508	DUPOUY, H, and J. P. MINET. Biological characteristics and biomass estimate of the squid (*Illex illecebrosus*) on Scotian Shelf (Div. 4VWX) in late summer. (12 pages)

SCR Doc. (continued)

SCR Doc. (continued)

82/VI/41	N530	AKENHEAD, S. A. Flemish Cap cod year-class strength and environmental variables. (10 pages)
82/VI/42	N531	KEELEY, J. R. Regional difference in water types on the Flemish Cap. (8 pages)
82/VI/43	N532	DUPOUY, H., T. AMARATUNGA, and L. COELHO. Prelimary data on prediction on predation of fishes on squid (*Illex illecebrosus*) on the Scotian Shelf (NAFO Div. 4VWX). (8 pages)
82/VI/44	N533	KEELEY, J. R. Marine environmental data service report for 1981-82. (21 pages)
82/VI/45	N534	WELLS, R. The shape of cod on the Flemish Cap. (5 pages)
82/VI/46	N535	WELLS, R. The condition factor of cod. (3 pages)
82/VI/47	N536	COELHO, M. L., T. AMARATUNGA, and H. DUPOUY. Some field data on fecundity of *Illex illecebrosus* (LeSueur). (6 pages)
82/VI/48	N537	PITT, T. K. Recalculation of natural mortality of American plaice from the Grand Bank. (5 pages)
82/VI/49	N539	NOSKOV, A. S. Estimation of stock size and allowable catch of silver hake (*Merluccius bilinearis*) on the Scotian Shelf. (4 pages)
82/VI/50 (Revised)	N540	HORSTED, Sv. Aa. Status of Subarea 1 cod and estimates of stock and yield for 1982-85. (27 pages)
82/VI/51	N541	KROEGER, M. First attempts to quantify variations in behaviour of groundfish otter trawls used by the Federal Republic of Germany in North Atlantic surveys. (15 pages)
82/VI/52	N545	BRODIE, W. G., and T. K. PITT. American plaice in NAFO Divisions 3L, 3N and 3O - a stock assessment update. (13 pages)
82/VI/53	N546	BRODIE, W. G., and T. K. PITT. Assessment update for the yellowtail stocks in Divisions 3LNO. (14 pages)
82/VI/54	N547	MILLER, D. S., B. S. NAKASHIMA, and J. E. CARSCADDEN. Capelin acoustic surveys in NAFO Divisions 2J+3KL and 3LNO and 3L, 1981-82. (12 pages)
82/VI/55	N548	ATKINSON, D. B. Status of roundnose grenadier in Subareas 0+1 and 2+3. (9 pages)
82/VI/56	N549	CARSCADDEN, J. E., and D. S. MILLER. An assessment of the capelin stock in Subarea 2 and Division 3K using a sequential capelin abundance model. (13 pages)
82/VI/57	N550	BISHOP, C. A., and S. GAVARIS. Stock assessment of cod in Divisions 3NO. (11 pages)
82/VI/58	N551	GAVARIS, C. A. An assessment of redfish on the Flemish Cap. (9 pages)
82/VI/59	N552	ATKINSON, D. B. Analysis of data on redfish in Divisions 3LN. (25 pages)
82/VI/60	N553	KOVALEV, S. M. Results of the experimental capelin fishery in the autumn of 1981. (4 pages)
82/VI/61	N554	BAKANEV, V. S., and V. A. ERMOLCHEV. Hydroacoustic assessment of capelin abundance in NAFO Divisions 3LNO in May-June 1981. (10 pages)
82/VI/62	N555	GORCHINSKY, K. V. Dynamics of yellowtail flounder stock on the Grand, Newfoundland Bank in 1973-81. (5 pages)
82/VI/63	N556	POSTOLAKY, A. I. Abundance and biomass of cod on the Flemish Cap. (4 pages)
82/VI/64	N557	ANTHONY, V. C. The calculation of $F_{0.1}$: a plea for standardization. (16 pages)

SCR·Doc. (continued)

82/VI/65 N558 WALDRON, D. E., and M. C. HARRIS. Scotian Shelf silver hake (*Merluccius bilinearis*) population abundance in 1981 with projections to 1983. (28 pages)

82/VI/66 N559 GAVARIS, S. Status of the cod stock in NAFO Division 3M. (3 pages)

82/VI/67 N560 BOWERING, W. R., and W. B. BRODIE. The Greenland halibut fishery in NAFO Subarea 2 and Divisions 3KL. (13 pages)

82/VI/68 N561 BISHOP, C. A., and S. GAVARIS. Assessment of cod stock in NAFO Divisions 2J+3KL. (12 pages)

82/VI/69 N562 ALBIKOVSKAYA, L. K. Characteristics of feeding of three species of wolffishes in the Northwest Atlantic. (9 pages)

82/VI/70 N563 UGLAND, K. I. Comments to D. A. Roff and W. D. Bowen, 1981, "Population dynamics of harp seals, 1967-1991, NAFO SCR Doc. 81/VI/166. (7 pages)

82/VI/71 N564 MOROSOVA, G. N. Distribution of three species of eelpout in Newfoundland divisions in relation with depths and bottom temperatures. (13 pages)

82/VI/72 N565 BJØRGE A. Field investigations of harp and hooded seal on the Front during the sealing season 1982. (12 pages)

82/VI/73 N566 KISELEVA, V. M. Age and growth of witch flounder in Divisions 3K. (12 pages)

82/VI/74 N567 MARI, A., and R. DOMINGUEZ. Selectivity study on silver hake in Divisions 4VW, May 1982. (17 pages)

82/IX/75 N581 LEAR, W. H., and R. WELLS. Vertebral averages of juvenile cod (*Gadus morhua*) from eastern Newfoundland and Labrador as indicators of stock origin. (28 pages)

82/IX/76 N582 SCOTT, J. S. Geographical distribution of haddock on the Scotian Shelf. (10 pages)

82/IX/77 N583 LARRAÑETA, M. G. An approach to the stock-recruitment relationship of cod (*Gadus morhua*) in Divisions 2J and 3KL. (8 pages)

82/IX/78 N584 BOWERING, W. R. Stock identification studies of Greenland halibut (*Reinhardtius hippoglossoides*) in the Northwest Atlantic from tagging experiments. (18 pages)

82/IX/79 N585 TEMPLEMAN, W. Stock discrimination in marine fishes. (16 pages)

82/IX/80 N586 GRAHAM, J. J., B. J. JOULE, C. L. CROSBY, and D. W. TOWNSEND. Discrimination of spawning groups of herring, *Clupea harengus*, along the coast of Maine. (18 pages)

82/IX/81 N587 ALMEIDA, F. P. An analysis of the stock structure of silver hake, *Merluccius bilinearis*, in NAFO Subareas 5 and 6. (36 pages)

82/IX/82 N590 NI, I-H. Meristic variation in golden redfish, *Sebastes marinus*, in the Northwest Atlantic. (10 pages)

82/IX/83 N591 NI, I-H. Meristic variation in beaked redfishes, *Sebastes mentella* and *S. fasciatus*, in the Northwest Atlantic. (30 pages)

82/IX/84 N593 KENCHINGTON, T. J. Population structure and management units of redfishes (*Sebastes* sp.) on the Scotian Shelf. (43 pages)

82/IX/85 N594 DICKIE, L. M. The genetic structure of mussel populations in eastern Canadian waters. (14 pages)

82/IX/86 N595 DAVIDSON, K., R. W. ELNER, and J. ROFF. Discrimination of Atlantic snow crab, *Chionoecetes opilio*, populations: a problem of management application. (13 pages)

SCR Doc. (continued)

82/IX/87	N596	NI, I-H., and W. TEMPLEMAN. Reproductive cycles of redfishes in southern Newfoundland waters. (12 pages)
82/IX/88	N597	NI, I-H., and E. J. SANDEMAN. The logistic model for determining size at maturity in species differentiation and stock discrimination for Northwest Atlantic redfishes. (13 pages)
82/IX/89	N598	LEAR, W. H. Discrimination of the cod stock complex in Divisions 2J+3KL based on tagging. (33 pages)
82/IX/90	N599	SINDERMANN, C. J. Parasites as natural tags for marine fish: a review. (18 pages)
82/IX/91	N600	DAWE, E. G., M. C. MERCER, and W. THRELFALL. On the stock identity of short-finned squid (*Illex illecebrosus*) in the Northwest Atlantic. (16 pages)
82/IX/92	N601	SHESTOV, V. P. Vertebral number as method of separating intrapopulational groups of haddock in the Newfoundland subarea. (22 pages)
82/IX/93	N602	SAVVATIMSKY, P. I. Variability in morphometric and meristic features of the roundnose grenadier (*Coryphaenoides rupestris*), related to their linear growth. (11 pages)
82/IX/94	N603	RIKHTER, V. A., A. S. NOSKOV, Yu. S. GRINKOV. On discrimination of the silver hake stocks of the Nova Scotia Shelf (Div. 4W) and southwestern slope of the Grand Bank (Div. 30). (6 pages)
82/IX/95	N604	NESTEROV, A. A. Data on distribution of the Northwest Atlantic saury, *Scomberesox saurus* (Walb.), for evaluation of the unity of their population. (5 pages)
82/IX/96	N605	CHUMAKOV, A. K., and V. P. SEREBRYAKOV. Distribution of Greenland halibut from the Greenland-Canadian population. (12 pages)
82/IX/97	N606	McGLADDERY, S. The parasites of northwestern Atlantic herring (*Clupea harengus* L.). (9 pages)
82/IX/98	N607	WALDRON, D. E., G. DRESCHER, and C. HARRIS. Discrimination of possible silver hake (*Merluccius bilinearis*) stocks on the Scotian Shelf. (26 pages)
82/IX/99	N608	PINHORN, A. T. Has the catchability coefficient (q) really changed in Div. 2J+3KL cod fishery? (6 pages)
82/IX/100	N609	BOWERING, W. R. Minimum trawlable biomass estimates of Greenland halibut in NAFO Divisions 2G and 2H from post-stratified groundfish surveys. (8 pages)
82/IX/101	N610	TSYGANOV, V. F., I. K. SIGAEV, and Yu. A. LOKTIONOV. Distribution of available potential energy, geostrophic circulation and biological productivity indices in two areas of the North Atlantic. (11 pages)
82/IX/102	N611	McGLADE, J. M. Pattern recognition: partitioning in morphological hyperspace. (5 pages)
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82/IX/106		(Document not issued)
82/IX/107	N615	CAMPBELL, A., and R. K. MOHN. The quest for lobster stock boundaries in the Canadian Maritimes. (45 pages)

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82/IX/108	N617	STOBO, W. T. Tagging studies on Scotian Shelf herring. (16 pages)
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82/IX/111	N633	BISHOP, C. A., and S. GAVARIS. Further considerations in assessment of the cod stock in Div. 2J+3KL. (24 pages)
82/IX/112	N616	MISRA, R. K., and I-H. NI. Introducing a new discriminant analysis (with covariance) and multivariate analysis of covariance, with a study of beaked redfishes *Sebastes mentella* and *S. fasciatus*. (10 pages)

SUMMARY DOCUMENTS, 1982

SCS Doc.	Serial	
82/VI/1 (Rev.)	N481	MAY, A. W. Canadian request for scientific advice concerning various matters. (2 pages)
82/VI/2	N484	NAFO SECRETARIAT. Historical catches of selected species by stock area and country. (38 pages)
82/VI/3	N485	NAFO SECRETARIAT. Extracts from resolutions passed at the 69th Statutory Meeting of ICES, October 1981. (1 page)
82/VI/4	N486	NAFO SECRETARIAT. Tagging activities reported for the Northwest Atlantic in 1981. (6 pages)
82/VI/5	N487	NAFO SECRETARIAT. Proposed NAFO/ICES study on redfish. (4 pages)
82/VI/6	N571	NAFO SECRETARIAT. Notes on statistical activities and publications, 1981/82. (4 pages)
82/VI/7	N569	NAFO SECRETARIAT. Provisional nominal catches in the Northwest Atlantic, 1981. (47 pages + Corrigendum, 2 pages)
82/VI/8	N490	COADY, L. W., J. S. SCOTT, and H. POWLES. Canadian research report, 1981. (21 pages)
82/VI/9	N492	CWP SECRETARY. Report of the *ad hoc* Inter-agency Consultation of Atlantic Fishery Statistics, 3 and 4 October 1981, Woods Hole, USA. (10 pages)
82/VI/10	N491	NAFO SECRETARIAT. Report to the CWP on NAFO fishery statistical program, publications and data-processing. (8 pages)
82/VI/11	N522	SIMONNET, R. EEC request for scientific advice on management in 1983 of certain stocks in Subareas 0 and 1. (1 page)
82/VI/12	N538	KONSTANTINOV, K. G. Report of USSR investigations in subareas off Newfoundland, Labrador and Baffin Island in 1981. (25 pages)
82/VI/13	N542	GODINHO, M. LOURDES M. Portuguese research report, 1981. (4 pages)
82/VI/14 (Revised)	N543	FRÉCHETTE, J., and D. G. PARSONS. Report of the Shrimp (*Pandalus borealis*) Ageing Workshop, Québec City, Québec, 11-14 May 1981, and Dartmouth, Nova Scotia, 20-21 November 1981. (58 pages)
82/VI/15	N544	MINET, J. P. France research report for 1981. (14 pages)
82/VI/16	N568	HORSTED, Sv. Aa., and SMIDT E. Denmark (Greenland) research report for 1981. (20 pages)

SCS Doc. (continued)

82/VI/17	N570	NAFO SECRETARIAT. Summary of reported sampling data for 1980. (16 pages)
82/VI/18	N577	NAFO. Provisional report of Scientific Council, Dartmouth, Canada, 2-18 June 1982. (77 pages + Addenda, 6 pages)
82/IX/19	N578	LEIVA, O., and E. FRAXEDAS. Cuban research report, 1981. (3 pages)
82/IX/20	N579	ERNST, P. German Democratic Republic research report for 1981. (11 pages)
82/IX/21	N580	HATANAKA, H. Japanese research report for 1981. (6 pages)
82/IX/22	N629	NAFO. Provisional report of Scientific Council, Dartmouth and Halifax, Canada, 8-16 September 1982. (24 pages)
82/IX/23	N632	NAFO. Rules of Procedures for the Scientific Council of NAFO. (4 pages)

VI. LIST OF PARTICIPANTS IN SCIENTIFIC COUNCIL MEETINGS, 1982

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