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# NORTHWEST ATLANTIC FISHERIES ORGANIZATION

## Scientific Council Reports 1979-1980

Dartmouth, Canada
December 1980

# PREFACE

The ICNAF Redbook, containing reports of meetings of the Standing Committee on Research and Statistics, was published annually until 1979, when ICNAF ceased to exist and was replaced by the Northwest Atlantic Fisheries Organization (NAFO). The Scientific Council of NAFO recognized the need for continuing the publication of the reports of its meetings and agreed to follow the same format of presentation as the ICNAF Redbook except for a change in the name to *NAFO Scientific Council Reports*.

This first issue of *NAFO Scientific Council Reports* contains the reports of seven meetings held during the calendar years 1979 and 1980: (A) Inaugural Meeting, March 1979; (B) Annual Meeting, June 1979; (C) Special Meeting, November 1979; (D) Special Meeting, February 1980: (E) Regular Meeting, June 1980; (F) Annual Meeting, September 1980; and (G) Special Meeting, November 1980. Part H contains the agenda, lists of recommendations, lists of research and summary documents, and a list of participants relevant to the Scientific Council meetings held during 1979 and 1980.

31 December 1980

V. M. Hodder
Assistant Executive Secretary

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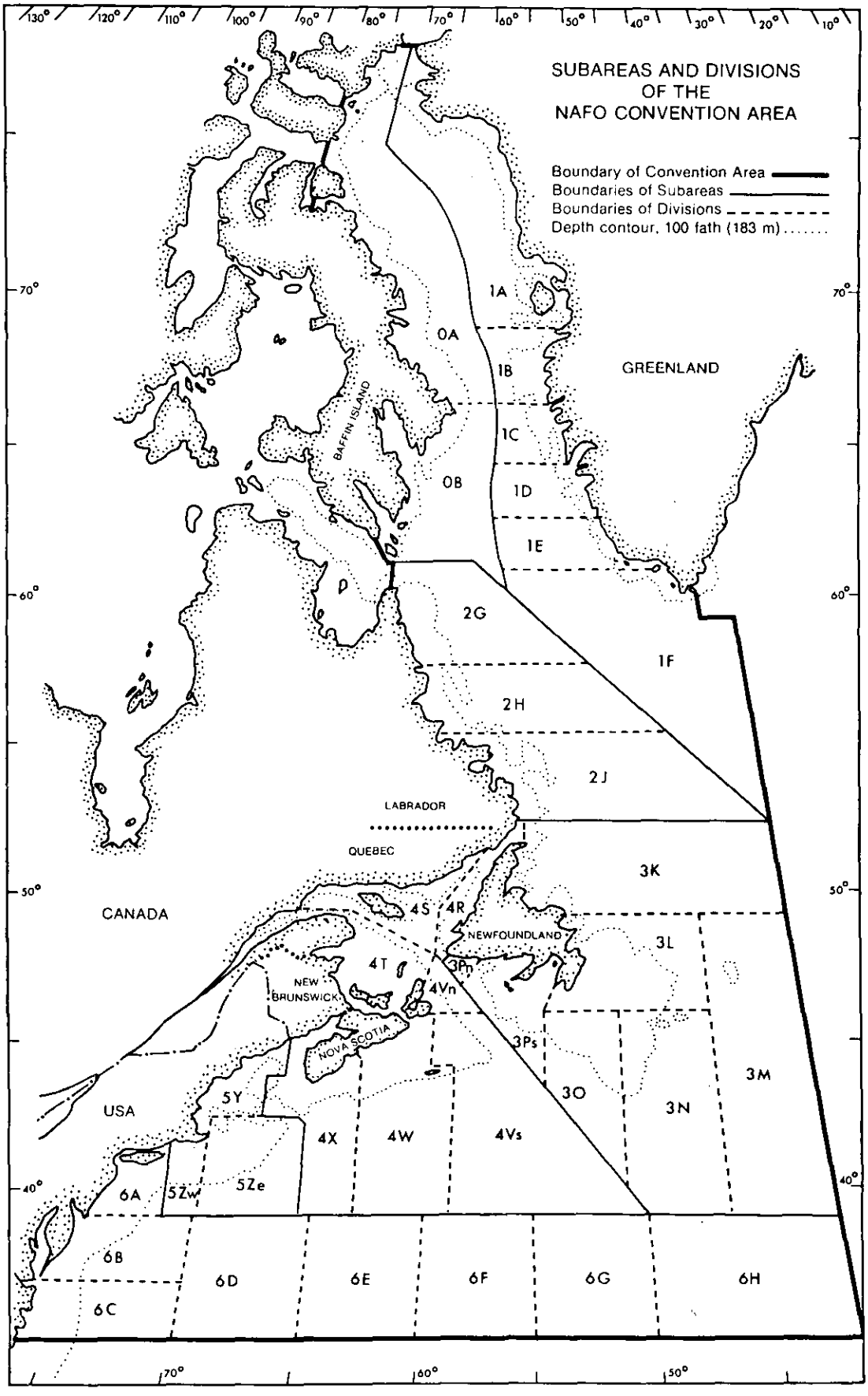
SUBAREAS AND DIVISIONS
OF THE
NAFO CONVENTION AREA
Boundary of Convention Area
Boundaries of Subareas
Boundaries of Divisions
Depth contour, 100 fath (183 m)
GREENLAND
BAFFIN ISLAND
LABRADOR
QUEBEC
CANADA
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NEW BRUNSWICK
NOVA SCOTIA
USA
0A
0B
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1B
1C
1D
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# PART A

REPORT OF SCIENTIFIC COUNCIL

Inaugural Meeting, March 1979

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# REPORT OF SCIENTIFIC COUNCIL

Inaugural Meeting, March 1979

Chairman: R. H. Letaconnoux Rapporteur: V. M. Hodder

The Inaugural Meeting of the Council was held at Montreal, Canada, during 8-9 March 1979. The first session was called to order by the President of NAFO, Dr A. W. May (Canada), who welcomed the representatives and advisers of the following Contracting Parties: Canada, Cuba, European Economic Community (EEC), German Democratic Republic (GDR), Iceland, Norway, Romania and Union of Soviet Socialist Republics (USSR). The provisional agenda, with the addition of an item under "Other Business" entitled "Adjustment to boundary between Subareas 0 and 1", was adopted (Part H, this volume). The Council unanimously agreed that the election of officers be deferred until its First Annual Meeting in June 1979 when there could possibly be additional representation on the Council by further ratifications of the Convention. Meanwhile, Mr R. H. Letaconnoux (EEC) was unanimously elected as Chairman for this Inaugural Meeting, and Mr V. M. Hodder (Assistant Executive Secretary) was appointed Rapporteur.

## I. ORGANIZATIONAL ARRANGEMENTS

### 1. Admission of Observers

The Council unanimously agreed that representatives of all current member countries of ICNAF and the observers from Faroe Islands, Food and Agriculture Organization of the United Nations (FAO), and the United States of America (USA) be invited to participate as observers in meetings of the Scientific Council and its committees and working groups.

### 2. Adoption of Rules of Procedure

An *ad hoc* working group, consisting of scientists from Bulgaria (P. Kolarov), Canada (L. S. Parsons, A. T. Pinhorn), Cuba (J. A. Varea), EEC (R. H. Letaconnoux), USSR (V. A. Rikhter, A. S. Seliverstov), and USA (R. C. Hennemuth), met on 9 March 1979 to consider a draft set of rules of procedure which had previously been prepared for review at this meeting. After amendment, the "Rules of Procedure of the Scientific Council of NAFO" (Appendix I) were adopted at the second session of the Council on 9 March 1980.

### 3. Basis for Formulation of Advice at the First Annual Meeting in June 1979

The Council noted that it will be expected to provide advice to the Fisheries Commission and to Contracting Parties exercising fisheries jurisdiction in Subareas 0 to 4 on the scientific basis for the management in 1980 of certain stocks in these areas. Since the Council has not yet established the relevant committee to provide the necessary advice, and since such advice will be formulated during the forthcoming meeting of the ICNAF Assessments Subcommittee in April 1979, the Council unanimously agreed to consider the Report of the Assessments Subcommittee of ICNAF as the basis for advice expected of the Council at the June 1979 Meeting.

### 4. Organization of Work for the First Annual Meeting

The Council agreed to meet during 22-29 May and elect its officers at the first session. In order to avoid as much duplication of discussion as possible, it was further agreed that the Chairman of the Scientific Council of NAFO, when elected, arrange a brief meeting with the Chairman of ICNAF's Standing Committee on Research and Statistics (STACRES) to discuss transitional arrangements, particularly on matters relating to statistics and sampling, biological surveys, and environmental studies. Joint sessions of the Scientific Council and STACRES were suggested.

## II. OTHER MATTERS

### 1. Adjustment of Boundary Between Subareas 0 and 1

The Council considered a Canadian proposal that the western boundary of Subarea 1 be modified to conform to the coinciding limits of the Canadian and Danish fishing zones in the area, and adopted the following resolution for transmittal to the General Council:

The Scientific Council

*Noting that the external limits of the Canadian and Danish fishing zones coincide in the area between Canada and Greenland up to 75° north latitude;*

*Noting that the difference between the western boundary of NAFO Subarea 1 and the coinciding limits creates difficulties for the coastal states concerned in the assignment of catches to their respective areas of jurisdiction; and*

*Noting that the western boundary of NAFO Subarea 1 was determined arbitrarily and does not conform to any stock boundary;*

*Resolves that the General Council be requested to act, pursuant to Article XX, paragraph 2, of the Convention, to modify the western boundary of Subarea 1 to conform to the coinciding limits in the area, and to modify subdivision lines correspondingly.*

## III. ADJOURNMENT

The Chairman thanked the participants for their cooperation during this Inaugural Meeting of the Council, and declared the meeting adjourned at 1630 hours on 9 March 1979.

# APPENDIX I. RULES OF PROCEDURE FOR THE SCIENTIFIC COUNCIL

## REPRESENTATION

Rule 1

1.1 Each Contracting Party shall inform the Executive Secretary of the names of its representatives on the Scientific Council.

1.2 Each Contracting Party through its representative(s) shall inform the Executive Secretary of the names of its alternates, experts, and advisers at or before the commencement of any meeting of the Scientific Council or its committees.

1.3 The Scientific Council may invite observers from any non-Member Government or International, public, or private organization to any meetings of the Scientific Council.

## ORDER OF BUSINESS

Rule 2

2.1 A provisional agenda for each annual or special meeting of the Council or any of its committees shall be drawn up by the Executive Secretary, in consultation with the Chairman of the Scientific Council and of the relevant committee or committees, and be dispatched by the Executive Secretary to all Contracting Parties and non-Member Governments and organizations invited to participate, not less than 60 days before the date fixed for the opening of the meeting.

2.2 The subject matter of a request for scientific advice from a coastal state, in accordance with Article VII, or from the Fisheries Commission, in accordance with Article VIII, shall be included in the provisional agenda for the relevant meeting of the Scientific Council. A memorandum containing the terms of reference prescribed in Article VII shall be circulated by the Executive Secretary to all Contracting Parties at least 30 days in advance of the meeting at which the subject matter is discussed. This requirement may be waived with the consent of the members of the Scientific Council.

## COMMITTEES

Rule 3

3.1 There shall be the following standing committees. Except as specified below, each standing committee shall be composed of a scientists appointed by each Contracting Party, who may be assisted by experts and advisers, and each with a chairman who shall be elected by the Scientific Council, in accordance with the provisions of Article X of the Convention, to serve for two years.

a) The Standing Committee on Fisheries Science which shall

i) provide a forum for consultation and cooperation among the Contracting Parties with respect to the study, appraisal, and exchange of scientific information and views relating to the fisheries of the Convention Area, including environmental and ecological factors affecting these fisheries; and

ii) provide scientific advice as required, in accordance with the provisions of Article VI(c) and VI(d) of the Convention.

b) The Standing Committee on Research Coordination which shall:

i) develop and recommend to the Council policies and procedures for the collection, compilation, and dissemination of statistical and sampling information on the living resources and fisheries of the Convention Area and environmental information from oceanographic investigations;

ii) coordinate the compilation and maintenance of statistics and records and their dissemination, including liaison with coastal states in the Convention Area;

iii) coordinate the planning and execution of international cooperative research in cooperation with coastal states in the Convention Area; and

iv) encourage and promote cooperation among the Contracting Parties in scientific research designed to fill gaps in knowledge pertaining to matters identified by the Standing Committee on Fisheires Science.

c) The Standing Committee on Publications which shall

i) develop, coordinate, and keep under review the publication and editorial policy and procedures of the Scientific Council and make recommendations to the Scientific Council on these matters; and

ii) be composed of the Vice-Chairman of the Scientific Council, who shall be the Chairman, and of five other members appointed by the Scientific Council for a period of two years; the Executive Secretary shall be an *ex officio* member of the Committee.

3.2 There shall be an Executive Committee of the Scientific Council, composed of the Chairman and Vice-Chairman of the Scientific Council and the Chairmen of the Standing Committees. The Executive Secretary shall be an *ex officio* member of the Executive Committee. This Committee shall keep under general review the planning and execution of the Scientific Council's program and ensure that the Scientific Council's organization effectively and efficiently meets the needs of the scientific program, facilitate coordination with other organizations, and provide advice to the Chairman of the Scientific Council on

a) the timetable for the work of the Committees and Working Groups, and
b) input by the Scientific Council to the work of the General Council.

3.3 The Scientific Council may establish such other standing or *ad hoc* committees or *ad hoc* working groups as it considers necessary.

## SECRETARIAT

Rule 4

4.1 The Executive Secretary shall be responsible for providing advice and assistance to the Scientific Council on matters relating to the preparation for, functioning of, and reporting on all meetings of the Scientific Council, and such services as are required by the Scientific Council, its Committees, and Working Groups for the performance of their duties and functions.

## CHAIRMAN AND VICE-CHAIRMAN

Rule 5

5.1 The Chairman and Vice-Chairman shall take office at the conclusion of the annual meeting at which they were elected.

5.2 the powers and duties of the Chairman shall be:

a) to declare the opening and closing of each meeting of the Scientific Council;
b) to preside over the proceedings of the sessions of the Scientific Council;
c) to rule on points of order;
d) to arrange for the appointment of *ad hoc* committees and working groups as required by the Scientific Council;
e) to sign, on behalf of the Scientific Council, a report of the proceedings of each annual or other meeting of the Scientific Council, for transmission to Contracting Parties, representatives, and others concerned, as the authoritative record of what took place; and
f) to act as Chairman of the Executive Committee.

5.3 The powers and duties of the Vice-Chairman shall be:

a) to exercise the powers and duties prescribed for the Chairman when he is unable to act;
b) to act as Chairman of the Publications Committee; and
c) to undertake such other duties as may be required.

5.4 If the office of the Chairman is vacated, the Vice-Chairman shall become Chairman for the unexpired balance of the term.

## VOTING

Rule 6

6.1 Voting, in accordance with Article X of the Convention, shall be taken by show of hands, by roll call in alphabetical order of the names of the Contracting Party or by ballot, as determined by the Chairman.

6.2 Between meetings of the Scientific Council, or in emergency, a vote may be taken by mail or other means of communication.

## RECORDS OF PROCEEDINGS OF THE SCIENTIFIC COUNCIL AND ITS COMMITTEES

Rule 7

7.1 Summary records of each plenary and committee session shall be drafted and distributed as soon as possible to session participants.

7.2 As soon as possible after each meeting of the Council, copies of all summary records and reports, including resolutions, recommendations, and other decisions adopted by the Scientific Council shall be transmitted by the Executive Secretary to the Contracting Parties and invited participants.

7.3 An annual report containing the proceedings of each meeting of the Scientific Council, together with reports of committees, shall be prepared by the Chairman, in consultation with the Executive Secretary, and published.

## FINANCIAL

Rule 8

8.1 The Scientific Council shall not incur any expenditure, except in accordance with a budget approved by General Council.

## AMENDMENT TO THE RULES OF PROCEDURE

Rule 9

9.1 These Rules of Procedure may be amended at any time by the Scientific Council, in accordance with Article X of the Convention.

Adopted on 9 March 1979

# PART B

REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, May-June 1979

CONTENTS

# REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, May-June 1979

Chairman: R. H. Letaconnoux Rapporteur: V. M. Hodder

The first session of the Council was called to order by the Executive Secretary on 22 May 1979. It was agreed that Mr R. H. Letaconnoux (EEC), as Acting Chairman of the Council, and Dr R. G. Halliday, as Chairman of ICNAF's Standing Committee on Research and Statistics should co-chair joint sessions of the two bodies during 22-26 May 1979, and that the Report of STACRES, including the reports of its subcommittees, would be considered for acceptance by both STACRES and the Scientific Council. The Assistant Executive Secretary (V. M. Hodder) was appointed Rapporteur.

Further sessions of the Council were held during 5-7 June 1979, at the first of which the President of NAFO, Dr A. W. May (Canada), called the meeting to order and requested that consideration be given to election of officers. The call for nominations resulted in Mr R. H. Letaconnoux (EEC) being unanimously elected as Chairman and Dr R. G. Halliday (Canada) as Vice-chairman for the ensuing two-year term. The provisional agenda (Part H, this volume) was adopted without amendment. A review of membership of the Council indicated representatives were present from Bulgaria, Canada, European Economic Community (EEC), Faroe Islands, German Democratic Republic (GDR), Union of Soviet Socialist Republics (USSR) and observers were welcomed from Japan, Poland, Spain and United States of America (USA) (Part H, this volume).

## I. ORGANIZATIONAL ARRANGEMENTS

### 1. Establishment of Committees

The Chairman noted that Rule 3 of the Rules of Procedure for the Scientific Council of NAFO (adopted at the Inaugural Meeting in March 1979) referred to the establishment of certain standing committees and indicated that the chairman will be elected to serve for two years. The Council unanimously agreed to the establishment of the following committees:

a) Standing Committee on Fishery Science (STACFIS)

Dr G. H. Winters (Canada) was unanimously elected as Chairman. This Committee is expected to meet for the first time in early 1980 to provide scientific advice on some stocks.

b) Standing Committee on Research Coordination (STACREC)

Dr A. S. Seliverstov (USSR) was unanimously elected as Chairman. This Committee is expected to meet for the first time at the 1980 Annual Meeting.

c) Standing Committee on Publications (STACPUB)

In accordance with Rule 3.1(c) of the Rules of Procedure of the Scientific Council, the Vice-chairman of the Council, Dr R. G. Halliday (Canada), was confirmed as Chairman of STACPUB, and the following five members appointed for two years: Mr P. Kolarov (Bulgaria), Dr J. Messtorff (EEC), Mr J. P. Minet (EEC), Mr A. T. Pinhorn (Canada) and Dr V. A. Rikhter (USSR).

d) Executive Committee

In accordance with Rule 3.2 of the Rules of Procedure of the Scientific Council, the following were confirmed as members of the Executive Committee: Chairman of the Scientific Council, Vice-chairman of the Scientific Council, the Chairmen of STACFIS, STACREC and STACPUB, and the Executive Secretary of NAFO.

## II. MATTERS RELEVANT TO THE WORK OF THE STANDING COMMITTEES

### 1. Fishery Science

The Council noted its unanimous decision in March 1979 to consider the Report of the Assessments Subcommittee of ICNAF as the basis for advice expected of the Council at its June 1979 Meeting. Accordingly, the Council, in joint sessions with ICNAF's Standing Committee on Research and Statistics (STACRES) during 22-26 May 1979 adopted the Report of the Assessments Subcommittee (*ICNAF Redbook* 1979, pages 63-84) as the basis for its scientific advice on the management of stocks in 1980.

The Council noted that, although specific requests for advice on certain stocks for 1980 have not yet been received, a mid-term meeting of STACFIS would likely be necessary early in 1980 to review the

status of shrimp in Subareas 0 and 1, capelin in Subareas 2 and 3, squid in Subareas 3 and 4, silver hake in Div. 4VWX, and the cod stocks in Div. 3M and 3NO. It was agreed that, if such a meeting was desired, STACFIS would require 7-8 days to complete its work. It was further agreed that, in order to have available the most complete research and statistical information possible, the meeting should be held no earlier than 5 February 1980 preferably at a site where adequate computing and printing facilities are available (e.g. NAFO Headquarters). It was noted that this matter will require further consideration under agenda item 12.

The Council took note of the comments of the Fisheries Commission regarding the stock assessment of cod in Div. 3M (FC Doc. 80/VI/2), and agreed to refer the matter to STACFIS for consideration at the next meeting when the status of this stock is reviewed.

The Council, after noting the concern of ICNAF's STACRES that the time available for its meetings often did not allow consideration of many research documents which were not directly related to stock assessments, indicated that one of its basic functions was to provide a forum for scientific discussion on matters relating to the fisheries of the Convention Area, and requested the Executive Committee to consider this matter in the future scheduling of the Council's meetings.

2. Research Coordination

The Council, in a joint meeting with ICNAF's STACRES during 22-26 May 1979, approved the Report of STACRES and its subcommittees (*ICNAF Redbook* 1979, pages 49-118), with particular reference to assessments, biological surveys, environmental research, statistics and sampling, ageing techniques and validation studies, gear and selectivity studies, and other matters, including the international observer program and all recommendations, as the basis for its research and statistical activities during 1979/80.

The Council noted that the General Council had adopted a proposal to amend Annex III of the Convention relating to the adjustment of boundaries between Subareas 0 and 1 (*NAFO Proceedings* 1979, page 71), in accordance with a resolution of the Scientific Council at the Inaugural Meeting in March 1979 (this volume, page 7). The Assistant Executive Secretary indicated that the Secretary of the CWP will be informed of the change in boundary lines, so that the necessary adjustments can be made in the maps which are appended to the notes for completion of STATLANT 21A and 21B forms.

3. Publications

The Council reviewed the Report of the Standing Committee on Publications (STACPUB) (Appendix I) and agreed unanimously to its adoption without amendment.

## III. COLLABORATION WITH OTHER ORGANIZATIONS

1. Redfish Research in Subarea 1 and East Greenland

The Council noted the suggestion of ICNAF's Assessment Subcommittee that, because the spawning areas of the redfish stock in Subarea 1 are not inside the Convention Area but at East Greenland and in the Irminger Sea, studies of the stock and fisheries in these overlapping areas should be considered in cooperation with ICES (International Council for the Exploration of the Sea). The Secretariat was requested to approach ICES with a view to collaboration on this problem.

2. NAFO Participation in the Tenth Session of the CWP

With regard to representation at the forthcoming meeting of the CWP (Coordinating Working Party on Atlantic Fishery Statistics) at Madrid, Spain, in August 1980, it was agreed that the Council be represented by the following: (i) Assistant Executive Secretary, (ii) Chairman of STACREC, and (iii) a representative to be nominated by Canada.

## IV. OTHER MATTERS

1. Rules of Procedure

The Council noted that the Working Group on Rules of Procedure for the General Council and Fisheries Commission (convened by Capt J. C. E. Cardoso, Portugal) had also suggested some amendments to the Rules of Procedure for the Scientific Council. It was agreed that no amendments would be considered at this meeting, but that the suggested amendments be referred to the Executive Committee for consideration in the interim, with the request that a report on this matter be considered at the 1980 Annual Meeting.

2. International Scientific Observer Scheme

The Council confirmed the adoption of the opinions expressed by STACRES (*ICNAF Redbook* 1979, page 59) that implementation of a scientific observer program would improve significantly the scientific knowledge on the effects of fishing on the resource. In discussing whether implementation of such a scheme was, in fact, a necessity, it was noted that biological sampling of commercial catches did not, in most cases, meet even the minimum levels recommended by STACRES and adopted by ICNAF (see ICNAF Sum. Doc. 77/VI/31, 78/VI/11 and 79/VI/14). Furthermore, it was noted that the minimum level of sampling would only be adequate if the data were of the highest quality, a criterion not often achieved. STACRES has frequently, in previous years, expressed its concern about the inadequacy of the data from the commerical fisheries (e.g. *ICNAF Redbook* 1978, pages 41 and 87).

The Council agreed that good statistics, ample biological sampling of the catches, and observation of the catches and fishing operations by scientific personnel were essential elements for good stock assessment. Since these elements are missing or inadequate for many stocks, and since the implementation of an international scientific observer scheme would aid greatly to improve the situation, the Council decided that such a scheme was justified and agreed to the establishment of the *ad hoc* Working Group on the Scientific Observer Scheme, consisting of representatives from each of Canada, Cuba, Spain, USSR, USA, and any other interest countries, with Mr J. S. Beckett (Canada) as Convener (*ICNAF Redbook* 1979, page 54). The Working Group was requested to proceed with the development of the specific requirements in accordance with the following terms of reference:

a) Review recent sampling data collection and identify specific data needs by stock and area;

b) Recommend what data should be collected, as a minimum, by a scientific observer on board a vessel, and identify other data that could be collected should the particular situation permit, with due attention to the need to avoid revealing details on the commercial aspects of fishing operations;

c) Develop the format of data collection; and

d) Recommend procedures for the transmittal and dissemination of the scientific data.

The Council agreed that the Convener of the Working Group should initiate preliminary consideration of this matter through correspondence with its members, and that the Working Group should meet at the time of the mid-term meeting of STACFIS early in 1980 and prepare a report for subsequent consideration by STACREC. The Executive Committee is requested to take this meeting of the Working Group into account when scheduling the mid-term meeting of STACFIS, noting that at least one day would be required.

## V. FUTURE SCIENTIFIC MEETINGS

1. Mid-term Meetings

a) Assessment of seals and shrimp for 1980

The Council was informed that Canada, subject to the concurrence of the other coastal state concerned, will request scientific advice in late 1979 on the management of the seal stocks in 1980.

The Council noted the requests of Canada and the European Economic Community (EEC) for advice on the status of the shrimp stocks in Subareas 0 and 1, as indicated in ICNAF Com. Doc. 79/VI/6 and 79/VI/16, and the views of ICNAF's Assessment Subcommittee (*ICNAF Redbook* 1979, page 83) regarding the difficulty of providing advice on conservation measures in 1980 without complete research and statistical data for 1979. The Council unanimously agreed that the most appropriate time to review the status of the shrimp stocks would be at a mid-term meeting of STACFIS in early 1980, to allow the acquisition and analysis of reasonably complete biological and statistical data for 1979. If requested to provide advice before the end of 1979, the Council agreed that November would be the earliest time when reasonably precise advice could be formulated.

b) Assessment of other deferred stocks for 1980

As noted in section II(1) above, the Council estimated that 7-8 days in early February 1980 would be required for STACFIS to formulate scientific advice for management in 1980 of certain stocks deferred from the 1979 Annual Meeting (cod in Div. 3M and 3NO, capelin in Div. 2+3K and 3LNO, silver hake in Div. 4VWX, and squid in Subareas 3 and 4).

c) Assessment of stocks for 1981

The Council noted the recommendation of ICNAF's STACRES "that future stock assessments be carried out in May (instead of early April) to allow for the compilation of more complete statistical

data, the pre-meeting distribution of relevant documentation, and the possible availability of some data for the early months of the current year" (*ICNAF Redbook*, page 51). The Council agreed that STACFIS should meet in late May or early June 1980 to review the status of the stocks for which conservation measures will be required for 1981, the actual time and duration of this meeting to be decided by the Executive Committee. The availability of adequate computer and printing facilities was emphasized in determining the site where the meeting might be held.

2. Annual Meeting in 1980

The Council agreed that its 1980 Annual Meeting will be held in conjunction with the 1980 Annual Meeting of NAFO.

## VI. OFFICERS FOR 1979/80 AND 1980/81

1. Scientific Council

| | |
|---|---|
| Chairman | - Mr R. H. Letaconnoux (EEC) |
| Vice-chairman | - Dr R. G. Halliday (Canada) |

2. Chairmen of Standing Committees

| | |
|---|---|
| Fishery Science (STACFIS) | - Dr G. H. Winters (Canada) |
| Research Coordination (STACREC) | - Dr A. S. Seliverstov (USSR) |
| Publications (STACPUB) | - Dr R. G. Halliday (Canada) |

3. Executive Committee

The five officers noted above and the Executive Secretary of NAFO constitute the Executive Committee.

4. Members of Publications Committee

| | |
|---|---|
| Dr R. G. Halliday (Chairman) | Mr A. T. Pinhorn (Canada) |
| Mr P. Kolarov (Bulgaria) | Dr V. A. Rikhter (USSR) |
| Dr J. Messtorff (EEC) | The Executive Secretary |
| Mr J. P. Minet (EEC) | |

## VII. ADJOURNMENT

The Chairman thanked the participants for their cooperation during the course of this first Annual Meeting of the Council, noting that excellent progress had been made in the transition from ICNAF to NAFO. He also expressed the gratitude of the Council for the efficient work of the Secretariat. The meeting adjourned at 1500 hours on 7 June 1979.

# APPENDIX I. REPORT OF STANDING COMMITTEE ON PUBLICATIONS (STACPUB)

Chairman: R. G. Halliday

Rapporteur: V. M. Hodder

The Committee met at Montreal, Canada, on 5 June 1979, to consider matters referred to it by the Scientific Council (Agenda item 9). All members of the Committee, as confirmed by the Scientific Council, were present (see page 18).

## 1. NAFO Scientific Publications

With reference to future publications relating to research and statistics, the Chairman noted that participants in recent meetings of ICNAF's Standing Committee on Research and Statistics (STACRES) had indicated the desirability of maintaining continuity in the numbering and general format of publications relating to research and statistics in the Northwest Atlantic. The Committee generally agreed with this suggestion and proceeded to review all of the current publications with a view to deciding which of the publication series needed immediate decisions on their continuation and general format and which could be deferred for consideration at the 1980 Annual Meeting. The question of the numbering of NAFO publication series was discussed and it was unanimously agreed that the numbering should run consecutively from those of ICNAF, in order to maintain continuity of similar ICNAF and NAFO publication series. The following publications were considered essential to the work of the Scientific Council, but final agreement on the name and general format of some of these was deferred to the 1980 Annual Meeting.

### a) Statistical Bulletin

The first issue for NAFO will contain fisheries statistics for the calendar year 1979 to be reported by Member States on NAFO STATLANT 21A and 21B forms in the first half of 1980. This issue will be numbered "Vol. 29", with a note on the title page of each continuing volume indicating that Vol. 1 to 28 were issued as ICNAF Statistical Bulletins. The color of the cover will be blue.

### b) Sampling Yearbook

The first issue for NAFO will contain lists of sampling data for 1979 to be reported by Member States in 1980 in accordance with the sampling requirements of the Scientific Council. This issue will be numbered "Vol. 24", with a note on the title page of each continuing volume indicating that Vol. 1 to 23 were issued as ICNAF Sampling Yearbooks. The color of the cover will be yellow.

### c) Selected Papers

It was agreed that No. 6 of this series, containing papers based on research documents presented to 1979 Meetings of ICNAF and expected to be published in early 1980, will be issued as "*ICNAF Selected Papers* No. 6", and that a final decision on the continuation of this series for NAFO, including the name and numbering, will be made at the 1980 Annual Meeting.

### d) Research Bulletin

Since the 1980 issue of this primary publication series is not expected to be ready for printing until late in 1980, it was agreed to defer the decision on the name and numbering of this series until the 1980 Annual Meeting. However, the Secretariat was requested to proceed wtih the processing of refereed papers under the assumption that there will be a primary NAFO research periodical. If sufficient papers are received during the latter part of 1979 to warrant publication in advance of the 1980 Annual Meeting, it was suggested that the Bulletin be issued as an ICNAF publication.

### e) Reports of Scientific Council Meetings

It was noted that *ICNAF Redbook* 1979, containing the reports of ICNAF scientific meetings in 1978/79, will be issued as usual in August 1979. It was agreed that a similar publication will be required for the reports of the Scientific Council and its Committees. However, since these reports for 1979 will consist of only a few pages in a bound volume, it was agreed to defer publication of the 1979 reports and include them with the 1980 reports in a single volume. The name and numbering of this series was, therefore, deferred to the 1980 Annual Meeting.

### f) List of Fishing Vessels

Since the next triennial volume of this series (for 1980) would not normally be issued until 1981, it was agreed to defer consideration of the need for this series until the 1980 Annual Meeting.

2. Scientific Council Meeting Documents

The Committee unanimously agreed to the need for "Research Document" and "Summary Document" series, starting in 1980, and further agreed that the ICNAF practice of numbering (i.e., year, month, and consecutive number) and title page colors (yellow and blue) be retained. The "Research Document" series will be used for scientific contributions from individual scientists. The "Summary Document" series will be used for the distribution of reports of scientific meetings and Secretariat reports on research and statistical matters. It was noted that the Summary Document series would serve as the medium of communication of Scientific Council matters to the Fisheries Commission and the General Council.

3. Editorial Policy Relating to Publications

The Committee agreed that, since most of the publications to be issued prior to the 1980 Annual Meeting will be issued as ICNAF publications, consideration of matters relating to editorial policy should be deferred to the 1980 Annual Meeting.

4. Adjournment

The Chairman thanked the members for their participation in this first meeting of the Committee on Publications and adjourned the meeting at 1900 hours on 5 June 1979.

# PART C

REPORT OF SCIENTIFIC COUNCIL

Special Meeting, November 1979

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# REPORT OF SCIENTIFIC COUNCIL

Special Meeting, November 1979

Chairman: R. H. Letaconnoux Rapporteur: V. M. Hodder

The Council met at NAFO Headquarters, Dartmouth, Canada, during 13-16 November 1979, to provide advice for 1980 on conservation of the shrimp stocks in Subareas 0 and 1 and the harp and hooded seal stocks in the Convention Area. Representatives attended from Canada, European Economic Community (EEC), Faroe Islands and Norway, and an observer was present from United States of America (see Part H, this volume).

The stock assessments were undertaken by the Standing Committee on Fishery Science (STACFIS), whose report, as approved by the Council, is Appendix I. The lists of research and summary documents reviewed at this meeting are given in Part H of this volume. Brief summaries of the shrimp and seal assessments and other matters considered by the Council are given below.

## I. FISHERY SCIENCE (APP. I)

### 1. Assessment of Shrimp Stocks in Subareas 0 and 1

In 1978, the offshore shrimp fishery in Subareas 0 and 1 was regulated by an overall TAC of 40,000 tons of which only about 27,000 tons were taken. The offshore fishery in 1979 was regulated by an overall TAC of 29,500 tons. Preliminary catch statistics for January-October 1979 indicate that the total catch in the management areas was about 22,300 tons. Information presented at this meeting confirms that the major part of the biomass in Div. 1B from July to October 1979 was found at the northwestern slopes of Store Hellefiske Bank, with a dominance of small shrimp (immature and males) on the shallower (150-200 m) parts of the Bank.

New information on the biology of shrimp relates to variation by depth and area in the distribution of various size groups, to diurnal variation in catch per effort due to vertical migration, to studies of modes in length frequencies as representing age-groups, and to studies of variation by area of the spawning/hatching rate of females.

For advising on the total allowable catch for 1980, all information available on biomass estimates, trends in catch rates, and composition of the stock was taken into consideration. There was good correspondence between the biomass estimates based on data from the two trawl surveys in 1979. The 1979 biomass estimates for the area between 66°N and 69°N were not very different from the estimates based on trawl survey data for the same area in 1976. However, the 1979 surveys used trawls with smaller meshes and thus caught relatively more small and medium-sized shrimp. Consequently, biomass in this area seems to be somewhat lower in 1979 than in 1976. It was generally agreed that a decrease in biomass had occurred over the period 1976 to 1978 as reported at the November 1978 Meeting. Catch rates also decreased over the same period. It is more difficult to compare catch rates in 1978 with those available for part of 1979, but the overall level of catch rates between the two years does not seem to differ significantly. At the same time, some changes seem to have occurred in the size composition of the stock with an increase (relatively as well as absolutely) in the number of small and medium-sized shrimp. Taking all of these factors into consideration, the Scientific Council advises that the overall TAC for the offshore shrimp grounds in Subarea 1 and adjacent parts of Subarea 0 in 1980 should remain at the same level as in 1979 (29,500 tons).

In view of the relatively low biomass of shrimp estimated for Div. 0B off Baffin Island and the very low catch rates, it was decided that advice on total allowable catch for this area was not necessary.

Although more information is gradually becoming available on the distribution and abundance of pre-recruit shrimp, knowledge about recruitment is still not good enough to allow more detailed forecasts of stock size and distribution. However, a review of the situation at the May-June 1980 meeting of the Scientific Council could be made if desired. The Council endorsed the recommendations of STACFIS regarding future research on shrimp (see Appendix I).

### 2. Assessment of Seal Stocks

#### a) Harp seals

A reanalysis of all available information shows that mean age of sexual maturity has declined from 6.2 years in the early 1950's to 4.3 years in 1979, while fertility rate has shown a corresponding increase from 0.85 to 0.94 during the same period. Since no new estimate of natural mortality was available, the previously estimated value of 0.10 has been used in this assessment.

A 1979 rag-recapture study provides a reliable estimate of 203,000 for the pup production at the Front, with 95% confidence limits of 174,000 and 239,000. An additional 20,000 pups may be added to account for a smaller southern patch, the size of which was estimated by eye. Since previous aerial survey data show that, on the average Gulf production is 0.375 of total production, the total Gulf and Front production for 1979 is estimated at 352,000 pups. Other estimates of pup production from both 1978 and 1979 tag-recapture studies are considered unreliable owing to various biases in the data.

The survival index method gives an estimate of pup production for mid-year 1973 of 342,000 pups, with 95% confidence limits of 267,000 and 625,000. This simple and reliable method of estimation, which depends on a wide spread of catch figures, will soon become inapplicable owing to the low variability of recent pup kills.

Recoveries of tagged harp seals show that homing increases with age. For animals aged 5 years and up, 12 of 16 recoveries (75%) have come from the area of birth.

Cohort analyses, based on the mean estimate of pup production from the 1979 tagging experiment (352,000) and on its lower confidence limit (304,000), give estimated age 1+ population sizes in 1979 of 1.38 and 1.26 million respectively. The mean value of 352,000 is considered to be the best estimate of 1979 pup production, since it agrees well with updated estimates derived from the aerial survey (320,000 for 1977) and from the survival index method (342,000 for 1973).

Population projections to 1985, based on an annual catch of 180,000 seals, indicate an instantaneous rate of increase for age 1+ seals of 0.02 per year for a 1979 pup production of 352,000 and 0.01 per year for a 1979 pup production of 304,000. Pup production in 1985 is estimated at 397,500 in the first case and 339,400 in the second.

With a mean whelping age of 5.3 years and fertility rate of 0.94, and assuming a continuing catch of 180,000 per year (80% pups, 20% age 1+ seals), sustainable yields are estimated to be 237,000 and 205,000 respectively for 1979 pup productions of 352,000 and 304,000. Replacement yield, based on the best estimate of pup production (352,000), is estimated at 205,400.

The catch in West Greenland attained a level near 10,000 seals in 1978 and appears to be increasing. Since a further catch of about 2,000 per year is taken in Arctic Canada, consideration should be given to increasing the exemption for arctic catches from 10,000 to 15,000 seals in 1980.

b) Hooded seals

No new analyses of age and reporductive samples were available, the most recent being those presented at the November 1978 meeting (ICNAF Res. Doc. 78/IX/91). Analysis of catch/effort data for the Front in 1979 was unsuccessful due to rapid changes in catchability of pups which enter the water at an early age compared to harp seals.

There is no new basis for revising the assessment presented in November 1978 (*ICNAF Redbook* 1979, page 13). STACFIS therefore advises that the TAC for hooded seals at the Front should remain at 15,000 for 1980, with the kill of adult females limited to 5% of the TAC.

c) Future research

The Scientific Council endorsed the recommendations of STACFIS regarding future research on harp and hooded seals (see Appendix I). The Council also noted the interest of STACFIS in obtaining information on biological responses of the White Sea population of harp seals to protection, requested the Secretariat to seek premission from the Northeast Atlantic Sealing Commission for the use of any relevant information in the national research reports submitted to that Commission by its members.

## II. OTHER MATTERS

1. Future Meetings

The Council reviewed the scheduling of meetings for the first half of 1980 and confirmed the following:

a) A special meeting of the Council will be held in Lisbon, Portugal, during 5-13 February 1980, to provide scientific advice for management in 1980 of the cod stocks in Div. 3M and 3NO, the capelin stocks in Div. 2+3K and 3LNO, the silver hake stock in Div. 4VWX, and the squid stocks in Subareas 3 and 4.

b) The regular meeting of the Council will be held at NAFO Headquarters, Dartmouth, Canada, during 3-13 June 1980, in conjunction with its three Standing Committees: Fishery Science (STACFIS), Research Coordination (STACREC), and Publications (STACPUB).

2. Reporting of Statistics from Cooperative Arrangements

The Assistant Executive Secretary briefly reviewed SCS Doc. 79/XI/1, which outlined the problems encountered by the Secretariat in documenting fishery statistics for 1977 and 1978 due to confusion regarding the reporting of statistics from cooperative arrangements between coastal states and other countries. He indicated that arrangements were being made with the Secretary of the CWP (Coordinating Working Party on Atlantic Fishery Statistics) to have specific instruction for the reporting of such statistics included in the "Notes for Completion of STATLANT 21A and 21B Forms", to facilitate the reporting of 1979 statistics.

## III. ADJOURNMENT

The Chairman thanked the participants for their cooperation during the course of this special meeting and expressed his appreciation to the Secretariat staff for their hospitality and efficient support. The meeting adjourned at 1200 hours on 16 November 1979.

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

Chairman: G. H. Winters

Rapporteurs: Various

The Committee met at NAFO Headquarters, Dartmouth, Canada, during 13-15 November 1979, to consider and report on matters referred to it by the Scientific Council (Agenda item 2), namely to assess the status of the shrimp stocks in Subareas 0 and 1 and the harp and hooded seal stocks in the Northwest Atlantic. Scientists attended from Canada, European Economic Community (EEC), Faroe Islands, Norway and United States of America (USA).

In considering the relevant agenda items (Part H, this volume), the Committee agreed that the assessments of shrimp and seals be carried out in two working groups which met concurrently. Consequently, the *ad hoc* Working Group on Shrimp (convened by Mr Ø. Ulltang, with Mr Sv. Aa. Horsted as rapporteur) and the *ad hoc* Working Group on Seals (convened by Dr A. W. Mansfield, with Mr D. E. Sergeant as rapporteur) met during 13-15 November, and their reports as approved by STACFIS are given in Sections I and II below.

## I. ASSESSMENT OF SHRIMP IN SUBAREAS 0 AND 1

### 1. Fishery Trends

The nominal catch of shrimp in Subareas 0 and 1 (Table 1) increased rapidly from less than 10,000 tons prior to 1973 to 50,000 tons in 1976 and declined to 34,500 tons in 1978. The offshore shrimp fishery has been regulated by total allowable catches since 1977. The total nominal catch for Subarea 1 in 1977 was 41,600 tons, of which 33,800 tons were taken in the offshore fishery against a total allowable catch (TAC) of 36,000 tons. In 1978, the offshore fishery in Subareas 0 and 1 was regulated by an overall TAC of 40,000 tons of shrimp, of which only about 27,000 tons were reported from the offshore grounds in both areas. In addition, about 7,600 tons of shrimp were taken in the inshore fishery in Subarea 1. The offshore fishery in 1979 was regulated by an overall TAC of 29,500 tons for Subareas 0 and 1. Preliminary catch statistics for January-October 1979 indicate that the total catch in the management areas (Subarea 0 and offshore grounds in Subarea 1) was about 23,200 tons, with the inshore catch in Subarea 1 being about 7,500 tons.

Table 1. Nominal catches (metric tons) of shrimp (*Pandalus borealis*) in Subareas 0 and 1[1].

| Area | Country | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979(Oct)[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| SA 0 | CANADA | - | - | - | - | - | - | - | - | 198[3] |
| | DEN-G | - | - | - | - | - | - | - | - | 329 |
| | DEN-M | - | - | - | - | - | - | 68 | 86 | 35 |
| | FAROES | - | - | - | - | - | - | 239 | - | 183 |
| | FRA-M | - | - | - | - | - | - | - | 21 | 42 |
| | NORWAY | - | - | - | - | - | 65 | 150 | 15 | 154 |
| | SPAIN | - | - | - | - | - | 327 | - | - | - |
| | TOTAL | - | - | - | - | - | 392 | 457 | 122 | 941 |
| SA 1 | CANADA | - | - | - | - | - | - | - | - | 910[3] |
| | DEN-G (a)[4] | 8,741 | 7,342 | 7,950 | 10,064 | 8,700 | 7,300 | 7,800 | 7,600 | 7,500 |
| | (b) | 200 | 150 | 185 | 180 | 1,089 | 2,478 | 7,081 | 5,531 | 12,161 |
| | DEN-M | - | - | 196 | 308 | 1,142 | 2,717 | 5,842 | 3,382 | 1,314 |
| | FAROES | 496 | 755 | 1,371 | 2,023 | 5,300 | 11,179 | 12,612 | 8,070 | 3,841 |
| | FRA-M | - | - | - | - | - | 803 | 924 | 805 | 303 |
| | FRG | - | - | - | - | - | - | 31 | - | - |
| | JAPAN | - | - | - | - | - | 146 | - | - | - |
| | NORWAY | - | 1,409 | 2,940 | 5,917 | 8,678 | 11,658 | 7,353 | 8,959 | 3,767 |
| | SPAIN | - | - | - | - | 6,948 | 6,925 | - | - | - |
| | USSR | - | - | - | 3,517 | 6,033 | 6,468 | - | - | - |
| | TOTAL | 9,437 | 9,656 | 12,642 | 22,009 | 37,890 | 49,674 | 41,643 | 34,347 | 29,796 |
| | OFFSHORE | 696 | 2,314 | 4,692 | 11,945 | 29,190 | 42,374 | 33,843 | 26,747 | 22,296 |

1 Statistics for 1971-78 pertain to ICNAF Statistical Area 0 and Subarea 1, and for 1979 to the new NAFO Subareas 0 and 1.
2 Preliminary statistics to end of month indicated.
3 Canadian data include catches from cooperative arrangements with other countries.
4 a = inshore, b = offshore catches.

2. Distribution (SCR Doc. 79/XI/5, 6, 7, 8, 9)

The papers presented at this meeting generally did not consider possible distribution of shrimp in areas other than those already known to be shrimp grounds. However, more detailed information on variation of shrimp density and size composition by depth and by fluctuations in temperature was reported.

Information from the two surveys carried out by Canada (SCR Doc. 79/XI/7) and France (SCR Doc. 79/XI/6 and 8), as well as analysis of data from the commercial fisheries, again showed a seasonal northward shift of the fishery but also a continuation of the between-years northward displacement of the areas of the heaviest concentrations of shrimp. It was noted that the quota of 3,000 tons set aside for the area north of 68°N latitude in the Greenland fishing zone was taken by the beginning of June, so that no commercial data were available for that area after that time. However, most fishing took place just south of 68°N latitude, indicating that the best concentrations occurred in this area. The surveys confirm that the major part of the biomass in Div. 1B was found at the northwestern slopes of Store Hellefiske Bank at depths between 200 and 400 m. The results of the Canadian survey indicate that, at the time of the survey, approximately 25% of the shrimp biomass observed between 66°N and 68°30'N occurred in Subarea 0. The distribution of shrimp seems, to a great extent, to be determined by hydrographic conditions. Both surveys show the major concentrations in water of 2° to 4°C temperatures with maximum concentrations in 3° to 4°C temperatures.

Earlier investigations have not shown any pronounced tendency to a variation of size distribution of shrimp with depth in the offshore area. However, the surveys in 1979 clearly show a dominance of small shrimp (immatures and males) on the shallower part (150-200 m) of the slopes of Store Hellefiske Bank, where males dominated in some of the samples down to a depth of 300 m. The photographic surveys showed the occurrence of small shrimp in both shallow and deep water. As was the case (for the first time) in 1978, small shrimp were again observed at some of the stations north of Store Hellefiske Bank and in Div. 1A. Also, some variation in the ovigerous/non-ovigerous ratio of females occurs from area to area.

3. Biology (SCR Doc. 79/XI/6, 7, 8)

New information on the biology of shrimp relates to variation by depth and area in the distribution of size groups (see preceding paragraph), to diurnal variation in catch per effort due to vertical migration, to studies of modes in length frequencies as representing age-groups, and to studies on variation by area of the female spawning/hatching rate.

Diurnal variation of shrimp is well documented (e.g. see *ICNAF Selected Papers* No. 4) and has to be taken into account when using catch per unit effort as stock abundance indices. A specific study during the Canadian survey (SCR Doc. 79/XI/7) indicates that catch per unit effort may vary by a factor as high as 9 and that the optimum catches may be in the early afternoon rather than centered around noon. However, the estimates of conversion factors are variable and they should be applied with caution.

A cooperative study by Canadian and French scientists (SCR Doc. 79/XI/8) indicates that grouping of carapace length, measured by tenths of a millimeter, into 0.3-mm classes with running average of three leads to modes in the length frequency diagram that may be interpreted as age-groups. From these data and those presented in SCR Doc. 79/XI/7, at least three age-classes of juveniles and males are well defined, while there is only one group of females which represents an age-class accumulation.

The 1979 surveys indicate that the period of spawning extended into October which is later than formerly observed for the inshore stocks. This phenomenon may be ascribed to different environmental (temperature) conditions. However, a striking difference was observed between the Div. 0B and Div. 1B samples, the former containing many more large non-spawning females than the latter in which almost all females were spawning.

4. Catch and Effort (SCR Doc. 79/XI/2, 5, 7)

Catch and effort data were available for Canadian, French, Greenland and Norwegian vessels based on logbook information (haul-by-haul) and limited data on catches for Faroese vessels. In addition, part of the information presented by Canada and Norway was obtained by observers on commercial vessels.

The Norwegian data (SCR Doc. 79/XI/2) indicate some increase in catch rate in Div. 1C and 1D from 1978 to 1979, whereas in Div. 1B there was a slight peak in catch rate during the early months of 1979 in contrast to no peak in the early months of 1978. The lack of a peak in 1978 may be attributed to ice conditions in that year, making direct comparison of catch rates in the two years difficult. However, the data up to August 1979 indicates no significant change in overall catch rate between the two years.

The French data (SCR Doc. 79/XI/5) provided details on monthly distribution of effort and catch for two trips by one vessel in 1979, but comparison with 1978 data was not possible due to the different distribution of fishing in the two years.

Data for the Greenland trawlers show their catch rate in the first part of 1979 to be higher than in 1978, when fishing operations were hampered by ice. The annually observed decrease in catches in the last part of the year occurred somewhat earlier in 1979 than in 1978, but data so far available do not indicate any significant change in overall catch rate from 1978 to 1979. However, when comparing only the July-August-September period, when ice is no hindrance and when shrimp may be more evenly distributed than earlier in the year, the Greenland data indicate a decrease in catch rate of about 20% from 1978 to 1979.

5. Biomass Estimates (SCR Doc. 79/XI/5, 6, 7, 9)

Biomass estimates were arrived at on the basis of the results of the Canadian and French surveys (SCR Doc. 79/XI/7 and 6 respectively) and of the Danish photographic survey (SCR Doc. 79/XI/9). Also, French commercial data were used to assess biomass in the same areas as those covered by the French survey.

Data from the 1979 photographic survey in Div. 1B and the adjacent part of Div. 1A are very limited due to bad weather conditions during the survey and due to a malfunction of the equipment. The data generally show higher densities of shrimp than in 1978, but it is not possible to draw firm conclusions from the 1979 photographic survey, because of the limited number of photographs, the large difference in density at two stations within one of the most important strata, and the difference in coverage between the two years. However, the photographic surveys seem to indicate a change in size composition of shrimp during the 1977-79 period. Small and medium-sized shrimp are more numerous (relatively as well as absolutely) on the 1979 photographs than on those for 1978 and 1977.

In discussing the results of the trawl surveys, some new information was presented (SCR Doc. 79/XI/7) indicating that the opening of the trawl used was over-estimated in previous calculations of the area swept. Investigations based on acoustic instrumentation show that the width of a Sputnik 1,600 mesh trawl is approximately 22 m. However, the effect of the trawl doors and bridles on fishing for shrimp is not well known, so that the path effectively fished may be somewhat wider than the width of the trawl. The new information indicates that previous biomass estimates may have been underestimated.

There is a good correspondence between the shrimp biomass estimates based on the data from the two trawl surveys in 1979. Using a 30-m trawl opening, the biomass between 66°N and 69°N is estimated to be about 45,000 tons, whereas the estimate is about 62,000 tons for a trawl opening of 22 m. This is not very different from the trawl survey estimate for the same area in 1976 (55,000 tons). It was noted, however, that the 1979 surveys used trawls with smaller meshes which caught relatively more small and medium-sized shrimp than in 1976. Therefore, biomass in this area may be somewhat lower in 1979 than in 1976. It was again pointed out that the biomass estimates are minimum estimates due to the assumption that all shrimp over the swept area are being caught. It should be noted that the area north of 69°N and east of 55°W, which was fished extensively in early 1979, was not covered by either of the trawl surveys or by the photographic survey.

For the shrimp grounds in Div. 0B off Baffin Island, the biomass estimated from the French survey is about 3,000 tons in 1979, which is about the same level as the estimate for 1977.

6. Total Allowable Catch

In advising on the total allowable catch for 1980, all information available on biomass estimates, trends in catch rates, and composition of the stock was taken into consideration. It was generally agreed that a decrease in biomass had occurred over the period from 1976 to 1978, as was indicated at the November 1978 Meeting (*ICNAF Redbook* 1979, pages 15-20). Catch rates also decreased over the same period. It is more difficult to compare catch rates in 1978 with those available for part of 1979 due largely to the effect of severe ice conditions in 1978, but the overall level of catch rate between the two years does not seem to differ significantly. However, some changes seem to have occurred in the size composition of the stock, this being reflected in the size composition of the landings of Greenland trawlers but not to the same extent in Norwegian catches. There are indications that the change in size composition is not only a relative change, as the photographic and trawl surveys point to some increase in the number of small and medium-size shrimp. Temperatures and the absence of cod as a predator on the main shrimp grounds seemed to provide optimum conditions for shrimp in 1979. Taking all of these factors into consideration, STACFIS advises that the overall TAC for the offshore shrimp grounds in Subarea 1 and adjacent parts of Subarea 0 in 1980 could be at the same level as in 1979 (29,500).

STACFIS noted that nearly all of the information presented at this meeting related to the area between 66°N and 69°N. The limited Norwegian catch and effort data from Div. 1D and 1C indicate a

stable or possibly somewhat improved fisheries situation on the grounds in these divisions from 1978 to 1979. It is considered likely that a proportion of the overall TAC will be caught in these divisions, but, as formerly, advice for a breakdown of the TAC by areas could not be provided.

As indicated in previous reports, it is likely that some interrelationships, probably varying between years, exist between the shrimp stock in Disko Bay and that in the offshore waters adjacent to Disko Bay. It was noted that this has led to protective measures by allowing only a small part of the overall TAC for the offshore grounds to be taken in the Greenland fishing zone in an area north of 68°N latitude. It was pointed out that, if the observed northward displacement of the best concentrations continues, a relatively higher proportion than previously of the overall catch would likely occur around 68°N latitude, if fishing were freely distributed. If the protective measures are maintained, it is therefore likely that the greater part of the fishery may occur as close to the border line as possible.

In its consideration of the advice, STACFIS noted that, although more information is gradually becoming available on distribution and abundance of pre-recruit shrimp, knowledge about recruitment is still not good enough to allow more detailed forecasts of stock size and distribution. However, since much of the important data are collected and the data base updated continuously, STACFIS agreed that it would be possible to review the situation at the June 1980 Meeting of the Scientific Council, if this was desired by the regulatory authorities.

In view of the relatively low biomass estimated for Division 0B off Baffin Island and the very low catch rates evident from the French survey, it was decided that advice on total allowable catch for this area was not necessary.

7. Discarding of Shrimp (SCR Doc. 79/XI/2, 7)

Reports on discards of shrimp by observers on Norwegian vessels and vessels chartered by Canada were presented. The Norwegian observations indicated a discard rate of 6.5% for 1979, while the Canadian observations indicated low rates of discard varying between 2% and 10%. It was discussed whether the price differential between small and large shrimp influences the discard rate. If individual vessels have a limited quota, these vessels may search for those parts of the grounds where catches are composed mainly of large shrimp. This would result in a very low discard rate. On the other hand, in a situation where very high catch rates occur on a stock of a more mixed structure, fishing may take place there with a high discard rate if large shrimp are caught in sufficient numbers to occupy the vessel's capacity of daily production. The discard problem seems to be negligible for those trawlers landing iced shrimp for land-based production.

8. By-Catch in the Shrimp Fishery (SCR Doc. 79/XI/2, 6, 7)

The major by-catch in the shrimp fishery continues to be small redfish and, to a lesser extent, Greenland halibut and American plaice, while very few cod are observed in the shrimp catches north of 66°N. Norwegian data for the years 1976-79 show a mean by-catch of between 0.8 and 1.8 fish per kg of shrimp caught. The French survey (SCR Doc. 79/XI/6) shows high variation in by-catch between hauls and areas, the by-catch of redfish in Subarea 0 being much less than in Subarea 1. Canadian observations also show large haul-to-haul variation with by-catches, mainly small redfish, ranging from 12% to 21% of the total catches.

9. Future Research Requirements

The value of having trawl surveys with good coverage of the total area was clearly demonstrated at this meeting. Also, the value of photographic surveys was stressed, especially if carried out in conjunction with trawl surveys. STACFIS, therefore,

recommends (1)

*i) that extensive stratified trawl surveys be carried out in the whole area of shrimp distribution in Subarea 1 and the adjacent parts of Subarea 0, in order to establish a time series of comparable observations;*

*ii) that stratified photographic surveys be continued and intensified and, as far as possible, be combined with trawl hauls; and*

*iii) that the observer program to closely monitor the shrimp fishery on a year-round basis be continued.*

STACFIS discussed whether the use of more than one survey vessel would result in better coverage simultaneously or whether vessels obtained better information by observing at various times of the year. The latter was thought to provide the most useful information but requires coordination between the laboratories engaged. Coordination is also needed to standardize gear and methods.

## II. ASSESSMENT OF SEAL STOCKS

1. Harp Seals (SCR Doc. 79/XI/1, 3, 4, 10, 12, 13)

a) Research in 1979

Canada reported on estimates of pup production from tagging and recapture and from survival indices and catch and effort analysis (SCR Doc. 79/XI/3, 4), on maturation and fecundity rates at different population sizes (SCR Doc. 79/XI/1), on population size and sustainable yield (SCR Doc. 79/XI/12), and on differential migrations and mixing of Gulf and Front herds (SCR Doc. 79/XI/3). Denmark presented catch statistics and age composition data for Greenland in recent years (SCR Doc. 79/XI/10), and a synopsis of tag recoveries in Greenland from 1949 to date (SCR Doc. 79/XI/13). Norway presented statistics for the 1979 Norwegian catch at the Front and recorded its participation in Canadian field studies at the Front in 1979.

b) Population assessment

i) Vital rates

Mean age at sexual maturity was recalculated using the method of DeMaster (1978)[1] to be 4.3 years. After reviewing a reanalysis of all available information (SCR Doc. 79/XI/1); it was agreed that mean age of sexual maturity has declined significantly from 6.2 to 4.3 years during a period of overall population decrease from 1951 to 1979. Although there are no empirical data to substantiate density-dependence, this relationship is supported by the existence of an increase in age at sexual maturity in the increasing White Sea population (Nazarenko, 1975)[2].

Fertility rate has also now been shown to have increased from 0.85 to 0.94 parallel with population decline, using data from late pregnancy. Ovulation rates have remained constant, as measured early in the reproductive cycle, so that the reproductive potential of the stock has not been impaired.

There were no new analyses of natural mortality (M), and it was therefore agreed to accept the previously calculated value of 0.10 (*ICNAF Redbook* 1979, page 11).

ii) Pup production

Only one reliable estimate emerged from a mark-recapture experiment at the Front in 1979 (SCR Doc. 79/XI/4). The result gave an estimated pup production on the Front of 203,000, with 95% confidence limits of 174,000 and 239,000. An additional 20,000 pups were added to account for a small southern patch, the size of which was estimated by eye. The total production on the Front in 1979 was therefore approximately 220,000 pups. If, as indicated from past aerial survey data, that Gulf production remains at 0.375 of the total, total production in 1979 is estimated at 352,000 pups (SCR Doc. 79/XI/3, 12).

Reanalysis of the 1978 mark-recapture experiment (SCR Doc. 79/XI/3) indicated that estimates of pup production were likely to be biased and therefore unreliable, due to non-random mixing of tagged and untagged pups in the landsmen's catch. An estimate of Gulf production in 1979 was not possible because of the low number of tag recoveries from the beater hunt. An estimate of production was also presented using tag recoveries from one-year-olds in 1979. This estimate of 589,000 pups may be optimistic and is thought to be biased due to incomplete sampling of age 1 animals in the landsmen's catch.

The survival index method, based on a predictive regression for the 1970-77 year-classes, gave an estimate of production for mid-year 1973 of 342,000 pups, with 95% confidence limits of 267,000 and 625,000 (SCR Doc. 79/XI/3). Since catch figures for this period are precise, a predictive regression is appropriate. This method assumes that both production and population are stable, but the use of a narrow range of years reduces potential bias. It was noted that this method of estimation, depending on a wide spread of catch figures, will soon become inapplicable due to low variability of recent pup kills.

iii) Stock relationships

Tag recoveries by area were analyzed for harp seals marked in the Gulf of St. Lawrence from

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1 DeMaster, D. P. 1978. Calculation of the average age of sexual maturity in marine mammals. *J. Fish. Res. Board Can.*, 35: 912-915.

2 Nazarenko, Y. I. 1975. Sexual maturation, reproductive rate, and missed pregnancy in female harp seals. *Rapp. P.-v. Réun. Cons. int. Explor. Mer*, 169: 413-415.

1966 to 1978 (SCR Doc. 79/XI/3). Homing was found to increase with age. For animals aged 5 years and up, there are 16 recoveries, of which 12 (75%) came from the area of birth.

iv) Population size and sustainable yield in 1979

Utilizing an updated catch-at-age matrix and a selectivity curve based on the 1979 moulting sample, cohort analyses for the period 1960-79 were carried out under two assumptions of the size of the 1979 pup production: (a) the mean (352,000), and (b) the lower confidence limit (304,000) of the 1979 tagging experiment. The mean value of 352,000 is considered to provide the best estimate of 1979 pup production, since it agrees well with previous estimates, which were derived from the 1977 aerial survey at the Front adjusted by the Front/Gulf production ratio (320,000), and from the survival index for mid-year 1973 (342,000), updated for trends in pup production based on cohort analysis. The age 1+ population size in 1979 ranged from 1.23 to 1.38 million for assumptions (b) and (a) respectively.

The estimated age composition of the population in 1979 depended on the 1979 sample of moulting seals. Two methods were used to check the accuracy of this age composition: the first recalculated the age composition, using information from survival indices for each of the first nine year-classes; and the second compared the relative age composition from cohort analysis in 1974 with a moulting sample obtained in that year and found no great selectivity except in age-group 1. Neither method showed gross differences in age composition from that obtained for 1979.

Populations were projected to 1985, using the two levels of pup production in 1979 referred to above. The projections assume the following: (a) M = 0.10; (b) fertility rate = 0.94; (c) most recent maturity ogive; (d) no density-dependence in parameters; (e) hunting mortality is distributed over the age-groups as in 1979; and (f) a yearly catch of 180,000 animals of which 80% are pups and 20% are age 1+ seals. Under these conditions and using the population age structure from a cohort analysis that produces 352,000 pups in 1979, the age 1+ population increases at an instantaneous rate of 0.02 per year. If pup production in 1979 is about 304,000, the age 1+ population increases at an instantaneous rate of only 0.01 per year. Pup production increases from 352,000 in 1979 to 397,500 in 1985 in the first case and from 304,000 to 339,400 pups in the second case.

With mean whelping age of 5.3 years and fertility rate of 0.94, the equilibrium sustainable yields were calculated to be 237,000 animals (80% pups) and 205,000 animals (80% pups) for 1979 pup productions of 352,000 and 304,000 respectively. These sustainable yield estimates assume a stable age distribution and a population in equilibrium. Since all evidence indicates that the population is increasing, these estimates are low. The replacement yield based on the best estimate of pup production (352,000) was estimated to be 205,400.

In considering TACs, it should be noted that arctic catches of harp seals have been assumed to be stable and less than 10,000 animals in recent years. However, estimates of catch for West Greenland in 1975-1978, adjusted for incomplete reporting, show that the catch is increasing and has reached a level of nearly 10,000. To this catch must be added about 2,000 animals caught annually in Arctic Canada. STACFIS therefore

recommends (2)

*that the exemption for arctic catches should be increased to a level of 15,000 harp seals in 1980.*

c) Future research

In order to improve the basis for assessment of the harp seal stocks, STACFIS

recommends (3)

*i) that another large-scale tagging experiment should be carried out, with efforts made to tag in all major whelping patches;*

*ii) that arctic catch statistics be improved and that data be collected on sinking losses in arctic hunting; and*

*iii) that further studies of food and feeding, and a wider study of animal condition throughout the annual migratory cycle be carried out.*

STACFIS considered that a review of information on biological responses of the White Sea population of harp seals to protection would be extremely valuable. It was agreed that a scientist be

designated to review the Norwegian and USSR literature and that permission be obtained from the Northeast Atlantic Sealing Commission to make use of relevant national reports submitted to the Commission by its members.

2. Hooded Seals (SCR Doc. 79/XI/10)

a) Research in 1979

Although considerable collections of jaws have been made of whelping, moulting and migrating animals, analyses have not been completed. Canada reported an attempt at daily catch/effort analysis at the Front by Leslie's method, which proved unsuccessful due to rapid changes in catchability of hooded seal pups which here enter the water at an early age compared to harp seal pups.

b) Stock assessment

Since no new data were available, there was no basis for revising the assessments made at the November 1978 Meeting (*ICNAF Redbook* 1979, pages 11-14). STACFIS, therefore, advises that the TAC for hooded seals should remain at 15,000 for 1980. It was also noted that in 1979 the target figure for kill of adult females (5% of total kill) was achieved and advises that this conservation measure be maintained.

c) Future research

In order to improve the basis for assessment of the hooded seal population, STACFIS

recommends (4)

*i) that analyses of material and data on fecundity, maturity and age composition be completed as soon as possible;*

*ii) that a review of existing knowledge on interrelationships of stocks of hooded seals be completed as soon as possible; and*

*iii) that detailed catch/effort data be collected from year to year at the Front.*

It should be noted that the hooded seal stocks living in the NAFO and the Northeast Atlantic Sealing Convention areas may be related, so that the research recommended in (i) and (ii) includes work on material collected outside the NAFO Convention area.

## III. ACKNOWLEDGEMENT

There being no further business, the Chairman expressed his thanks to all participants, especially the conveners and rapporteurs of the working groups, for their interest and cooperation during the course of the meeting, and to the Secretariat for their usual efficient work.

# PART D

## REPORT OF SCIENTIFIC COUNCIL

Special Meeting, February 1980

CONTENTS

# REPORT OF SCIENTIFIC COUNCIL

Special Meeting, February 1980

Chairman: R. H. Letaconnoux Rapporteur: V. M. Hodder

The Council met at Lisbon, Portugal, during 5-13 February 1980, to provide advice for 1980 on the conservation of certain stocks for which management measures had been deferred from the 1979 Annual Meeting (*NAFO Proceedings* 1979, pages 114-115), namely, the cod stocks in Divisions 3M and 3NO, the silver hake stock in Divisions 4VWX, the capelin stocks in Subareas 2 and 3, and the squid-*Illex* stock in Subareas 3 and 4. Representatives attended from Bulgaria, Canada, European Economic Community (EEC), Faroe Islands, Japan, Poland, Portugal, and Union of Soviet Socialist Republics (USSR), and observers were present from Spain. The participants were welcomed to Portugal by the Director of the National Fisheries Research Institute.

The stock assessments were undertaken by the Standing Committee on Fishery Science (STACFIS), whose report, as approved by the Council, is given in Appendix I. In considering the agenda for this meeting (Part H, this volume), it was agreed that Item 3 be deferred to the June 1980 Meeting of the Council. The list of participants and the research documents reviewed at this meeting are listed in Part H of this volume. Brief summaries of the assessments and other matters considered by the Council are given below.

## I. STOCK ASSESSMENTS (APP. I)

### 1. General Fishery Trends

For the stocks considered at this meeting of the Council, the nominal catches and total allowable catches (TACs) since 1972 were as follows:

| Species | Stock area | | TACs and Catches (000 tons) 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| Cod | 3M | TAC | - | - | 40 | 40 | 40 | 25 | 40 | 40 |
| | | Catch | 58 | 23 | 25 | 22 | 22 | 27 | 33 | 29 |
| | 3NO | TAC | - | 103 | 101 | 88 | 43 | 30 | 15 | 25 |
| | | Catch | 103 | 80 | 73 | 44 | 24 | 18 | 15 | 27 |
| Silver hake | 4VWX | TAC | - | - | 100 | 120 | 100 | 70 | 81 | 70 |
| | | Catch | 114 | 300 | 96 | 116 | 97 | 37 | 48 | 52 |
| Capelin | 2+3K | TAC | - | - | 110[2] | 160[2] | 160[2] | 212[2] | 212 | 75 |
| | | Catch | 46 | 136 | 127 | 199 | 216 | 152 | 55 | 11 |
| | 3LNOPs | TAC | - | - | 148[3] | 180[3] | 180[3] | 200[3] | 200 | 10 |
| | | Catch | 25 | 132 | 161 | 167 | 144 | 75 | 30 | 12 |
| Squid-*Illex* | 3+4 | TAC | - | - | - | 25[4] | 25[4] | 25[4] | 100 | 120 |
| | | Catch | 2 | 10 | + | 18 | 42 | 83 | 93 | 153 |

[1] Provisional catch data.
[2] Countries without specific allocations could each take up to 10,000 tons.
[3] Countries without specific allocations could each take up to 5,000 tons.
[4] Countries without specific allocations could each take up to 3,000 tons.

### 2. Cod in Division 3M

The provisional nominal catch in 1979 was 29,000 tons from a TAC of 40,000 tons. Except in 1977 when the TAC was reduced, the catches have been substantially less than the TACs since their introduction in 1974. Commercial catch rates in 1979 continued at the low level of recent years. An analysis of available length and age composition data indicates that the proportion of larger and older cod during the 1970's was much lower than in the 1960's, with 1979 catches composed almost entirely of ages 4 to 6.

A cohort analysis, with F = 0.64 for fully-recruited age-groups in 1979, yielded biomass estimates which were reasonably well correlated with research survey abundance indices for the 1972-76 period, resulting in 69,000 tons as the best estimate of the stock size in 1979. Projections of stock size and catch at $F_{0.1}$ = 0.20 implies a catch of about 8,000 tons in 1980 from a stock size (age 3+) of 75,000 tons and a spawning stock (age 6+) of 40,000 tons at the beginning of the year. Since exten-

sive exploitation of cod less than age 6 implies a loss in yield-per-recruit, the Council was concerned that recent catches consisted almost entirely of ages 4-6 cod.

3. Cod in Divisions 3N and 3O

The provisional nominal catch in 1979 was 27,000 tons against a TAC of 25,000 tons. Catches from this stock had declined from a high of 227,000 tons in 1967 to a low of 15,000 tons in 1978. Commercial catch rates have declined drastically from the mid-1960's to 1978, with some slight improvement indicated by preliminary data for 1979.

A review of two general production model analyses, utilizing catch and effort data for all of the major fleets fishing in the area up to 1979, indicated a yield at 2/3 $F_{MSY}$ of about 100,000 tons for the 1960's and 1970's in one case, and yields at 2/3 $F_{MSY}$ of 100,000 and 65,000 tons for the 1960's and 1970's respectively in the other case, under the assumption that an ecological change had occurred which may explain the lower level of recruitment in the 1970's. Both models were considered inadequate to represent the current status of the stock which is obviously not in equilibrium.

Two cohort analyses were examined, one based on $F = 0.60$ and the other based on $F = 0.25$ for fully-recruited age-groups in 1979. After discussion on the significance of various correlations between population numbers (and biomasses) from cohort analysis on the one hand and abundance indices from research surveys and commercial catch rates on the other, for the two different values of F assumed for 1979, the cohort analysis with $F = 0.25$ in 1979 was considered to best represent the current status of the stock. The assessment indicated that fishing at $F_{0.1} = 0.20$ in 1980 would yield a catch of 26,000 tons. Projections of stock size to the beginning of 1982 under average recruitment levels imply an increase in stock size (age 3+) from a low of 95,000 tons in 1976 to 223,000 tons in 1980 and an increase in spawning stock (age 6+) from 34,000 tons in 1976 to 197,000 tons in 1982.

The Council emphasizes that caution should be exercised in interpreting the results of the assessment because of uncertainty about the assumed level of fishing mortality in 1979. The stock is capable of yielding 70,000-80,000 tons or more at optimal biomass levels of 500,000-600,000 tons, but the projected catch for 1980 and biomass in 1982 are well below these levels. Furthermore, it is important to note that two year-classes (1974 and 1975) will constitute 70% of the spawning biomass in 1982, and that the next two year-classes (1976 and 1977) are estimated to be very weak. For these reasons, the Council advises that a cautious approach to the exploitation of the cod stock in Div. 3NO should be maintained until clear evidence of rebuilding the stock to the optimal level is indicated.

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

The provisional nominal catch in 1979 was 52,000 tons from a TAC of 70,000 tons. The TAC was not fully utilized mainly due to Canadian and Cuban catches being substantially less than their allocations. Commercial catch rates were higher in 1979 than in 1978. The age composition of catches has confirmed a shift to older age-groups following the introduction of additional management measures in 1977, the fishery now being supported by age-groups 2 to 4.

The assessment indicated that fishing at $F_{0.1}$ in 1980 would yield a catch of 100,000 tons. If recruitment continues at presently estimated levels, a preliminary estimate of the catch at $F_{0.1}$ in 1981 is 85,000 tons, with a projected rapid return to the recent TAC level of 70,000 tons. The accuracy of this assessment is adversely affected by discontinuity in the estimates of catch rates and fishing effort, introduced as a result of recent changes in regulatory measures, thus creating uncertainty about the level of fishing mortality in 1979.

5. Capelin in Subareas 2 and 3

a) Overall fishery trends

Nominal catches have declined rapidly from 366,000 tons in 1975 to 85,000 tons in 1978, and to 23,000 tons in 1979 due partly to closure of the offshore fishery in the southern part of the area (Div. 3NO) during 1979. Commercial catch and effort statistics for Subarea 2 and Div. 3K indicate declines from 6.47 tons per hour in 1975 to 1.34 tons per hour in 1979 for USSR trawlers and from 5.01 tons per hour in 1977 to 1.00 tons per hour in 1979 for Romanian trawlers.

b) Subarea 2 and Division 3K

Biomass estimates from both Canadian and USSR acoustic surveys indicated a decline in capelin abundance in recent years. Estimates of the sizes of the 1975, 1976 and 1977 year-classes from sequential capelin abundance models indicate that these year-classes are very weak relative to the strong 1973 year-class which has now virtually disappeared from the population. Using the best estimates available for the sizes of the 1973 to 1977 year-classes and assuming average recruitment of the 1978 year-class at age 2, projections to 1980 indicate a low stock size

relative to earlier levels. Since the stock size in 1980 and 1981 will be largely dependent on the sizes of the 1977 and 1978 year-classes and because of uncerntainty about the strength of the 1978 year-class, the Council advises a closure of the autumn capelin fishery in this area or a small nominal TAC. A small fishery of 10,000-15,000 tons in 1980 would allow scientists to better assess the status of the stock in 1980 and to quantify the advice for 1981.

c) Divisions 3L, 3N and 3O

Biomass estimates from Canadian and USSR acoustic surveys in 1979 indicated that this stock is still substantially below historical levels of abundance. Projections for 1980 could not be made due to unresolved differences in age compositions of catches from Canadian and USSR surveys in 1979. However, the bulk of the spawning stock in 1980 will consist of the 1976 and 1977 year-classes which are known to be weak. Consequently, in order to allow for an increase in the spawning stock in Div. 3N and to protect the stock on its migration through Div. 3N and 3O, the Council advises that Div. 3N and 3O should be closed to a capelin fishery in 1980. Furthermore, the Council noted that, although capelin abundance in Div. 3L is still low, a small demonstrative fishery in 1980 would unlikely have a deleterious effect on the spawning stock but would provide quantitative data for use in providing better advice on the status of the stock in 1981.

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

a) Fishery trends

The overall nominal catch in both subareas has increased rapidly from 14,000 tons in 1975 to about 153,000 tons in 1979 against a TAC of 120,000 tons. The excess of catch over TAC in 1979 was due largely to the high abundance of squid in inshore waters of Subarea 3 and the rapid expansion of inshore fishing effort. Preliminary statistics indicate that about 82,000 tons were taken in Subarea 3 mostly by the inshore fishery, and about 71,000 tons were taken in Subarea 4 mostly by the offshore fishery.

b) Biological studies

New data on the life cycle of *Illex* included observations on larval and juvenile stages from a spring survey seaward of the continental shelf in Gulf Stream waters, together with continuous observations during the fishing season on the progression of maturation from late juvenile to pre-spawning adult stages. Length frequency distributions were typically unimodal and showed the progression of a single modal class throughout the season. Mean Sizes for both sexes in Subareas 3 and 4 during the 1979 fishery were consistent with those reported for previous years. Research on age determination using statoliths showed that the number of "rings" and the statolith length both increased with mantle length. Seasonal fluctuations in food and feeding related to availability of prey species were noted in studies on *Illex* from the Scotian Shelf. The major components of *Illex* food were crustaceans, fish and squid, and the frequency of occurrence of these food types in relation to size of predator showed increased cannibalism in larger squid.

c) Environmental effects

Several sources of information indicated that environmental factors, especially temperature, may influence the migration and biomass of squid on the offshore and inshore fishing grounds. Squid were found to be abundant at temperatures greater than 6°C on the Scotian Shelf and were concentrated at temperatures between 6 and 8°C on the offshore grounds in Subarea 3. It was noted that the abundance of squid offshore in Subarea 3 in the spring is not a reliable index for forecasting the magnitude of the subsequent inshore migration, mainly due to fluctuations in the frontal zone between the cold Labrador Current and the North Atlantic Current.

d) Abundance estimates

Various biomass estimates and abundance indices for *Illex* in Subareas 3 and 4 in 1979 were considered and compared with the results of earlier studies. Biomass estimates from sequential population analyses were considered unreliable, while those based on data from stratified random bottom trawl surveys were considered to be underestimates due to systematic overestimation of catchability coefficients. Also, the estimates by the areal expansion method, based on untested assumptions which may lead to substantial bias, showed a wide range of values. However, it was concluded that *Illex* abundance was very high in Subareas 3 and 4 in 1979, the overall biomass probably being in the range of 500,000 to 3,000,000 tons in August.

e) Management regime

Since the inshore fishery is geographically restricted to a narrow band along the coast, fishing mortality is considered to affect a limited proportion of the stock. In years of high abundance,

the inshose fishery could probably exceed its allowance without leading to excessive exploitation of the stock. The offshore fishery, on the other hand, takes place in areas where squid may be concentrated in years of low abundance, and it was considered that the most satisfactory means of preventing over-exploitation would be by controlled offshore catch allocations in conjunction with effort restraints, as currently practised.

The Council consequently agreed that the catch associated with a target exploitation rate of 0.4 would, under approximately average conditions of abundance, result in an overall catch of 150,000 tons, a level which would not be associated with a serious risk of excessive exploitation. Under such conditions, one would expect an inshore catch of about 50,000 tons. If the biomass of squid in 1980 is very high, as in 1979, the inshore allowance could be exceeded without causing excessive exploitation of the stock. If the biomass in 1980 is low, the offshore fishery will probably not be able to maintain a high catch-per-unit-effort. Limitation of offshore fishing effort by applying the 1978 catch rate to the 1980 TAC would ensure that fishing mortality would not increase greatly despite reduced abundance.

7. Future Research Requirements

The Council endorsed the requirements, listed in the Report of STACFIS (Appendix I), for intensified research on cod, capelin and squid, and, in addition, emphasized the need for intensified studies on the feeding of squid in inshore areas to elucidate the predator-prey relationships between squid and various fish species, especially juvenile cod.

## II. OTHER MATTERS

1. Flemish Cap Project

The Convener of the *ad hoc* Working Group on the Flemish Cap Project (Mr R. Wells) reported that a meeting of Canadian, Polish and USSR scientists involved in this project was held at St. John's, Canada, during 18-22 January 1980, and that a report would be available in advance of the June 1980 Meeting of the Council.

2. Georges Bank-Gulf of Maine Larval Herring Program

The Council noted that the Task Force on the Larval Herring Program had been reactivated, as recommended at the 1979 Annual Meeting, and is scheduled to meet at Woods Hole, USA, during 28 April-2 May 1980.

3. Cooperative Research on Squid

The Council agreed that much had been accomplished from cooperative research projects in the past, and that arrangements for cooperative research on squid in 1980 be considered at the June 1980 Meeting of the Council.

## III. FUTURE MEETINGS

1. Scientific Council Meeting in June 1980

The Scientific Council and its Standing Committees will meet at NAFO Headquarters, Dartmouth, Canada, during 3-13 June 1980. The Secretariat was requested to develop, for consideration by the Executive Committee of the Council, the agenda for this meeting, covering all of the major items normally considered previously by ICNAF's Standing Committee on Research and Statistics, and allocating them for consideration by the three Standing Committees of the Council, namely, the Committees on Fishery Science (STACFIS), Research Coordination (STACREC), and Publications (STACPUB).

2. Scientific Council Meeting in September 1980

The Scientific Council will meet at St. John's, Newfoundland, Canada, during 3-8 September 1980, to deal with any outstanding matters from the June 1980 Meeting and to provide a forum for discussion on general scientific matters related to the resources of the Convention Area (e.g. the Flemish Cap Project and the Georges Bank-Gulf of Maine Larval Herring Program). The suggested topics included the possibility that Canada could present a paper evaluating the effects on the stocks of reductions in fishing mortality levels in recent years. The Council agreed that the agenda for the September 1980 Meeting would be developed at the June Meeting on the basis of these topics and others that may be proposed at that time. Scientists were invited to suggest appropriate topics for consideration.

## IV. ADJOURNMENT

The Chairman thanked the National Fisheries Research Institute for the excellent meeting facilities and the hospitality, the Chairman of STACFIS, Dr G. H. Winters, with the aid of Dr F. Nagasaki for ably dealing with the assessment matters, the participants for their interest and cooperation during the course of the meeting, and the Secretariat staff for their usual efficient work. The meeting was adjourned at 1100 hours on 13 February 1980.

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

Chairman: G. H. Winters *Rapporteur: Various*

At the request of the Scientific Council, STACFIS met during 5-12 February 1980 to assess the status of the cod stocks in Division 3M and 3NO, the silver hake stock in Divisions 4VWX, the capelin stocks in Subareas 2 and 3, and the squid (*Illex*) stocks in Subareas 3 and 4. Conservation measures for these stocks in 1980 were deferred from the 1979 Annual Meeting (*NAFO Proc.* 1979, pages 114-115). Scientists attended from Bulgaria, Canada, European Economic Community (EEC), Faroe Islands, Japan, Poland, Portugal, Spain, and Union of Soviet Socialist Republics (USSR).

In considering the relevant section of the Scientific Council agenda (Part H, this volume), STACFIS agreed that the assessments be carried out in two working groups which would meet concurrently. Consequently, meetings of the *ad hoc* Working Group on Squid (convened by F. Nagasaki) and the *ad hoc* Working Group on Cod, Silver Hake and Capelin (convened by G. H. Winters) were held during 6-12 February, and the results of the stock assessments, as approved by STACFIS, are given in Section I below. Future research requirements for the assessed stocks are outlined in Section II.

## I. STOCK ASSESSMENTS

1. Cod in Division 3M (ICNAF Res. Doc. 79/VI/125; SCR Doc. 80/II/6, 25, 26, 27, 28, 41)

a) Fishery trends

Nominal catches from this stock were less than 10,000 tons prior to 1961. In the 1960-64, 1965-69 and 1970-74 periods, average annual catches were 26,000, 43,000 and 33,000 tons respectively. Total allowable catches (TACs) have been imposed since 1974, but actual catches have generally been less than the TACs. Recent catches and TACs were as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 40 | 40 | 40 | 25 | 40 | 40 |
| Catch (000 tons) | 23 | 25 | 22 | 22 | 27 | 33 | 29[1] |

[1] Provisional data, with the assumption that Spain took its allocation of 4,590 tons.

b) Assessment parameters

Examination of age compositions from biological sampling of the commercial fishery during 1959-68 and 1972-79 indicated that the proportion of older and larger cod was much lower in the 1970's than in the 1960's (SCR Doc. 80/II/28). The 1972 and 1973 year-classes predominated in the catches during 1975-78. In the 1979 fishery, the 1973 and 1974 year-classes, which were about equal in numerical strength, comprised about 78% and the 1975 year-class about 18% of the catches.

The results of Canadian and USSR surveys conducted in recent years were reviewed. From the USSR survey in March 1979 (SCR Doc. 80/II/41), the 1977 year-class as 2-year-olds comprised about 11% of the catches. From the Canadian survey in January 1980 (SCR Doc. 80/II/27), the same year-class as 3-year-olds comprised about 60% of the catches.

Standardized catch rates derived from a multiplicative technique incorporating catch and effort data by country, gear and month (SCR Doc. 80/II/25) were quite similar to the annual catch rates of Portuguese trawlers. The standardized catch rate for 1979, based on limited catch and effort data, was about 0.40 tons per hour fished. From the asymmetrical yield curve of the multiplicative model and from a parabolic yield curve calculated at this meeting, with the assumption that the catch rate for 1980 would be the same as that estimated for 1979, the yield in 1980 at 2/3 $F_{MSY}$ is projected to be in the range of 10,000-15,000 tons. However, since this stock is obviously not in equilibrium, predicted yields from such general production models are very questionable.

Cohort analyses were presented covering the 1959-68 and 1972-79 periods (SCR Doc. 80/II/28). There were no age composition data for the commercial fishery in 1969-71, and sampling was poor for some years during 1972-79. Partial recruitment factors for 1979 were derived from the relative comparison of age compositions from the commercial fishery and the Canadian survey in 1979, yielding a dome-shaped pattern with higher fishing mortality on age-groups 5

and 6 than on older age-groups, as follows:

| Age (years) | 3 | 4 | 5 | 6 | 7+ |
|---|---|---|---|---|---|
| % selected | 18 | 53 | 117 | 100 | 27 |

The average weight-at-age values used in the cohort analyses were derived from the annual sampling of commercial catches, and there was reasonably good agreement between the calculated catches and the reported nominal catches. The average weight-at-age values for 1979 were as follows:

| Age (years) | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12+ |
|---|---|---|---|---|---|---|---|---|---|---|
| Av. weight (kg) | 0.79 | 1.07 | 1.48 | 2.45 | 4.35 | 5.34 | 6.61 | 8.21 | 11.04 | 15.08 |

The correlations for the 1972-76 period between biomass estimates (age 3+) from cohort analyses at various terminal F-values in 1979 and both the standardized commercial catch rates and the Faroese longline catch rates were negative, implying that the catch rates were not reliable estimates of stock abundance. The correlations for the 1972-76 period between the biomass estimates (age 3+) from cohort analyses at terminal F-values of 0.64 and 1.30 in 1979 and the catch rates from USSR surveys were reasonably good, with $r^2 = 0.75$ and 0.68 respectively. The biomasses in 1979 implied by these regressions were 70,000 and 68,000 tons respectively. These estimates are similar to a total biomass estimate from the USSR survey in 1979 of 67,000 tons, which may be an underestimate due to the vertical distribution of the fish at the time of the survey, as previous USSR investigations have shown that the bias may be in the order of 30-40%. Since the cohort analysis at terminal F = 0.64 indicated a biomass (age 3+) of 69,000 tons in 1979, it was agreed to use this value in making the projections for 1980.

The biomasses of age 2+ cod were calculated for the 1972-79 period under the assumptions that there was insignificant fishing mortality on 2-year-olds and that natural mortality (M) was 0.20. The correlation between these biomass estimates and the USSR survey catch rates for 1972-78 (excluding 1977 as anomalous) was good ($r^2 = 0.79$). The biomass of age 2+ cod in 1979 estimated from this regression was 83,000 tons.

With estimates of 83,000 and 69,000 tons as the biomasses of age 2+ and age 3+ cod respectively, the biomass of age 2 cod in 1979 was therefore estimated to be 14,000 tons. With an average weight of 0.342 kg, the number of age 2 cod in 1979 was estimated to be 41 million. Taking M = 0.20 and considering fishing mortality to be insignificant on 2-year-olds, the recruitment of age 3 cod in 1980 was estimated to be 34 million fish.

c) Results of assessment

The partial recruitment pattern observed in recent years has been quite variable, and, since no methods of predicting the pattern for 1980 was available, it was agreed to use for the 1980 projections the average pattern adopted for assessing this stock in April 1979 (*ICNAF Redbook* 1979, page 71), namely

| Age (years) | 3 | 4 | 5 | 6+ |
|---|---|---|---|---|
| % selected | 4 | 17 | 90 | 100 |

Using these partial recruitment factors for 1980 and the other agreed parameters for 1979, projections of stock biomass at the beginning of 1980 and 1981 and catch in 1980 at $F_{0.1} = 0.20$ were determined as follows:

| Year | Recruitment at age 3 ($10^3$) | F for fully recruited ages | Catch (tons) | Stock size (000 tons) Age 3+ | Age 4+ | Age 6+ |
|---|---|---|---|---|---|---|
| 1979 | 1,436 | 0.64 | 28,000 | 69 | 68 | 43 |
| 1980 | 34,000 | 0.20 | 8,000 | 75 | 48 | 40 |
| 1981 | - | - | - | - | 75 | 44 |

Fishing at the level of $F_{0.1}$ = 0.20, a catch of 8,000 tons is projected for 1980. The Committee noted that the instantaneous growth rate derived from the average weight-at-age data is about 0.5 up to age 6 and about 0.2 at age 7, the implication being that there would be a loss in yield-per-recruit if there is extensive exploitation of cod less that 6 years old.

2. Cod in Divisions 3N and 3O (SCR Doc. 80/II/10, 24, 41, 49)

a) Fishery trends

Catches from this stock have declined from a high of 227,000 tons in 1967 to 15,000 tons in 1978, the level of the TAC. Provisional statistics for 1979 indicate a catch of about 27,000 tons against a TAC of 25,000 tons, During 1973-77, the catches were substantially less than the corresponding TACs. Recent catches and TACs were as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|
| TAC (000 tons) | 103 | 101 | 88 | 43 | 30 | 15 | 25 |
| Catch (000 tons) | 80 | 73 | 44 | 24 | 18 | 15 | 27[1] |

[1] Provisional data

b) General production models

The Committee reviewed two general production model analyses which utilized catch and effort data for all of the major fleets fishing in the area up to 1978 with estimates for 1979 (SCR Doc. 80/II/10, 24). The authors of SCR Doc. 80/II/10 proposed that the low level of recruitment in recent years in Div. 3N and 3O has resulted from an ecological change rather than from high fishing mortality. Consequently, equilibrium yield curves based on two different levels of recruitment were calculated, one for the 1960's and the other for the 1970's, the estimated yield at 2/3 $F_{MSY}$ being about 100,000 and 65,000 tons respectively. In SCR Doc. 80/II/24, the estimated biomass was shown to have declined from a peak of more than 600,000 tons in the mid-1960's to a low of less than 300,000 tons in the mid-1970's with some slight recovery since then. The single equilibrium yield curve indicated a yield of about 100,000 tons at 2/3 $F_{MSY}$, but the right-hand limb of the curve is very steep with stock collapse predicted at sustained effort close to 70,000 hours fished. Both analyses show a decline in catch-per-unit-effort (CPUE) from the mid-1960's to 1978 with some improvement in 1979.

The Committee considered that both general production model analyses suffer from the same inadequacies, their use being questionable for a stock that is obviously not in equilibrium. In any case, it was considered that the critical CPUE point is that for 1979. In SCR Doc. 80/II/24, the CPUE value for 1979 is based almost solely on data for Canada (N) tonnage class 5 trawlers and is not considered representative of the fishery on the stock over its entire range in Div. 3N and 3O during the year, mainly because the majority of the catch and effort data pertain to the Canadian fishery in January-March in a small part of Div. 3O adjacent to Subdiv. 3Ps where catch rates were very high. Also, in SCR Doc. 80/II/10, the catch rates for 1977 and 1978 are considered to be low in relation to stock abundance in these years and the 1979 catch rate is based on very preliminary data. For these reasons, the Committee could not consider the projections from either of these models as accurately reflecting the status of the stock in the late 1970's, and therefore agreed to use the cohort analysis as a better estimator of current stock status.

c) Cohort assessment parameters

Catch-at-age data for 1972-79 were used in the cohort analysis (SCR Doc. 80/II/49) to determine fishing mortalities and stock sizes. However, the estimation of fishing mortality for 1979 was subject to some uncertainty.

Using F = 0.25 for fully-recruited age-groups in 1979 resulted in population numbers (age 3+) from the cohort analysis which were well correlated with numbers per standard set (age 3+) from the Canadian surveys in 1972-79 ($r^2$ = 0.80, excluding the anamolous 1973 point). Also, for 3-year-olds, the numbers from the cohort analysis and the numbers per standard set from the Canadian surveys in 1972-79 were well correlated ($r^2$ = 0.84), and the numbers of 3-year-olds from the cohort analysis were reasonably well correlated ($r^2$ = 0.60) with the numbers of 2-year-olds (for the corresponding year-classes) per standard set from the Canadian surveys. However, there was no significant correlation between the biomass estimates (age 3+) from the cohort analysis and the commercial catch rates using the standardized CPUE values from SCR Doc. 80/II/24

on the one hand and those from SCR Doc. 80/II/10 on the other. Also, there was no correlation between population numbers (age 3+) from the cohort analysis and catches per hour (age 3+) from the USSR surveys in 1972-79.

Using F = 0.60 for fully-recruited age-groups in 1979 resulted in biomass estimates (age 3+) from the cohort analysis which appeared to be well correlated ($r^2$ = 0.92) with the standardized commercial catch rates for 1972-78 from SCR Doc. 80/II/24, but the 1976 estimate, and more importantly the 1979 estimate, were completely outside the range of the correlation and were thus excluded from the calculation of $r^2$. Also, the resultant population numbers (age 3+) from the cohort analysis were not significantly correlated with either the numbers per standard set (age 3+) from the Canadian surveys or the numbers per hour fished (age 3+) from the USSR surveys.

After discussing the problems associated with determining realistic estimates of fishing mortality and stock size in 1979, the Committee agreed to accept the results of the cohort analysis which correlated well with the Canadian survey data (i.e. F = 0.25 for 1979) as best representing the current status of the stock, but at the same time recognizing the uncertainties associated with the parameter estimates.

For use in the cohort analysis, the partial recruitment factors for 1979, derived from the relative comparison of age compositions from the commercial fishery and the Canadian surveys in 1979, are as follows:

| Age (years) | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11+ |
|---|---|---|---|---|---|---|---|---|---|
| Part. recruitment | 0.03 | 0.36 | 0.76 | 1.00 | 1.00 | 1.00 | 0.91 | 0.76 | 0.30 |

Recruitment estimates at age 3 by year-class were obtained from (i) the correlation of numbers at age 3 from the cohort analysis and from the Canadian surveys, and (ii) the correlation of numbers at age 3 from the cohort analysis and numbers at age 2 for the same year-classes from the Canadian surveys. These, together with the actual estimates for 3-year-olds from the cohort analysis, are as follows:

| Year-class | Estimated recruitment at age 3 (millions) | | |
|---|---|---|---|
| | Cohort age 3 *vs* surveys age 3 | Cohort age 3 *vs* surveys age 2 | Actual cohort estimates |
| 1975 | 53 | 40 | 62 |
| 1976 | 24 | 20 | 18 |
| 1977 | - | 22 | - |

For the assessment, the Committee agreed to use the numbers at age 3 from the cohort analysis as estimates of the sizes of the 1975 and 1976 year-classes, namely, 62 million and 18 million fish respectively. In addition, 25 million fish at age 3 was accepted as the size of the 1977 year-class.

d) Results of cohort analysis

The stock sizes for 1979 and 1980 were calculated by cohort analysis as outlined above, and a catch projection was made for 1980 at $F_{0.1}$ = 0.18. In addition, stock sizes at the beginning of 1981 and 1982 were projected by assuming that the size of the 1978 and 1979 year-classes at age 3 is equal to the geometric mean of the sizes of the 1969-76 year-classes (i.e. 40 million fish) and that fishing occurred at the $F_{0.1}$ level in 1981. The results of the analysis and projections are as follows:

| Year | Recruitment at age 3 ($10^6$) | F for fully-recruited ages | Catch (tons) | Stock size (000 tons) | | |
|---|---|---|---|---|---|---|
| | | | | Age 3+ | Age 4+ | Age 6+ |
| 1979 | 18 | 0.25 | 27,000 | 204 | 191 | 67 |
| 1980 | 25 | 0.18 | 26,000 | 223 | 205 | 132 |
| 1981 | 40 | 0.18 | - | 257 | 228 | 189 |
| 1982 | 40 | - | - | 284 | 255 | 197 |

e) Conclusions

The catch at $F_{0.1}$ implied for 1980 from the cohort analysis is about 26,000 tons. Stock size projections to the beginning of 1982, under the assumptions of fishing at $F_{0.1}$ in 1980 and 1981 and of recruitment at age 3 in 1981 and 1980 being equal to the average level for 1969-76, indicate an increase in biomass of age 3+ fish to 284,000 tons in 1982 from a low of 95,000 tons in 1976. The spawning biomass (age 6+) is also projected to increase to 197,000 tons by 1980 from a low of 34,000 tons in 1976.

The Committee emphasized that caution should be exercised in interpreting the results of the cohort analysis and the projections for several reasons. Firstly, the results of the analysis with F = 0.25 for 1979 is the most optimistic assessment of the status of the stock in the late 1970's. If F in 1979 was as high as 0.60, as indicated by one analysis, the total biomass during the late 1970's is estimated to have remained stable at the low level of 60,000-70,000 tons. Secondly, the stock, if rebuilt to its optimal level, could yield about 70,000-80,000 tons and possibly up to 100,000 tons. The total biomass necessary to produce this yield is in the order of 500,000-600,000 tons, compared with the projected level of about 300,000 tons by 1982 under the most optimistic assessment of the stock status in 1979. Thirdly, about 50% of the total biomass and about 70% of the spawning biomass in 1982 will consist of two age-groups (ages 7 and 8), and the two immediately following year-classes (1976 and 1977) are estimated to be poor. In fact, the two dominant year-classes (those of 1974 and 1975), which will contribute to most of the increase in projected biomass by 1982, average about 68 million fish, whereas the recruiting year-classes in the 1960's averaged about 100 million fish. The total biomass in the mid 1960's was in the order of 400,000-500,000 tons, much higher than the present biomass and also significantly higher than the biomass projected for 1982. Therefore, the Committee advises that a cautious approach to exploitation of the cod stock in Div. 3N and 3O should be maintained until clear evidence of rebuilding of the stock to the optimal level is indicated.

3. Silver hake in Divisions 4V, 4W and 4X (SCR Doc. 80/II/18, 19, 20, 21, 46, 48)

a) Fishery trends

Provisional statistics indicate an increase in catch to 52,000 tons in 1979 from 48,000 tons in 1978 and 37,000 tons in 1977. The 1979 TAC of 70,000 tons was not fully utilized, due mainly to Canadian and Cuban catches being substantially less than their allocations. Recent catches and TACs were as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 100 | 120 | 100 | 70 | 81 | 70 |
| Catch (000 tons) | 300 | 96 | 116 | 97 | 37 | 48 | 52 |

Commercial catch rates for both the Cuban and USSR fleets increased in 1979 over those of 1978, but the extent of the increase could not be determined due to the preliminary nature of the 1979 data.

b) Assessment parameters

The 1979 catch consisted predominately of age-groups 2, 3 and 4, and it was confirmed that the changes in management measures instituted in 1977 have changed the recruitment pattern to the fishery, with less dependence of recent catches on ages 1 and 2 fish. The partial recruitment factors used in the assessment, representing the means of the 1977 and 1978 values, are as follows:

| Age (years) | 1 | 2 | 3 | 4 | 5 | 6+ |
|---|---|---|---|---|---|---|
| Part. recruitment | 0.05 | 0.52 | 1.00 | 0.97 | 0.75 | 0.65 |

The average weight-at-age values also appear to have changed in the most recent years, and the values used in this assessment are the means of weight-at-age data for 1976-79, as follows:

| Age (years) | 1 | 2 | 3 | 4 | 5 | 6+ |
|---|---|---|---|---|---|---|
| Mean weight (g) | 50 | 130 | 200 | 250 | 315 | 500 |

The above changes in parameters required the recalculation of the yield-per-recruit curve, giving $F_{0.1} = 0.67$. The natural mortality (M) was taken to be 0.40, a value estimated several years ago and used in previous assessments.

A fishing mortality rate of 0.33 for fully-recruited age-groups was used for 1979, and the results of the virtual population analysis were fairly consistent with the historical data on commercial catch rates and fishing effort. However, these latter data have certain deficiencies. In particular, the catch and effort data for 1977-79 which were collected by observers are not directly comparable with data prior to 1977 from ICNAF Statistical Bulletins. Consequently, there is some uncertainty as to the precise status of the stock in 1979.

The change in partial recruitment factors makes recruitment estimates at age 1 for 1980 of less importance to the calculation of yield for 1980 than in previous assessments. It was noted that the inverse relationship between survey estimates of squid population numbers in one year and year-class strength of age 1 silver hake in the next (ICNAF Res. Doc. 79/VI/48) still holds with the addition of data for 1978 (SCR Doc. 80/II/21), giving an estimate of $1.06 \times 10^6$ fish as the size of the 1979 year-class at age 1.

c) Assessment results

The calculations indicate a yield in 1980 of 100,000 tons at $F_{0.1} = 0.67$. If the size of the 1980 year-class is assumed to be the same as that of the 1979 year-class, provisional calculations imply a catch of 85,000 tons at $F_{0.1}$ in 1981. In general terms, the stock is estimated to have experienced fishing mortalities below $F_{0.1}$ in recent years, due to the catches being substantially less than the TACs. Although a large increase in yield is indicated for 1980, the projections suggest that the yield will quickly return to the recent TAC level of 70,000 tons. These projections depend largely on future recruitment levels which cannot be predicted at this time.

4. Capelin in Subareas 2 and 3 (SCR Doc. 80/II/4, 13, 14, 15, 16, 42, 43, 44, 45)

a) Fishery trends

The nominal catch of capelin in Subareas 2 and 3 increased from 2,800 tons in 1971 to 366,000 tons in 1975 and declined to 85,000 tons in 1978. Preliminary statistics indicate a catch of 23,000 tons in 1979, due in part to the prohibition of an offshore fishery in Div. 3LNO. Recent catches and TACs were as follows:

| Area | | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|---|
| 2+3K | TAC (000 tons) | - | 110[1] | 160[1] | 160[1] | 212[1] | 212 | 75 |
| | Catch (000 tons) | 136 | 127 | 199 | 216 | 152 | 55 | 11 |
| 3LNO | TAC (000 tons) | - | 148[2] | 180[2] | 180[2] | 200[2] | 200 | 10 |
| | Catch (000 tons) | 132 | 161 | 167 | 144 | 75 | 30 | 12 |

[1] Countries without allocations could each take up to 10,000 tons.
[2] Countries without allocations could each take up to 5,000 tons.

b) Biological studies

The Committee recognized that there were two sources of bias associated with acoustic surveys: one associated with survey design and the other with calibration parameters, especially the target strength. Statistical methodology is presently available to estimate the variance associated with survey design, but, although it is known that the variance associated with target strength can be large, basic research on estimating this parameter and applying it to biomass estimates has been limited. In this regard, the Committee complimented USSR scientists on their attempts to provide an absolute calibration of their echo-integration system (SCR Doc. 80/II/44) by modelling fish schools. Various improvements in the experiment were suggested such as using a wider range of school density and attempting the experiment with living fish.

In a discussion on estimation of natural mortality of capelin, it was noted that the method used by Icelandic scientists (ICES CM 1979/11:27) can be highly biased by the sampling data, especially the age composition and the sex ratio. Because there is always some bias involved in sampling capelin and because the method is very sensitive to such bias, an estimate of natural mortality by this method should be treated with caution.

A method to estimate the maturation rates of capelin using catch-per-unit-effort data was presented by Canadian scientists (SCR Doc. 80/II/16). The analysis revealed that there is

annual variation in maturation rates and that there is an increase in these rates with age. Because sequential capelin abundance models (SCAM) are very sensitive to this parameter, reliable estimates of the proportion mature at age are necessary to produce unbiased estimates of biomass and year-class strength using these models.

c) Subarea 2 and Division 3K

i) Commercial catch-effort analysis

Catch rates of USSR BMRT-type trawlers, considered at the April 1979 Meeting as a useful index of abundance (*ICNAF Redbook* 1979, page 34), has declined from 6.47 tons per hour in 1975 to 1.34 tons per hour in 1979 (SCR Doc. 80/II/13). Catch rates of Romanian trawlers in Div. 2J declined from 5.01 tons per hour in 1977 to 2.02 tons per hour in 1978 and to 1.00 tons per hour in 1979 (SCR Doc. 80/II/4).

ii) Research surveys

A USSR acoustic survey in Div. 2J during November 1979 provided a biomass estimate of 14,500 tons (SCR Doc. 80/II/43), which represent a decline in abundance by a factor of 4 from the estimate in 1978 and by a factor of 100 from the estimate in 1974. A Canadian acoustic survey during October-November 1979 provided biomass estimates of about 6,300 tons in Div. 2J and 39,500 tons in Div. 3K (SCR Doc. 80/II/13), which represent for the area as a whole a decline in abundance by a factor of 5 from the 1977 level.

The age composition of samples taken during the USSR survey indicated that the 1975 and 1976 year-classes predominated, whereas samples taken during the Canadian survey indicated that the 1977 and 1978 year-classes predominated. This is in contrast to the age composition of samples from the 1979 commercial fishery where only the 1977 year-class was dominant.

iii) Numerical population models

A sequential capelin abundance model (SCAM) was used to estimate the biomass of capelin on 1 September 1979 (SCR Doc. 80/II/13). This model used new estimates of spawning mortality and the proportions mature at age, derived from a comparison of mean length-at-age data and a maturity ogive. Because few research samples were available, estimates of partial recruitment for age 2 were not considered reliable, and thus the projections of population numbers at age 2 from the two SCAM analyses with terminal F's at 0.010 and 0.012 were not very realistic. Using the 1979 catch rate of 1.34 tons per hour for USSR BMRT-type trawlers in the regressions of total biomass estimates on 1 September from SCAM (with terminal F = 0.012 and 0.010) against catch rates of USSR BMRT-type trawlers in 1973-78 yielded total biomass estimates for 1979 from which the biomass estimates of age 3 and older capelin were subtracted, giving estimates of $15.0 \times 10^9$ and $42.3 \times 10^9$ fish respectively as the size of the 1977 year-class at age 2. The general trend in total biomass from these analyses indicates a decline over the last four years such that the biomass in 1979 was only about 7% of the peak biomass in 1976. The three strongest year-classes were indicated to be those of 1973, 1974 and 1969.

A second method using SCAM to predict the sizes of recent year-classes was presented (SCR Doc. 80/II/15). This model used the same estimates for such parameters as catch-at-age, mean weight-at-age and spawning mortalities, but the values for the proportions mature-at-age were derived using catch-per-unit-effort data (SCR Doc. 80/II/16). Estimates of the sizes of the 1975, 1976 and 1977 year-classes at age 2 were obtained from regressions relating numbers-at-age from the model to catch-per-unit effort for the corresponding year-classes, these estimates being $9.6 \times 10^9$ for the 1975 year-class, $8.3 \times 10^9$ for the 1976 year-class, and $25.0 \times 10^9$ for the 1977 year class. A further estimate of the strength of the 1977 year-class at age 2 ($8.9 \times 10^9$ fish) was derived from the regression of biomass estimates on 1 September from the model against catch rates of USSR BMRT-type trawlers in 1978, using a catch rate of 1.34 tons per hour in 1979 to obtain a biomass estimate for 1979. These analyses showed that the 1973 and 1969 year-classes were the strongest in recent years with those of 1974, 1975 and 1976 being the weakest year-classes.

iv) Recruitment estimation and prognosis for 1980

The four estimates of the size of the 1977 year-class at age 2 ranged from $8.9 \times 10^9$ to $42.3 \times 10^9$ fish, the average being $22.8 \times 10^9$ . These estimates were all lower than the value used in the prognosis for 1979 (*ICNAF Redbook* 1979, page 36) and substantially lower than that estimated for the strong 1973 year-class, as indicated below:

| Year-class | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
|---|---|---|---|---|---|---|---|---|
| Estimated numbers ($10^6$) at age 2 on September 1 | 15,160 | 22,210 | 19,612 | 57,739 | 14,564 | 9,608 | 8,130 | 22,800[1] |

[1] Mean of four estimates.

The biomass of the stock on 1 January 1980 and 1 September 1980 were calculated using the average of the four estimates as the size of the 1977 year-class at age 2 ($22.8 \times 10^9$) and the geometric mean of the 1969-76 year-class sizes at age 2 as an estimate of the 1978 year-class (Table 1, Option 1). The biomasses of the stock on 1 January 1980 and 1 September 1980 were also calculated using the average of the two lowest estimates of the size of the 1977 year-class at age 2 ($11.95 \times 10^9$) and the geometric mean of the 1969-76 year-class sizes at age 2 as an estimate of the 1978 year-class (Table 1, Option 2). This latter value for the size of the 1977 year-class was chosen for this projection because the total biomass on 1 September showed a decline from 1978 to 1979, which agrees with declines in abundance from commercial catch rates and acoustic surveys.

Table 1. Capelin in Subarea 2 and Div. 3K: estimates of stock size on 1 September 1979 and projected estimates of stock size on 1 January and 1 September 1980.

| | Stock size numbers (000) | | |
|---|---|---|---|
| Age | 1 Sep 1979 | 1 Jan 1980 | 1 Sep 1980 |
| Option 1 | | | |
| 2 | 22,800,000 | 27,275,180 | 22,331,030 |
| 3 | 3,575,340 | 20,292,150 | 13,619,630 |
| 4 | 777,860 | 3,190,100 | 1,142,230 |
| 5 | 170,440 | 693,350 | 147,170 |
| 6 | 28,440 | 139,530 | 22,480 |
| Biomass (tons) | 505,190 | 693,010 | 776,180 |
| Option 2 | | | |
| 2 | 11,950,000 | 27,275,180 | 22,331,030 |
| 3 | 3,575,340 | 10,474,660 | 7,030,360 |
| 4 | 777,860 | 3,190,100 | 1,142,230 |
| 5 | 170,440 | 693,350 | 147,170 |
| 6 | 28,440 | 139,530 | 22,480 |
| Biomass (tons) | 355,510 | 525,160 | 610,770 |

The Committee concluded that the stock sizes provided in Option 2 (Table 1) were more realistic because the trends in biomass agree with trends in commercial catch rates from 1976 to 1979 and acoustic survey estimates of abundance from 1977 to 1979. Since the 1978 year-class, for which no quantitative information is available, comprises a substantial proportion of the projected stock size estimates in 1980, these estimates could be subject to substantial error. Because the 1975 to 1977 year-classes are very weak, the spawning stock in 1980 will be low and it will depend in 1981 to some extent on the 1978 year-class for which there is no quantitative estimate. The Committee therefore advises a closure of the autumn fishery for capelin in Div. 2J+3K or a small nominal TAC. A small fishery of 10,000-15,000 tons in 1980 would allow scientists to better assess the status of the stock in 1980 and to quantify their advice for 1981.

d) Divisions 3L, 3N and 3O

i) Commercial catch-effort analysis

No offshore commercial fishery occurred in these divisions in 1979.

ii) Research surveys

USSR acoustic surveys in May-June 1979 provided biomass estimates of 483,000 tons of mature capelin and 246,000 tons of immature capelin in Div. 3L, and 2,730 tons of mature

capelin in Div. 30 (SCR Doc. 80/II/42). These estimates for Div. 3L represent an increase over 1978 levels, but information available for Div. 3NO indicates that the spawning population was substantially lower than historical values which ranged from 685,000 to 1,050,000 tons. Acoustic surveys by Canada in June-July 1979 resulted in a biomass estimate of 185,000 tons in Div. 3LNO and two estimates of 3,300 and 20,250 tons of spawning capelin in Div. 3N. No previous acoustic estimates by Canada were available for comparison.

Age compositions of capelin samples from the Canadian and USSR surveys in Div. 3LNO were different. In the Canadian samples, the 1976 and 1977 year-classes dominated in Div. 3L and examination of the mean length indicated that many of these fish were immature, whereas the 1975 and 1976 year-classes dominated the mature population in Div. 3NO. In the USSR samples, the 1977 year-class was not strongly represented in Div. 3L and 3N, most of the fish being mature and belonging to the 1975 and 1976 year-classes. No reasons for these differences were apparent, but it was suggested that the USSR samples, being relatively few in number, may not be truly representative of the age structure of the population.

iii) Numerical population analyses

No numerical analyses were available for the populations in Div. 3LNO.

iv) Recruitment estimation and prognosis for 1980

Stock size projections for 1980 were not made because the differences between the Canadian and USSR estimates of the age composition of the stock could not be resolved. However, it is known that the 1975 and 1976 year-classes are very weak and the 1977 year-class appears to be only slightly stronger. These year-classes, especially those of 1976 and 1977, will comprise the bulk of the spawning stock in 1980. Consequently, in order to allow further increase in the spawning stock in Div. 3N and to protect this stock during its migration through Div. 3O to Div. 3N, the Committee advises that there should be no fishery for capelin in Div. 3N and 3O during 1980.

The Committee noted that, although stock abundance is still low in Div. 3L, a small demonstrative fishery in Div. 3L in 1980 would not likely have a deleterious effect on the spawning stock but would yield quantitative data in 1980 for use in providing better advice for 1981, and therefore advises that the 1980 TAC for Div. 3L remain at the level of 16,000 tons as in 1979.

5. Short-finned squid (*Illex illecebrosus*) in Subareas 2 to 4 (SCR Doc. 80/II/1, 2, 3, 5, 7, 8, 9, 11, 12, 17, 18, 22, 23, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40)

a) Fishery trends

The nominal catch of *Illex* in Subareas 2 to 4 increased rapidly from an annual average of about 4,500 tons during 1970-74 to 92,700 tons in 1978. Preliminary data indicate that the 1979 catch was about 153,000 tons, an increase of 65% over that of 1978. Recent catches and TACs were as follows:

| Year | Nominal catches (tons) by subarea 2 | 3 | 4 | Total SA 2-4 | TAC (tons) |
|---|---|---|---|---|---|
| 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 |

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

Catches in Subarea 3 have shown a steady and rapid increase from 1972-74 to 1979, the catch of 81,800 tons in 1979 being double that of 1978. Increased catches in Subarea 3 have resulted from an apparent increase in the abundance of *Illex* in coastal waters and the expansion of effort in the inshore fishery, as the offshore fishery accounted for only 2,400 tons or about 3% of the catch in 1979 (SCR Doc. 80/II/32). Catches in Subarea 4, after increasing rapidly

during 1975-77 from 14,000 to 50,700 tons, increased only slightly to 52,000 tons in 1978 and more rapidly to 71,000 tons in 1979. These increases in Subarea 4 were the result of increased offshore fishing effort under established TACs. Although inshore catches increased from about 1,100 tons in 1978 to roughly 6,400 tons in 1979, they have comprised a relatively small proportion of the total catch in Subarea 4. There are indications that the inshore component of the catch in both Subareas 3 and 4 would have been higher if market prospects and onshore freezing capacity had been greater.

The seasonal pattern of the fishery in Subareas 3 and 4 in 1979 shows catches increasing rapidly following the commencement of the directed fishery in July to a peak in September and then decreasing rapidly during the autumn, as follows:

| Month | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|
| Catch (000 tons) | + | 1.7 | 21.3 | 36.8 | 51.1 | 32.8 | 9.2 | 0.2 | 153.1 |

In Subarea 3, inshore jigging continued to be the dominant method of fishing while offshore trawl catches remained low (SCR Doc. 80/II/12, 34). Significant changes in the Subarea 4 fishery included expansion of inshore jigging and the introduction by Japan, through cooperative arrangements with Canada, of an offshore jigger fishery in which seven vessels of the 100-499 tonnage class took more than 6,000 tons.

Preliminary catch and effort data for the directed squid fishery on the offshore grounds by vessels operating under their national allocations indicated an increase from 7.5 tons per day in 1978 to 12.7 tons per day in 1979 for Subarea 3 and an increase from 9.3 tons per day in 1978 to 16.9 tons per day in 1979 for Subarea 4. However, data for vessels operating under cooperative arrangements with Canada in 1979 resulted in values of 28.1 and 22.9 tons per day for Subareas 3 and 4 respectively (SCR Doc. 80/II/32). Consequently, because of the apparent differences in catch rates, no directed comparison was possible with data presented previously for 1978 (*ICNAF Redbook* 1979, page 40).

b) By-catches

By-catches in the directed trawl fishery for squid on the Scotian Shelf in 1979 (SCR Doc. 80/II/8, 12, 18) did not change greatly from the situation in previous years. Silver hake and argentine were the dominant by-catch species. Cod, pollock, haddock and redfish were also caught but in very small quantities, usually comprising less than 1% of the catch in the directed squid fishery. There was no by-catch in the experimental squid-jigging operations. Preliminary analysis of data for the area eastward of the "small-mesh gear" line along the edge of the Scotian Shelf indicated that by-catches were negligible, but this may have been due to the fact that only off-bottom trawls could be used in the area. By-catches of haddock and pollock were higher westward of the "small-mesh gear" line, but experimental fishing in this area was very limited in 1979. Observations on by-catch in other areas were limited to those on one trawler fishing for squid on St. Pierre Bank with a 10% by-catch consisting mainly of pollock. The by-catch of squid in the directed fishery for silver hake on the Scotian Shelf was about 10% in 1979, substantially higher than in 1978 (2.4%) but slightly lower than in 1977 (12%).

c) Biological characteristics

i) Distribution

During a plankton survey in March-May 1979, *Illex* larvae and juveniles were recorded for the first time in the Gulf Stream seaward of the Scotian Shelf (SCR Doc. 80/II/38). In 1979, the period of occurrence on the continental shelf and in coastal waters was from May to late December in Subarea 4 (SCR Doc. 80/II/30, 32) and from June to early December in Subarea 3 (SCR Doc. 80/II/34). The extension of *Illex* distribution into the southern Gulf of St. Lawrence, which was reported for 1978 (*ICNAF Redbook* 1979, page 27), was again reported in 1979, apparently in greater abundance. Squid were abundant in many localities along the coastlines of Newfoundland and Nova Scotia, and large quantities were reported to have been washed ashore in the Bay of Fundy and at many localities in Newfoundland.

ii) Life cycle

Length frequency distributions of *Illex* in 1979, reported from inshore and offshore surveys ir Subarea 3, extended from July to November, while those from offshore surveys in Subarea 4 extended from February to December (SCR Doc. 80/II/2, 11, 12, 30, 34). The length frequencies were typically unimodal with a consistent single modal class progressing through the season for both sexes. However, inconsistent modes were apparent in some samples and

these were attributed to insensitivity of sampling methods to determining size variation which may exist between components of the stock (SCR Doc. 80/II/12, 30). Length frequency distributions of males and females from a survey in Subdiv. 3Ps showed no marked variation with depth (SCR Doc. 80/II/11). Weekly length compositions from samples taken during May to December in Subarea 4 were used to construct Bertalanffy growth curves for 1977 to 1979, which indicated that, although growth in May appeared to be slower in 1977 and 1979 than in 1978, mean sizes by the end of August were similar in all three years (SCR Doc. 80/II/30). The $L_\infty$ values ranged from 293 to 347 mm (mantle length) in females and from 232 to 278 mm in males.

Using the 1978 and 1979 growth curves to trace the progression of maturation through the season showed that males became mature at the same mantle length (228 mm) in late November 1978 and in late October 1979, whereas females at approximately the same sizes (250 mm in 1978 and 258 mm in 1979) became mature in early and late December of 1978 and 1979 respectively. It was suggested that these stages and dates relate to the *imminant emigration* phase, when *Illex* leave their summer residency on the continental shelf for their spawning areas. An offshore survey in Subarea 4 during October-November 1979 showed a definite trend toward larger and more mature squid being located at greater depths (SCR Doc. 80/II/40). Studies in Subarea 3 did not cover sufficient periods of time to allow the tracing of maturation patterns to the same extent as in Subarea 4. However, a study of *Illex* from a survey in Subdiv. 3Ps during October 1979 (SCR Doc. 80/II/11), using the same maturation criteria as used for Subarea 4, indicated that the majority of males were mature (56-69%) whereas less than 1% of the females had entered the late stage of maturity (vitellogenesis); but a study from inshore Newfoundland samples (SCR Doc. 80/II/34), using different maturation criteria (ICNAF Res. Doc. 73/71), indicated that very few males (less than 5%) had become mature in November and all females observed were immature.

Information on the sex ratio of *Illex* in Subarea 4 during July-August showed males at about 59% (SCR Doc. 80/II/2). Similar percentages were reported for samples taken at Holyrood, Newfoundland, until the end of August (SCR Doc. 80/II/34). The percentages of males were noted to decline during the latter part of the season, the most rapid decline occurring during the last month (SCR Doc. 80/II/12, 30, 36). Although no conclusive evidence was presented, it was suggested, among other factors, that these changes might be the result of larger females cannibalizing on smaller males and/or emigration of the earlier maturing males.

The Committee noted that a better understanding of the life cycle of *Illex* has been achieved through the accumulation of information, presented at this and previous meetings, from observations on egg and larval stages in the laboratory, on larval and early juvenile stages found in Gulf Stream waters of Subareas 3 and 4 in the spring, and on the progression of maturation in juvenile to mature adult stages during the summer and autumn on the continental shelf.

iii) Spawning

Observations on maturity and spawning were again made on *Illex* in captivity (SCR Doc. 80/II/39), indicating that the egg masses were extruded by mantle contraction as the females "rested" on the bottom of the pool and became neutrally or positively bouyant with the influx of colder, more saline water into the pool. The Committee agreed that there was insufficient evidence to relate these observations to natural conditions. Specifically, concern was expressed with regard to the suggestion of bottom spawning and the bouyancy of egg masses, as in nature larvae have been found in the upper 500 m of the water column (SCR Doc. 80/II/38).

iv) Age determination

The Committee recognized that research into age determination of *Illex* from statoliths had progressed. One study (SCR Doc. 80/II/1) found that the number of "rings" increased with mantle length, but that they did not appear to represent chronological marks based on a cohort analysis of samples from inshore Newfoundland waters. However, age validation may have been complicated by the presence of mixed age-groups in the samples. Another study (SCR Doc. 80/II/22) pointed out some characteristic views on ageing methodology from a literature review of the subject on various squid species, and suggested for *Illex* a relationship between mantle length and statolith length and between mantle length and the number of growth "rings".

v) Food and feeding patterns

The majority of the *Illex* stomachs examined from Subarea 3 were empty or less than half full and no specific feeding pattern was discernable (SCR Doc. 80/II/12). In Subarea 4,

however, studies undertaken in 1978 and 1979 (SCR Doc. 80/II/31) indicated that feeding activity was at a high level in May, decreased during the summer and increased again by September, corresponding with fluctuations in the apparent abundance of euphausiids which represent the most common prey species. It is likely that *Illex* feeds on euphausiids in the upper regions of the water column at night and returns to the bottom to digest their meal during daylight hours, but the occurrence of fish in the stomachs also indicates demersal predation. Experiments in the laboratory indicated that it took 14-16 hours for *Illex* to fully digest a meal of macerated or chunky food (SCR Doc. 80/II/29).

Three major types of *Illex* food (crustaceans, fish and squid) were identified (SCR Doc. 80/II/31). The crustaceans were mainly euphausiids and the squid were mainly *Illex illecebrosus* but the fish species were less readily identifiable. A study of the frequency of occurrence of these prey groups in relation to size of *Illex* indicated that the importance of crustaceans as food decreased from more than 80% in juvenile squid of 145 mm (at the time of immigration) to less than 50% in squid of 200-225 mm mantle length. Cannibalism consistently increased from about 40% in squid of 200-225 mm to more than 80% in the 1978 and about 60% in the 1979 samples for the largest sizes of *Illex*. The occurrence of fish as food was about 10% for all size groups of *Illex* greater than 200-225 mm. The progression of predation from feeding on crustaceans to fish and squid was attributed to availability and size-relative preference of prey (SCR Doc. 80/II/31). Mysids, copepods and amphipods and eggs of this crustacean constituted the stomach contents of the few juvenile *Illex* (10-70 mm) with sufficient food to quantify.

vi) Tagging

Tagging studies on squid conducted in Newfoundland waters since 1965 (SCR Doc. 80/II/33) indicated very few tag returns up to 1977. However, tagging studies in 1978 and 1979, with improved tagging techniques, higher rewards for tag returns and greater publicity about the experiments, demonstrated that such studies are useful in elucidating inshore migration patterns. Preliminary results indicate both small-scale and large-scale movements in coastal waters, but increased offshore tagging effort is needed in order to understand the shoreward migration pattern.

d) Environmental influence on distribution and abundance

i) Scotian Shelf

Data from a Canadian survey in 1979 (SCR Doc. 80/II/17) confirmed the general trend of high abundance being connected with high mean bottom temperatures. Although no linear relationship is obvious between temperature and abundance, there is the tendency for abundance to be high at bottom temperatures greater than 6°C and for large squid catches to occur in areas where the temperature ranged from 8 to 10°C. The results of a joint Canada/USSR survey in March-April 1979 (SCR Doc. 80/II/38) indicate that most of the catches of juvenile *Illex* occurred in waters influenced by the Gulf Stream system at temperatures ranging from 15 to 20°C and salinities between 35.4 and 36.6‰. These results indicate that temperature may indirectly influence squid abundance through larval and juvenile survival and distribution.

ii) Gulf of St. Lawrence

Although no apparent relationship was obvious between temperature and *Illex* abundance from data available for 1970-78, it was noted that both the mean bottom temperature and squid abundance were high in 1978 (SCR Doc. 80/II/17).

iii) Newfoundland area

Data from a French survey on St. Pierre Bank (Subdiv. 3Ps) in October 1979 (SCR Doc. 80/II/11) indicated that 90% of the catches containing squid were made at temperatures between 6 and 8°C along the slope of the bank. Temperatures (-1 to 3°C) on shallower parts of the bank, influenced by the Labrador Current system, appeared to be unsuitable for squid and probably formed a thermal barrier to their migration. Data for the coastal waters around St. Pierre and Miquelon islands indicate that the inshore migration of squid begins when the temperature reaches 7°C at the end of June and that the offshore migration occurs in early November when the temperature falls below this value. These observations, together with those for inshore Newfoundland waters indicate that the squid-jigging fishery usually occurs at temperatures from 7 to 15°C. However, it was noted that high catch rates in southeastern Newfoundland localities (Div. 3L) in 1979 were associated with low water temperatures (< 5°C), and it was suggested that other environmental factors, such as wind direction, may influence the inshore distribution of squid.

An updated study, based on observations during 1966-79 (SCR Doc. 80/II/5), indicated that the offshore abundance of *Illex* observed in trawl surveys on the Grand Bank in the spring is not a reliable index to forecast the magnitude of the subsequent inshore migration. The forecast index does not seem to be correlated with either yearly sea-surface temperature anomalies or iceberg numbers, but the observations suggest that the fluctuation of the frontal zone between the cold Labrador Current and the warmer North Atlantic Current may play a determining role in the distribution of squid not only because of temperature preference but also because of food availability.

e) Abundance indices

Various estimates and indices of *Illex* abundance in Subareas 3 and 4 for 1979 were considered and compared with the results of earlier studies. The estimates, summarized in Tables 2 and 3, were classified as (i) sequential abundance estimates, (ii) stratified random groundfish survey estimates, (iii) areal expansion of commercial fishery catch rates, and (iv) others.

Table 2. Summary of abundance estimates for *Illex illecebrosus* in Subareas 3 and 4 in 1979, based on research documents and other information considered by STACFIS.

| Country | Area | Source | Time period | Population ($10^6$) | Biomass (tons) | Survey area | Comments |
|---|---|---|---|---|---|---|---|
| Canada | 3N | SCR 80/II/35 | Jun | 193.3 | 21,410 | | Strat. random trawl survey |
| | 3O | " | " | 333.0 | 29,030 | | " " " " |
| | 3Ps | " | " | 44.2 | 3,600 | | " " " " |
| | 3 | " | Sep 1-15 | 6,548.0 | 1,763,370 | | Sequential abundance analysis |
| | 4T | SCR 80/II/17 | Sep | | 13,320 | | Strat. random trawl survey |
| | 4VWX | " | Jul | | 70,300 | | " " " " |
| | 4VWX | Unpubl. data | Sep 2 | | 44,520 | | Sequential abundance analysis |
| | 4VWX | SCR 80/II/37 | Oct-Nov | 135.0 | 45,000 | | Areal expansion, research survey |
| | 4 | SCR 80/II/32 | Jul 8 | | 62,000 | | Catch/effort *vs* cumulative catch |
| | 4 | " | Sep 2 | | 132,000 | | " " " " |
| Cuba | 4VW | SCR 80/II/7 | Jul | | 85,570 | $1.7 \times 10^6$ ha | Areal expansion - Cuban fishery |
| | | " | Aug | | 102,420 | $1.5 \times 10^6$ ha | " " " " |
| | | " | Sep | | 96,840 | $2.4 \times 10^6$ ha | " " " " |
| France | 3Ps | SCR 80/II/11 | Oct 12-31 | 262.5 | 70,000 | | Strat. random trawl survey |
| Japan | 4VWX | SCR 80/II/9 | Sep | | 692,000 | 4,769 $mi^2$ | Areal expansion - Japanese catch from Canadian allocation |
| Poland | 4W | SCR 80/II/23[a] | Jul | 564.6 | 107,030 | 17,050 $km^2$ | Areal expansion - Polish fishery |
| Romania | 4W | SCR 80/II/3 | Aug | 635.0 | 98,781 | 9,988 $km^2$ | Areal expansion - Romanian fishery |
| USSR | 3+4 | SCR 80/II/36[a] | Aug | | $1.5-3.0 \times 10^6$ | | Areal expansion, March research vessel survey |

[a] Estimates revised by STACFIS from documented values.

Table 3. Relative biomass density estimates for *Illex illecebrosus* in Subareas 3 and 4, based on (A) stratified random trawl surveys, and (B) areal expansion of commercial fishery data.

| | | | 1979 | 1978 | 1977 | 1976 | 1975 | 1974 | 1973 | 1972 | 1971 | 1970 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. | 3NOP | May-Jun | 1.0 | 0.15 | 0 | 0.04 | 0.001 | 0.002 | 0.01 | 0.13 | 0.09 | 0.02 | SCR 80/II/5 |
| | 3Ps | Oct | 1.0 | | 0.96 | | | | | | | | SCR 80/II/11 |
| | 4T | Sep | 1.0 | 2.32 | 1.15 | 1.27 | 0.08 | 0 | 0.004 | 0.002 | 0.03 | 0 | SCR 80/II/17 |
| | 4VWX | Jul | 1.0 | 0.16 | 0.66 | 2.90 | 0.35 | 0.14 | 0.13 | 0.05 | 0.21 | 0.03 | " |
| B. | 4VW | Jul | 1.0 | 0.29 | 1.78 | | | | | | | | SCR 80/II/7 |
| | | Aug | 1.0 | 1.05 | 0.86 | | | | | | | | " |
| | | Sep | 1.0 | 0.92 | | | | | | | | | " |
| | 4VWX | Sep | 1.0 | 0.36 | | | | | | | | | SCR 80/II/9 |
| | 4W | Jul-Oct | 1.0 | 0.83 | 1.34[a] | | | | | | | | SCR 80/II/23 |

[a] Not adjusted for area.

i) Sequential abundance estimates

Sequential abundance estimates based on bi-weekly commercial catch reports were presented for Subareas 3 (SCR Doc. 80/II/35) and Subarea 4 (unpublished data). Such estimates rely on assumed natural mortality and end-of-season fishing mortality rates, as well as data chosen for the application of "terminal F", and the resulting estimates are sensitive to these parameters. The terminal F-value for the Subarea 3 estimate was obtained by maximizing the correlation between calculated bi-weekly fishing mortality rates and "fishing effort" obtained by dividing the bi-weekly catch by catch rates at Holyrood, Newfoundland. The Committee noted that a decline of 76% in the Holyrood catch rates from 1 July to 30 September did not correspond to the calculated 28% decline in population numbers during this period. It was concluded that the catch rates at Holyrood indicated a high local exploitation rate and did not measure the overall abundance of *Illex* in Subarea 3. Since no other index was available to calibrate the sequential abundance estimate, the Committee considered the estimate for Subarea 3 to be unreliable. The Committee was also unable to achieve a satisfactory calibration of the sequential abundance estimate for Subarea 4, because the catch-per-unit-effort *series* showed no decline over time when the rates were expressed in terms of numbers.

ii) Stratified random trawl survey estimates

Biomass estimates based on stratified random bottom trawl surveys were available for Div. 3NOP in June 1979 (SCR Doc. 80/II/36), Subdiv. 3Ps in October (SCR Doc. 80/II/11), Div. 4T in September (SCR Doc. 80/II/17), and Div. 4VWX in July (SCR Doc. 80/II/17). These estimates were considered to be underestimates due to systematic overestimation of catchability coefficients, but it was concluded that they can be used in year-to-year comparisons to indicate relative changes in *Illex* abundance.

The geographical distribution of research vessel catches on the Scotian Shelf in 1979 was unusual, with several large catches being made northeast of Sable Island. The disproportionate influence of small numbers of large catches in determining the mean catch per tow and the abundance estimates was noted. Diel effects were not allowed for in the calculation of the abundance estimates on the Scotian Shelf.

iii) Areal expansion of commercial fishery catch rates

Areal-expansion estimates of the squid biomass in the areas of commercial fishing were presented in SCR Doc. 80/II/3, 7, 9 and 23. It was noted that these estimates depend on the untested assumptions that squid density is uniform over large areas and that commercial fishing operations do not concentrate on local areas of high relative density. Any tendency of the commercial fleet to locate and exploit areas of high local abundance would cause the density to be overestimated. This overestimation is compensated in some degree by overestimation of the catchability coefficient and limiting the area for which the calculated densities are extrapolated. It was noted that detailed analysis of commercial catch, effort and location of capture data from logbook records could lead to estimates of the biases involved.

Systematic differences in catch rates were noted between Japanese vessels fishing from the Canadian allocation and those fishing from the Japanese allocation for squid, the factor being 2 in the case of catch per hour fished and 4 for catch per day fished. Because such large differences have a substantial impact on the analysis of commercial fishery data, the Committee

recommends (1)

*that commercial catch and effort statistics of national fleets, classified by tonnage class, gear type and NAFO division (and subdivision, where applicable), be reported in provisional and final form to the NAFO Secretariat, distinguishing statistics relating to catches from national quotas and those suballocated from the Canadian quota.*

iv) Other estimates

*Illex* abundance estimates were also presented in SCR Doc. 80/II/32, 36, 37. A regression of catch rate on cumulative catch for the offshore fishery in Subarea 4 led to rough estimates of 60,000-130,000 tons for the area fished. Areal expansion and projection to August of USSR survey catches of larval and juvenile squid in March 1979 led to biomass estimates of 1.5-3.0 million tons for Subareas 3 and 4. The Committee noted that the assumed survival rate was arbitrary so that the absolute magnitude of the biomass in August was not reliably estimated. The potential value of such pre-season surveys in providing an index of abundance of young *Illex* was stressed, and the Committee emphasized

the value of repeating such surveys and of refining the estimation technique. A research vessel survey in October-November 1979 led to a biomass estimate of 45,000 tons of *Illex* in a band along the edge of the Scotian Shelf.

The Committee, being fully aware of the sources of bias and uncertainty in the various abundance estimates, noted that (i) the reported preliminary catch of *Illex* in Subareas 3 and 4 was 153,000 tons, (ii) an estimated biomass of about 70,000 tons remained along the slope of St. Pierre Bank and 45,000 tons in a narrow band along the edge of the Scotian Shelf near the end of the fishing season, (iii) commercial catch rates in Subarea 4 remained high throughout the fishing season, and (iv) commercial catch rates and research vessel surveys indicated a greater abundance of *Illex* in Subareas 3 and 4 in 1979 than in 1978. Consequently, the Committee concluded that the biomass of *Illex* was quite high in Subareas 3 and 4 in 1979, probably between 500,000 and 3,000,000 tons in August (SCR Doc. 80/II/36).

The ratio of stratified random trawl survey abundance indices for 1979 in Subarea 3 (Div. 3NOPs in June) and in Subarea 4 (Div. 4VWX in July) was 54:70 (Table 2), approximately the same (5:7) as the estimated biomass ratio for these subareas in 1978 (*ICNAF Redbook* 1979, page 45). The Committee recognized that the relative proportions of the biomass in Subareas 3 and 4 may vary substantially from year to year due to oceanographic and other factors. The research vessel survey data indicate that the abundance of *Illex* was much greater during the 1975-79 period than during 1970-74 (Table 2), the ratio of averaged indices for these periods being 5:1 for Div. 3NOPs and 10:1 for Div. 4VWX.

f) Management regime

Due to high inshore abundance of *Illex*, the preliminary total catch of 153,000 tons in Subareas 3 and 4 exceeded the recommended 1979 TAC of 120,000 tons by 27%. The larger-than-expected catch does not appear to have increased the exploitation rate for *Illex* beyond the target level adopted by ICNAF's Standing Committee on Research and Statistics (*ICNAF Redbook* 1978, page 28) because abundance in 1979 was high. The 1979 TAC was divided into an inshore allowance of 35,000 tons and offshore allocations of 85,000 tons. The offshore fishery was controlled by licence limitation on the area fished and by enforcement of catch allocations, but the inshore fishery was not controlled. In view of the unexpected excess (by a factor of 2.4) of the inshore catch over the allowance, the Committee examined the consequences of not regulating the inshore fishery.

Although offshore surveys do not appear to provide a predictive index, there is the tendency for Newfoundland inshore catches to be high when trawl survey estimates in Div. 3NOPs are high (SCR Doc. 80/II/5). Similarly, abundance indices for Subareas 3 and 4 show roughly parallel trends. Thus, it is possible that inshore availability of large quantities of *Illex* occurs only in years of high abundance over much of Subareas 3 and 4. If this is so, fishing mortality in the inshore fishery, which is geographically restricted to a narrow band along the coast, would affect a limited proportion of the stock. Therefore, it appears that, in years of high squid abundance, the inshore fishery could exceed its allowance without leading to excessive exploitation of the stock. However, this conclusion remains speculative, and, until there is firm evidence to support this view, potential inshore catches should continue to be allowed for within an overall TAC.

The offshore fishery, however, takes place in areas where squid may be concentrated in years of low abundance. The offshore fleet is highly mobile and can locate the squid concentrations when abundance is low. Also, information from the offshore fishery in 1979 indicates that the catch rates of some vessels may vary by as much as a factor of 4 by changes in fishing tactics. The Committee considers that the use of some measure of fishing effort, such as "days on grounds", as the basis for regulation of the offshore squid fishery with no catch limitation could lead to unforeseen large changes in the catchability coefficients of the commercial fleets. For these and other reasons outlined in previous reports (*ICNAF Redbook* 1978, page 23, and *ICNAF Redbook* 1979, page 29), the Committee considers that controlled offshore catch allocations in conjunction with effort constraints, as currently practised, remain the most satisfactory means of preventing biological over-exploitation and a low spawning stock size.

The Committee had no new information that would justify changing previous advice on the opening date of the offshore squid fishery (currently 1 July) in Subareas 3 and 4.

g) Total allowable catch in 1980

Previous advice on appropriate catch levels in 1978 and 1979 was based on estimating stock abundance in the previous year and applying a target exploitation rate of 0.40, under the assumption that there would be no significant change in the biomass. This approach was adopted because it was not possible, due to its one-year life cycle, to forecast the abundance of *Illex* for the ensuing year. Although abundance estimates for larval and juvenile *Illex* were available

for the first time from a winter-spring survey in 1979, there is still no reliable means of predicting the biomass in 1980. Furthermore, 1979 was a year of very high abundance, such that catches in the range of 200,000 to 1,200,000 tons might have corresponded to the exploitation rate of 0.40.

The possible consequences of applying various TACs to estimated stock biomasses in 1968-79 were examined. Using the 10-year series of biomass estimates of *Illex* from the Canada (M) bottom trawl surveys in Div. 4VWX (SCR Doc. 80/II/17) as relative abundance indices, *Illex* biomasses were calculated for Subareas 3 and 4 by assuming research vessel catchability to be 10% and equal abundance of squid in the two subareas (Table 4). TAC levels of 100,000, 150,000 and 200,000 tons are expressed as percentages of the calculated biomasses. These estimates are crude and are intended only to indicate in a general way what might have happened if a constant TAC had been in effect from 1968 onwards. Also, it must be emphasized that the catchability factor of 10% has not been experimentally measured and that it may differ substantially from the assumed value as well as varying from year to year. With these limitations, Table 4 shows that closure of the fishery would have been necessary in years of low abundance when a TAC of 100,000 tons exceeded the calculated biomass, whereas in years of high abundance a TAC of 200,000 tons represents a calculated exploitation rate less than half of the target value of 0.40 used in previous assessments. Thus, no single TAC is appropriate for all years, and the need for a means of forecasting squid abundance is underlined.

In evaluating the likely consequences of alternative TACs, it was assumed that offshore allocations would be taken unless the fishery was closed and that inshore catches would be proportionate to squid abundance. In 1976-79, inshore catches represented 27-57% of the total catches and averaged 45%. If this relative proportion continues and if a TAC of 150,000 tons were chosen, serious over-exploitation would not likely occur except in years of low abundance. The squid fishery would be expected to fail in these years under almost any circumstances, and it would be necessary for managers to detect and deal with situations of very low abundance. In years of exceptionally high abundance, catches would be less than those corresponding to the target exploitation rate (0.40), but this is also considered inevitable until some means of predicting squid abundance is developed. Although tentative, the above analysis indicates a range of situations that might arise in 1980. On the basis of relative abundance indices for the last 12 years, the Committee advises that a TAC of 150,000 tons would not be associated with a serious risk of excessive exploitation.

Table 4. Possible historical impact of various TAC levels on squid (*Illex*) in Subareas 3 and 4.

| Year | Calculated biomass 3+4 (000 t) | % TAC is of calculated biomass TAC 100,000 tons | TAC 150,000 tons | TAC 200,000 tons |
|---|---|---|---|---|
| 1968 | 100[1] | 100** | 150** | 200** |
| 1969 | 22[1] | 493** | 680** | 907** |
| 1970 | 38 | 260** | 390** | 520** |
| 1971 | 294 | 34 | 51* | 68* |
| 1972 | 64 | 157** | 235** | 313** |
| 1973 | 178 | 56* | 84* | 112** |
| 1974 | 190 | 53* | 79* | 105** |
| 1975 | 496 | 20 | 30 | 40 |
| 1976 | 5,250 | 2 | 3 | 4 |
| 1977 | 1,010 | 10 | 15 | 20 |
| 1978 | 220 | 45 | 68* | 91** |
| 1979 | 1,406 | 7 | 11 | 15 |
| No. of years when more than 50% of TAC would have been taken (*+**) | | 6 | 8 | 8 |
| No. of years when more than 90% of TAC would have been taken (**) | | 4 | 4 | 7 |

[1] Estimated from overall ratio of Canadian and USA survey indices in 1970-77, excluding 1976.

h) Conclusions

Having considered the various biomass estimates and indices of abundance of *Illex* in Subareas 3 and 4 in 1979, the Committee observed that:

i) The biomass in 1979 was very large, greater than that of 1978.

ii) The biomass in 1979 was not precisely estimated but it was considered to be in the range of 500,000-3,000,000 tons.

iii) The estimated biomass in 1979 could not be used to project the stock size in 1980, due to the very short life cycle of *Illex*.

iv) Various approaches, using estimated relative values of successive annual generations were discussed to assess the possible biomass and the level of exploitation in 1980.

v) The catch associated with a target exploitation rate of 0.40 could be in the range of 100,000 to 200,000 tons, and a 1980 TAC of 150,000 tons would not be associated with a serious risk of excessive exploitation.

vi) If the squid biomass in 1980 is very high, as in 1979, the inshore allowance could be exceeded without causing excessive exploitation of the stock.

vii) If the biomass in 1980 is low, the offshore fishery will probably not be able to maintain high catch rates, and the limitation of offshore fishing effort by applying the 1978 catch rate to the 1980 TAC would ensure that fishing mortality would not increase greatly despite reduced abundance.

## II. FUTURE RESEARCH REQUIREMENTS

1. Cod in Divisions 3M and 3NO

The Committee noted with concern that commercial catch rate data for recent years are not very well correlated with biomass estimates from cohort analysis. The value of research vessel surveys was stressed, and it was agreed that efforts should be intensified in that direction.

2. Capelin in Subareas 2 and 3

In view of the importance of acoustic techniques in detecting trends in capelin abundance, the Committee agreed that high priority should be placed on experiments to estimate the variance associated with the calibration parameters, especially target strength which is known to be highly variable. Also, attempts to calculate the variance associated with survey design should be started immediately.

3. Squid in Subareas 3 and 4

a) The Committee noted the progress being made in studies on the use of statoliths as indicators of age in *Illex* and urged that such studies be continued.

b) The Committee noted the success of recent inshore tagging experiments and suggested that future research be directed toward the development of offshore tagging techniques, as it was considered that offshore tagging would be significant in determining migratory patterns, stock discrimination and the estimation of population parameters.

c) The Committee noted the very significant progress in 1979 toward understanding the larval and juvenile distribution of *Illex* and the influence of environmental factors, and strongly urges the continuation and expansion of such studies, including increased emphasis on the determination of oceanographic processes and environmental factors which may influence growth, distribution and mortality of larvae and juvenile *Illex* prior to their appearance on the continental shelf.

d) The Committee agreed that increased emphasis should be placed on studies relating to the influence of environmental conditions on the distribution and abundance of *Illex* during their occurrence on the continental shelf.

## III. ACKNOWLEDGEMENT

There being no further business, the Chairman expressed his thanks to all participants for their interest and cooperation during the course of the meeting, especially to the rapporteurs who summarized the results of the discussions on their assigned topics and to Dr F. Nagasaki who agreed on short notice to be Convener of the *ad hoc* Working Group on Squid, and to the Secretariat for their usual efficient work.

# PART E

REPORT OF SCIENTIFIC COUNCIL

Regular Meeting, June 1980

CONTENTS

# REPORT OF SCIENTIFIC COUNCIL

## Regular Meeting, June 1980

Chairman: R. H. Letaconnoux Rapporteur: V. M. Hodder

The Scientific Council and its Standing Committees met at NAFO Headquarters in the Bedford Institute of Oceanography, Dartmouth, Canada, during 3-13 June 1980, to consider and report on the various matters listed in the agenda (see Part H, this volume). In addition to dealing with matters of general scientific interest, the Council considered requests from the Fisheries Commission and the coastal contracting parties (Canada and European Economic Community) for advice on management in 1981 of a number of stocks in Subareas 0 to 4. Representatives attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany and France), German Democratic Republic, Japan, Poland and Union of Soviet Socialist Republics (USSR), and observers were present from Spain and United States of America (USA) (see Part H, this volume).

Prior to the first session of the Council, the Executive Committee met briefly to review the agenda and the scheduling of meetings of the Standing Committees. It was noted that Dr A. S. Seliverstov had recently resigned as Chairman of the Standing Committee on Research Coordination, and the Council at its first session unanimously elected Dr V. A. Rikhter (USSR) to act as Chairman of STACREC for the remainder of the 2-year term.

The reports of the Standing Committees, as adopted by the Council at this meeting, are given in Appendix I (STACFIS), Appendix II (STACREC) and Appendix III (STACPUB); the amended Rules of Procedure, adopted unanimously on 13 June 1980, are given in Appendix IV. Brief summaries of the committee reports and other matters considered by the council are given below.

## I. FISHERY SCIENCE (APP. I)

### 1. General Fishery Trends

The total nominal catch of all species (except seaweeds) in Subareas 0 to 6 was about 2.97 million tons in 1979, an increase from 2.84 million tons in 1978 (see Appendix I, Table 1). The total catch of "groundfish" species increased from 1.14 million tons in 1978 to 1.24 million tons in 1979 (9%); within this group, increases were noted for cod (20%) in Subareas 1, 3 and 4, for redfish (10%) in Subareas 2 and 3, for yellowtail flounder (25%) in Subareas 3 and 5, for Greenland halibut (10%) in Subareas 1 and 4, and decreases occurred for haddock (12%) in Subareas 4 and 5, for silver hake (16%) in Subarea 5, for witch flounder (18%) in Subarea 3, and for roundnose grenadier (42%) in Subarea 3. The total catch of pelagic species declined from 605,000 tons in 1978 to 577,000 tons in 1979 (5%), due largely to a decline for herring (18%) in Subarea 4, although increases were noted for mackerel (18%) in Subarea 4 and for menhaden (8%) in Subareas 5 and 6. For the "other fish" category, the total catch declined from 177,000 tons in 1978 to 128,000 tons in 1979 (28%), due entirely to a major decrease for capelin (65%) in Subarea 3. The total catch of "invertebrate" species increased from 916,000 tons in 1978 to 1,024,000 tons in 1979 (12%), with increases noted for squids (61%) in Subareas 3, 4 and 5, for clams (13%) in Subarea 6, and for shrimp (15%) in Subareas 1, 2 and 4, and a decrease for scallops (9%) in Subareas 5 and 6.

With respect to the nominal catches of all species by subarea, increases from 1978 to 1979 were recorded for Subarea 0 (1,000 to 2,000 tons), Subarea 1 (128,000 to 170,000 tons), Subarea 3 (575,000 to 620,000 tons), Subarea 4 (724,000 to 729,000 tons), Subarea 5 (529,000 to 557,000 tons) and Subarea 6 (801,000 to 816,000 tons), and a decrease for Subarea 2 (77,000 to 72,000 tons).

### 2. Stock Assessments

#### a) Summary

STACFIS reviewed the state of, and advised on, catch levels in 1981 for a number of stocks in Subareas 0 to 4, which lie completely or partly within the 200-mile fisheries zones of Canada and the European Economic Community (Agenda Annexes 1 and 2) and the three stocks which lie outside national fisheries zones in Div. 3M. Insofar as it was possible, total allowable catch (TAC) levels for 1981 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 at Appendix I.

When it was possible to do so for some stocks, management options at various levels of fishing mortality and the long-term effects on catch and biomass are presented rather than a TAC associated with a particular level of fishing mortality, in accordance with requests from Canada and the European Economic Community. Such management options are provided for the cod stocks in Subarea 1 and Div. 2J+3KL.

Table 1. Summary of recent catches (1974-79) and TACs (1974-80) for stocks reviewed at the June 1980 meeting of STACFIS, together with the advised TACs for 1981.

| Species | Stock area | Nominal catches (000 tons) | | | | | | TACs (000 Tons) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1974 | 1975 | 1976 | 1977 | 1978 | 1979[1] | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
| Cod | 1 | 48 | 48 | 33 | 38 | 39 | 51 | 107 | 60 | 45 | 31 | ...[2] | ...[2] | ...[2] | ( )[3] |
| | 2J+3KL | 373 | 288 | 214 | 173 | 139 | 172 | 657 | 554 | 300 | 160 | 135 | 180 | 180 | ( )[3] |
| | 3M | 25 | 22 | 22 | 25 | 33 | 30 | 40 | 40 | 40 | 25 | 40 | 40 | 13 | ( )[4] |
| | 3NO | 73 | 44 | 24 | 18 | 15 | 28 | 101 | 88 | 43 | 30 | 15 | 25 | 26 | ( )[4] |
| Redfish | 1 | 3 | 9 | 14 | 31 | 8 | 9 | - | - | - | - | 13 | ... | ... | ( )[3] |
| | 3M | 35 | 16 | 17 | 20 | 17 | 20 | 40 | 16 | 16 | 16 | 16 | 20 | 20 | (20) |
| | 3LN | 22 | 18 | 21 | 16 | 12 | 14 | 28 | 20 | 20 | 16 | 16 | 18 | 25 | (25) |
| Silver hake | 4VWX | 96 | 116 | 97 | 37 | 48 | 52 | 100 | 120 | 100 | 70 | 70 | 70 | 90 | (70-80) |
| A. plaice | 3M | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 4 | 2 | 2 | ( 2) |
| | 3LNO | 46 | 43 | 52 | 44 | 50 | 49 | 60 | 60 | 47 | 47 | 47 | 47 | 47 | (55) |
| Witch | 2J+3KL | 16 | 12 | 11 | 8 | 7 | 4 | 22 | 17 | 17 | 17 | 17 | 17 | 17 | ( 8) |
| | 3NO | 8 | 6 | 6 | 6 | 3 | 3 | 10 | 10 | 10 | 10 | 10 | 7 | 7 | ( 5) |
| Yellowtail | 3LNO | 24 | 23 | 8 | 12 | 15 | 18 | 40 | 35 | 9 | 12 | 15 | 18 | 18 | (21) |
| G. halibut | 0+1 | 14 | 25 | 16 | 13 | 12 | 19 | - | - | 20 | 20 | 20 | 25 | 25 | (25) |
| | 2+3KL | 27 | 29 | 25 | 32 | 39 | 34 | 40 | 40 | 30 | 30 | 30 | 30 | 35 | (55) |
| R. Grenadier | 0+1 | 12 | 5 | 9 | 3 | 6 | 7 | - | 10 | 14 | 8 | 8 | 8 | 8 | ( 8) |
| | 2+3 | 28 | 27 | 21 | 15 | 21 | 8 | 32 | 32 | 32 | 35 | 35 | 35 | 30 | (27) |
| Wolffishes | 1 | 6 | 6 | 6 | 6 | 6 | 17 | - | - | - | - | - | - | - | ( )[3] |
| Argentine | 4VWX | 17 | 15 | 7 | 2 | 2 | 3 | 25 | 25 | 25 | 20 | 20 | 20 | 20 | (20) |
| Capelin | 2+3K | 127 | 199 | 216 | 152 | 55 | 12 | 110 | 160 | 160 | 212 | 212 | 75 | 5 | ( )[4] |
| | 3LNO | 158 | 166 | 144 | 74 | 30 | 12 | 148 | 180 | 180 | 200 | 200 | 10 | 16 | ( )[4] |
| Shrimp | 0+1 | 22 | 38 | 50 | 42 | 34 | 37 | - | - | - | 36[5] | 40[5] | 29.5[5] | 29.5[5] | ( )[4] |
| Squid | 2-4 | 1 | 18 | 42 | 83 | 94 | 160 | - | - | - | - | 100 | 120 | 150 | (150) |

[1] Provisional statistics.
[2] Catches restricted to Greenlanders' fishery and to by-catch.
[3] See relevant subsections of STACFIS Report (Appendix I).
[4] Deferred to mid-term meeting.
[5] TACs pertain to offshore grounds.

Increases in TAC for 1981, compared with 1980, were advised for American plaice in Div. 3LNO, yellowtail in Div. 3LNO, and Greenland halibut in Div. 2+3KL. Decreases in TAC were advised for witch flounder in Div. 2J+3KL and Div. 3NO, roundnose grenadier in Subareas 2+3, and silver hake in Div. 4VWX. In the case of redfish and wolffishes in Subarea 1, the information available was inadequate for assessment, and the Council can only indicate approximate sustainable yield levels based mostly on historical catch data.

In view of the substantial contribution of recruiting year-classes to annual yields, no TACs were advised for the shrimp stocks in Subareas 0+1 and the two capelin stocks in Subareas 2+3, because of the necessity of having available complete information from the commercial fishery and research vessel surveys in 1980. Advice on TAC levels in 1981 for the cod stocks in Div. 3M and Div. 3NO was also deferred to a mid-term meeting, due to the continued uncertainty about the state of these stocks and the need to consider potentially valuable data from the commercial fishery and research vessel surveys in 1980. In view of the unlikely prospect that the abundance of squid in 1981 can be predicted, the Council reiterates the management regime proposed for squid at its Special Meeting in February 1980 (Part D, this volume).

b) Additional comments relevant to assessments

i) Fishery statistics for Subarea 1

In its review of the stock assessments, particularly with reference to cod and redfish and possibly other species in Subarea 1, the Council noted the implications that the data base (i.e. Statistical Bulletin) contains inaccurate catch and effort statistics. Although the magnitude of the discrepancies have not yet been determined, the Council strongly urges that, if the errors are large, updated statistics should be reported to the Secretariat, so that the data base can be amended for future use.

ii) Redfish in Divisions 3L and 3N

The Council noted the great uncertainty associated with the assessment of this stock and agreed that the calculated equilibrium yield at 2/3 $F_{MSY}$ of 32,000 tons is likely to be an overestimate. Not being able to realistically specify a particular catch associated with

2/3 $F_{MSY}$, the Council advises that a catch of 25,000 tons in 1981 should control fishing effort at a level less than that associated with $F_{MSY}$.

iii) Wolffishes in Subarea 1

The Council noted the problems associated with assessing wolffish in Subarea 1 due to the limited biological information available and the absence of information on separate catch statistics for the two commercially-caught species. The scientific necessity of breaking down the catches of wolffish by species was noted, if detailed assessments of the wolffish stocks are required. The matter was referred to STACREC for further consideration.

iv) Squid-*Illex* in Subareas 3 and 4

The Council agreed that it would be unnecessary to consider the management of squid at a mid-term meeting in 1981 but that a 3-day session should be held immediately before the June 1981 Meeting of the Scientific Council to consider all of the biological information that may be available at that time.

3. Gear and Selectivity

The Council noted the results of mesh selection studies on Greenland halibut in 1979, and

recommends (1)

*that selection studies on Greenland halibut be continued, using a range of mesh sizes including the current minimum mesh size in effect (130 mm).*

4. Ageing Techniques and Validation Studies

The Council noted that the guidelines for cod otolith interpretation are not yet available and

recommends (2)

*that these guidelines be prepared and documented in time for the September 1980 Meeting of the Council.*

Regarding the apparent discrepancies in age interpretation of redfish by scales and otoliths, the Council

recommends (3)

*i) that scientists of the various laboratories search their data files for sampling data which validate redfish ageing by otoliths or scales and document such data;*

*ii) that validation of ageing redfish by scales be presented; and*

*iii) that comparative ageing studies on the same redfish specimens be initiated by the exchange of material between Canadian and Federal Republic of Germany scientists.*

The Council also noted the apparent discrepancies in age interpretation of roundnose grenadier, and therefore

recommends (4)

*that an exchange of ageing material for grenadier be initiated between Federal Republic of Germany and German Democratic Republic scientists in an attempt to resolve the differences.*

## II. RESEARCH COORDINATION (APP. II)

1. Statistics and Sampling

a) CWP activities relevant to NAFO statistics

The Council noted the work of the CWP (Coordinating Working Party on Atlantic Fishery Statistics), particularly with regard to the operation of the STATLANT system, the development of a standard world list of 3-alpha species identifiers, the improvements to standards for fishing vessels, gear and effort, and the updating of conversion factors. It was also noted that the 10th Session of the CWP will be held at Madrid, Spain, during 22-29 July 1980, with NAFO being represented by the Assistant Executive Secretary and two Canadian nominees, Dr W. G. Doubleday and Mr D. A.

Tilley. Concerning the recent use of "off-bottom" trawls in some areas for some directed fisheries, the Council endorsed the STACREC

recommendation (5)

*that the Assistant Executive Secretary obtain from Canadian scientists an account of the recent use of the "off-bottom" trawl, including a description of the trawl, for consideration at the 10th Session of the CWP, with a view to its possible incorporation in the standard gear list.*

b) Fishery statistics

The Council expressed grave concern about the difficulties being encountered by the Secretariat, after the implementation of 200-mile fisheries management zones, in obtaining and compiling fishery statistics for stock assessments and for publication in the Statistical Bulletin. The problems are attributed in part to the late submission of STATLANT 21 reports by member states and in part to complications arising from the reporting of statistics from cooperative arrangements between Canada and other countries. The notes for the completion of STATLANT forms have been modified to avoid confusion about reporting procedures, and the Council urges that particular attention be given to the preparation of future STATLANT submissions.

In considering the content and format of the NAFO Statistical Bulletin, the Council endorsed the STACREC

recommendations (6) (7) (8)

*i) that the NAFO list of species be amended to include the two commercially-caught species of wolffish (Anarhichas lupus and A. minor), the two species of redfish (Sebastes marinus and S. mentella); blue ling (Molva byrkelange), and roughhead grenadier (Macrourus berglax), with their 3-alpha identifiers;*

*ii) that the Secretariat circulate to Scientific Council members for comment sample listings of the proposed new format for Statistical Bulletin Table 5, and present the findings for decision at the September 1980 Meeting of the Scientific Council; and*

*iii) that countries reporting large quantities of unspecified finfish in their national statistics should conduct studies during fishing operations with a view to providing an estimated breakdown of such quantities by species in future reports.*

c) Sampling program

The Council noted that the sampling data base for 1977 and 1978 was still incomplete, thus delaying the publication of the lists in Sampling Yearbook, and strongly urged scientists to check their national files to ensure that all available commercial length compositions and age-lenth keys are submitted to the Secretariat as soon as possible. The Council emphasized that the new CFS-1 and CFS-2 forms are to be used in reporting data for 1979 and subsequent years, and urged that all national data, as well as sampling data collected by international observers, be forwarded to the Secretariat for incorporation into its data base.

The Council noted the results of studies related to an appropriate partial length measurement for grenadiers and endorsed the STACREC

recommendation (9)

*that length measurements of the roundnose (Macrourus rupestris) and roughhead (M. berglax) grenadiers separated by sex be made and reported as partial lengths, measured from the tip of the snout to the base of the first anal fin-ray (anal-fin length) in half-cm intervals.*

d) Scientific observer program

The Council endorsed the procedures adopted by STACREC for the collection and reporting of data by international observers, noting that the Secretariat will coordinate the development of a suitable form for the reporting of set details, and reiterates the STACREC

recommendation (10)

*that the bilateral parties involved in the International Observer Scheme should identify the appropriate fisheries to be covered.*

e) List of fishing vessels

The Council agreed that publication of the triennial list of vessels should be continued without change, but indicated that the Fisheries Commission might wish to comment on the adequacy of the vessel characteristics listed in the tables.

2. Biological Surveys

a) Survey activity

The Council noted that STACREC had reviewed research vessel survey activities in the Northwest Atlantic in 1979 and survey plans for 1980, details of which are listed in Tables 1 and 2 of Appendix II.

b) Manual on groundfish surveys

The editor (Dr W. G. Doubleday) informed the Council that a revised draft of the manual, planned for review at this meeting, would be provided at the September 1980 Meeting. Meanwhile, the Council urged its members to provide the editor with information on survey methodology as noted in Section II(3) of Appendix II. No amendments to survey stratification schemes were reported, but Danish scientists indicated that the scheme for Subarea 1 was under revision.

c) Special survey needs

The Council observed that there was an increasing tendency to use data from research vessel surveys for estimating the minimum trawlable biomass of certain stocks, especially those for which analytical assessments are difficult or impossible. In particular, the increase in survey activity on the Grand Bank and Flemish Cap since 1978 was noted, and the Council endorsed the STACREC

recommendation (11)

*that the effectiveness of the existing survey activity for cod in Div. 3M, 3N and 3O be evaluated in order to determine future needs in these divisions.*

3. Environmental Studies

a) Environmental conditions in 1979

The Council noted that the review of environmental conditions in 1979 (Appendix II, Section III (1)) must be considered preliminary as it lacked input from the Marine Environmental Data Service (MEDS), whose progress report for 1979 was not completed in time for this meeting and will now be considered at the September 1980 Meeting.

b) Flemish Cap project

The Council observed that preliminary discussion of data being accumulated for the Flemish Cap area took place at a meeting of the Working Group in January 1980, and that further analyses will be considered at the September 1980 Meeting. Meanwhile, concern was expressed about the excessive loss of a number of moored current meters and their guard buoys, presumably through fishing activity, and the Council strongly

recommends (12)

*that the Fisheries Commission consider how the fishing fleets might best be made aware of the location of moored scientific equipment in the NAFO Area.*

c) Gulf of Maine-Georges Bank project

The Council noted that the Task Force on the Larval Herring Program had preliminary discussions in a meeting at Woods Hole, USA, during 28 April-1 May 1980, and that a more comprehensive review of the data was planned for September 1980. The Council agreed to endorse the STACREC

recommendation (13)

*that the Task Force on the Larval Herring Program should meet on 3-4 September 1980, in conjunction with the Scientific Council Meeting at St. John's, Newfoundland, to review further the analyses of the time series of data and to evaluate the data base with emphasis on factors affecting the recruitment process in herring.*

d) Other cooperative research projects

Noting the need for expansion of survey activity to cover the likely times and areas of larval and juvenile squid (*Illex*) distribution, the Council endorsed the action of STACREC in establishing a working group to examine the status of cooperative studies on squid and to coordinate survey activity, and

recommends (14)

*that the ad hoc Working Group on Coordination of Squid Research, with Mr T. Rowell (Canada) as Convener, meet immediately before the September 1980 Meeting of the Council to consider final vessel availability and program planning relative to surveys for larval and juvenile Illex in early 1981.*

## III. PUBLICATIONS (APP. III)

1. Consideration of Publication Requirements

The Council endorsed the proposals of STACPUB relating to the format and numbering of the Statistical Bulletin, Sampling Yearbook, List of Fishing Vessels, and Scientific Council Reports, and noted that final decisions on other scientific publications and editorial policy relating to them were deferred to the September 1980 Meeting. Meanwhile, the Secretariat was requested to proceed with the preparation of material for the first NAFO Research Bulletin.

2. Status of Working Papers

The Council endorsed the views of STACPUB that working papers have no official status outside of the meetings to which they are presented, and strongly emphasized that scientists intending to present substantial data and analyses should suitably prepare the material for distribution as research documents.

3. Papers for Possible Publication

The Council noted that the STACPUB members had reviewed all research documents presented to the November 1979, February 1980 and June 1980 Meetings, and have nominated 17 of them for possible publication in one of the NAFO publication series, subject to revision by the authors and acceptance by the editors.

## IV. COLLABORATION WITH OTHER ORGANIZATIONS

1. NAFO Participation in 10th Session of CWP

The Council noted that the 10th Session of the Coordinating Working Party on Atlantic Fishery Statistics will be hosted by ICCAT and ICSEAF at Madrid, Spain, during 22-29 July 1980, to discuss a variety of statistical matters, and that NAFO will be represented by the Assistant Executive Secretary and two Canadian nominees, Dr W. G. Doubleday and Mr D. A. Tilley.

2. Proposed NAFO/ICES Study on Redfish

The Council noted that the spawning areas of redfish inhabiting Subarea 1 are actually outside the NAFO area in the adjacent ICES region, and agreed that studies of the stock and fisheries in the area should be considered in cooperation with ICES. The main objective of the proposed joint study is to investigate whether the redfish resource of West Greenland can be assessed and managed separately from redfish in the adjacent ICES region. The second objective should be to identify deficiencies in the data base and, if necessary, to develop research programs to collect the relevant information. The third objective should be to assess the status of the stock and to advise on the management of redfish in Greenland waters.

The study could be initiated by evaluating all available information on (i) distribution and drift of larvae and 0-group redfish at East and West Greenland and in the Irminger Sea, (ii) distribution and emigration of juvenile and adult redfish along the Greenland coast and to the spawning areas in the Irminger Sea on the basis of tagging results and changes in model length, with a view to establishing immigration and emigration coefficients to be used in assessments, and (iii) the establishment of a catch-at-age series (including estimates of by-catches and discards in the fisheries for cod and shrimp) and a catch-per-unit-effort series for assessments.

Noting the need for immediate action on the above proposal, the Council

recommends

*that the Executive Secretary should communicate with the General Secretary of ICES with a view to initiating the establishment of a Joint NAFO/ICES Working Group on Redfish Research in the Greenland Area.*

## V. RULES OR PROCEDURE (APP. IV)

### 1. Revision to Rules of Procedure

At the Inaugural Meeting of NAFO in March 1979, the Scientific Council adopted its Rules of Procedure as listed in Appendix II to its Report of the March 1979 Meeting. Meanwhile, the General Council appointed an *ad hoc* Working Group to examine the proposed Rules of Procedure for the General Council and the Fisheries Commission, which were subsequently adopted at the June 1979 Annual Meeting. The Working Group also analyzed the Rules of Procedure for the Scientific Council and proposed certain amendments which were referred to the Executive Committee for consideration (SCS Doc. 80/VI/2). The revised Rules of Procedure were presented to the Scientific Council and were unanimously adopted on 13 June 1980 (Appendix IV).

### 2. Guidelines for the Application of Rule 1.2 in the Event of a Request for an Invitation to Attend a Meeting of the Scientific Council as an Observer

The Executive Committee recommended and the Scientific Council unanimously agreed that a request for an invitation to attend a meeting of the Scientific Council shall be dealt with by the Executive Secretary in the following manner:

a) If the request comes from an international public organization having related objectives, the reply should be positive, as required by the Convention. If the international public organization does not appear to have related objectives, it should be replied that admission is subject to the approval of the Scientific Council by vote at the beginning of the meeting in question.

b) If the request comes from a non-Member Government, it should be replied that admission is subject to the approval of the Scientific Council by vote at the beginning of the meeting in question.

c) If the request comes from a national public organization or any private organization, it should be replied that admission is subject to:

   i) the acceptance of a paper or papers presented by the requesting organizations, of significant scope relevant to any item **or** items of the agenda of the meeting in question, with the presence of the requesting organization only allowed in the sessions dealing with the paper(s) and item(s) in question; such paper(s) must be submitted to the Secretariat at least 30 days before the commencement of the Scientific Council meeting during which the paper will be expected to be considered;

   ii) approval by the Contracting Party within whose jurisdiction the requesting headquarters or branch of the organization is located; and

   iii) approval of the Scientific Council by vote at the beginning of the meeting in question.

   The presented paper(s) should be sent to the Chairman of the Scientific Council and to the representatives of the Contracting Party referred to in c(ii) above. Without the assent of every one of these representatives, the request shall be immediately rejected. Once the assent of all these representatives is in hand, the request and the paper(s) shall be sent to their Contracting Party without whose approval the request shall also be rejected.

## VI. FUTURE SCIENTIFIC MEETINGS

### 1. Annual Meeting of NAFO, September 1980

The Scientific Council and its Standing Committees will meet during 3-8 September 1980 to consider the following items, some of which were deferred from this meeting:

a) Larval herring studies in the Gulf of Maine-Georges Bank area, 1970-79.
b) Evaluation of the Flemish Cap research program.
c) Review of proposed manual on groundfish surveys.
d) Review of MEDS progress report for 1979/80.

e) Guidelines for cod otolith interpretation.
f) Coordination of research surveys for *Illex* in 1981.
g) Plans for joint NAFO/ICES research on redfish in the Greenland area.
h) Proposed new Table 5 for Statistical Bulletin.
i) Editorial policy relating to publications.

2. Mid-term Meeting for Assessment of Deferred Stocks

The Council noted that STACFIS had not been able to provide advice for management in 1981 of shrimp in Subareas 0 and 1, capelin in Subareas 2 and 3, and cod stocks in Div. 3M and 3NO, and agreed that an appropriate time to consider the status of these stocks would be at a meeting early in 1981, when data from the commercial fisheries and research surveys would be fully available. Arrangements for this mid-term meeting will be considered at the September 1980 Meeting.

3. Special Topics for Review at 1981 Meetings of the Scientific Council

a) A special session on "Squid biology and distribution" will be held immediately before the June 1981 Meeting of the Council to review all information that may be available at that time.

b) The topic "Evaluation of scientific advice provided for management of the Northwest Atlantic fish stocks, with particular reference to cod" will be considered by STACFIS at the June 1981 Meeting, when one or more papers on the subject are expected to be available.

c) A special session with invited lectures on "Remote sensing methods and their possible application to fisheries science" will be held during the September 1981 Meeting of the Council, with Dr R. W. Trites (Canada) as convener.

d) A special session on "Review of environmental conditions in the Northwest Atlantic during the 1970-79 decade" will be held during the September 1981 Meeting of the Council, the convener to be appointed at the September 1980 Meeting.

## VII. OTHER BUSINESS

1. Provisional Report of February 1980 Meeting

The Council reviewed and formally approved the report of its meeting at Lisbon, Portugal, during 5-13 February 1980, as presented in Part D (this volume).

2. Tribute to L. R. Day, retiring Executive Secretary

The Chairman noted that Mr L. R. Day, who has been Executive Secretary of ICNAF (now NAFO) since 1963, will be retiring at the end of June 1980, and, on behalf of the Scientific Council, paid him a tribute as given in Appendix V.

## VIII. ADJOURNMENT

The Chairman expressed his appreciation to the Director and staff of the Bedford Institute for the excellent meeting facilities, to the Secretariat for their usual efficient work in servicing the meeting, to the chairman and rapporteurs of committees and working groups and to all participants for their co-operation and contributions. The meeting adjourned at 1300 hours on 13 June 1980.

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

Chairman: G. H. Winters

Rapporteur: Various

The Committee met at Dartmouth, Nova Scotia, Canada, during 3-9 June 1980, to consider and report on matters referred to it by the Scientific Council, particularly the provision of advice on conservation measures for certain stocks in Subareas 0 to 4. Scientists attended from Canada, EEC (Denmark, Federal Republic of Germany and France), German Democratic Republic, Japan, Poland, Spain, USSR and USA. Instead of appointing a single rapporteur to record the results of the discussions on the many items considered, it was agreed that the Chairman designate scientists, as required, to prepare draft reports on the various topics for approval and incorporation into this STACFIS report.

Since the 1979 catch statistics available to the Committee were generally confined to species and stocks under catch quota regulation and were therefore very incomplete, the Chairman, in collaboration with the Assistant Executive Secretary, was requested to prepare the usual summary of fishery trends as soon as reasonably complete statistics for 1979 become available. This summary, based on provisional nominal catches for 1979 (SCS Doc. 80/IX/27), is given in Section I below, the results of the stock assessments are presented in Section II, and other matters considered by the Committee are given in Sections III to V.

## I. FISHERY TRENDS

### 1. General Trends for the NAFO Area

Provisional nominal catches in the Northwest Atlantic for 1979, as compiled from the STATLANT 21A returns of 16 countries with some preliminary data for four others, are summarized in Table 1, together with similar data for 1978. It is important to note that the 1979 catch figures in this section of the report may differ slightly from those used in Section II, because complete statistics for some of the countries noted above were not available when the stock assessments were carried out.

Table 1. Nominal catches (000 tons) for 1978 and 1979[1]. (The symbol + indicates less than 500 tons.)

| Species | SA 0 | | SA 1 | | SA 2 | | SA 3 | | SA 4 | | SA 5 | | SA 6 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1978 | 1979 | 1978 | 1979 | 1978 | 1979 | 1978 | 1979 | 1978 | 1979 | 1978 | 1979 | 1978 | 1979 | 1978 | 1979 |
| Atlantic cod | - | - | 38 | 51 | 34 | 26 | 192 | 249 | 164 | 197 | 48 | 50 | + | + | 476 | 573 |
| Haddock | - | - | + | + | - | - | 1 | 1 | 33 | 29 | 27 | 24 | - | + | 61 | 54 |
| Atlantic redfishes | + | + | 8 | 9 | 12 | 17 | 68 | 76 | 30 | 28 | 14 | 15 | - | - | 132 | 145 |
| Silver hake | - | - | - | - | - | - | + | + | 48 | 52 | 27 | 10 | 12 | 11 | 87 | 73 |
| Red hake | - | - | - | - | - | - | - | - | 1 | + | 5 | 7 | 1 | 2 | 7 | 9 |
| Pollock | - | - | - | + | - | - | 1 | 1 | 23 | 28 | 22 | 19 | + | + | 46 | 48 |
| American plaice | - | - | 6 | 6 | + | + | 58 | 56 | 19 | 19 | 10 | 11 | + | + | 93 | 92 |
| Witch flounder | - | - | - | - | 1 | + | 11 | 8 | 7 | 7 | 3 | 3 | + | + | 22 | 18 |
| Yellowtail flounder | - | - | - | - | - | - | 17 | 19 | 2 | 2 | 11 | 16 | + | 1 | 30 | 38 |
| Greenland halibut | 1 | 1 | 11 | 18 | 7 | 6 | 32 | 29 | 7 | 10 | + | - | - | - | 58 | 64 |
| Other flounders | - | - | 1 | 1 | + | + | 1 | 1 | 6 | 6 | 15 | 14 | 10 | 14 | 33 | 36 |
| Roundnose grenadier | - | + | 6 | 7 | 5 | 5 | 15 | 3 | - | + | - | - | - | - | 26 | 15 |
| White hake | - | - | - | - | + | + | 4 | 3 | 9 | 11 | 4 | 3 | + | + | 17 | 17 |
| Wolffishes | - | - | 6 | 17 | + | + | 2 | 2 | 2 | 2 | 1 | 1 | + | + | 11 | 22 |
| Other groundfish | - | - | 6 | 5 | 1 | + | 2 | 1 | 9 | 9 | 11 | 12 | 8 | 7 | 37 | 34 |
| Atlantic herring | - | - | + | + | + | + | 28 | 32 | 217 | 146 | 51 | 65 | + | + | 296 | 244 |
| Atlantic mackerel | - | - | - | - | - | + | 14 | 15 | 12 | 16 | 1 | 1 | 1 | 1 | 28 | 33 |
| Atlantic menhaden | - | - | - | - | - | - | - | - | - | - | 43 | 59 | 220 | 226 | 263 | 285 |
| Other pelagic fish | - | - | - | - | - | - | + | 1 | 4 | 3 | 7 | 5 | 7 | 6 | 18 | 15 |
| Capelin | - | - | + | + | 11 | 11 | 74 | 13 | 10 | 9 | - | - | - | - | 95 | 33 |
| Other finfish | - | + | 12 | 22 | 2 | + | 5 | 8 | 16 | 5 | 10 | 11 | 37 | 32 | 82 | 95 |
| Squids | - | - | - | - | + | + | 41 | 89 | 53 | 72 | 8 | 29 | 20 | 6 | 122 | 196 |
| Clams | - | - | - | - | - | - | - | + | 4 | 3 | 30 | 31 | 207 | 238 | 241 | 272 |
| Scallops | - | - | - | - | - | + | + | + | 8 | 12 | 153 | 140 | 73 | 61 | 234 | 213 |
| Other molluscs | - | - | - | - | - | - | - | - | 2 | 2 | 9 | 9 | 172 | 170 | 183 | 181 |
| Shrimp | + | 1 | 34 | 36 | 4 | 6 | + | - | 7 | 9 | + | + | + | + | 45 | 52 |
| Other crustaceans | - | - | - | - | - | - | 9 | 13 | 31 | 39 | 17 | 18 | 32 | 38 | 89 | 108 |
| Other invertebrates | - | - | - | - | - | - | - | - | - | + | 1 | 2 | 1 | + | 2 | 2 |
| All species | 1 | 2 | 128 | 170 | 77 | 72 | 575 | 620 | 724 | 729 | 529 | 557 | 801 | 816 | 2835 | 2966 |

[1] Provisional data for 1979 from SCS Doc. 80/IX/27.

The total nominal catch of all finfish and invertebrates increased from 2.84 million tons in 1978 to about 2.97 million tons in 1979 (5%), after having declined from 2.96 million tons in 1977 and 3.43 million tons in 1976. The total groundfish catch increased from 1.14 million tons in 1978 to 1.24 million tons in 1979 (9%), largely due to increases for cod (20%), redfish (10%), yellowtail flounder (25%), and Greenland halibut (10%), with declines noted for haddock (12%), silver hake (16%) and roundnose grenadier (42%). The total pelagic fish catch declined from 605,000 tons in 1978 to 577,000 tons in 1979 (5%), due mostly to a decline for herring (18%). Catches for the "other fish" category decreased significantly from 177,000 tons in 1978 to 128,000 tons in 1979 (28%) due almost entirely to a decline for capelin (65%). The total catch of invertebrates increased from 916,000 tons in 1978 to 1,024,000 tons in 1979 (12%) due mainly to increases for squid (61%), clams (13%) and shrimp (14%).

2. Subarea 0

The total nominal catch of all species increased from 1,000 tons in 1978 to about 2,000 tons in 1979, Greenland halibut being the main species taken.

3. Subarea 1

The total nominal catch of all species increased from 128,000 tons in 1978 to 170,000 tons in 1979 (33%). Significant increases were noted for cod (34%) and Greenland halibut (64%). The catch of unspecified finfish increased from 18,000 tons to 27,000 tons (50%) and represented 20% of the total finfish catch in the subarea.

4. Subarea 2

The total nominal catch of all species declined slightly from 77,000 tons in 1978 to 72,000 tons in 1979 (9%), due mainly to a decrease for cod (23%) although an increase was noted for redfish (42%). The capelin catch remained at the low level of 11,000 tons as in 1978.

5. Subarea 3

The total nominal catch of all species increased from 575,000 tons in 1978 to 620,000 tons in 1979 (8%). Significant increases for cod (30%), redfish (12%), herring (14%) and squid (117%) were largely offset by a large decline for capelin from 74,000 tons in 1978 to 14,000 tons in 1979. The catch of flounders declined by about 10% from 1978 to 1979.

6. Subarea 4

The total nominal catch of all species (except seaweeds) increased from 724,000 tons in 1978 to 729,000 tons in 1979 (1%). Increases were noted for cod (20%), silver hake (8%), pollock (22%), mackerel (33%), squid (36%) and other invertebrates (25%), but these were mostly offset by decreases for haddock (12%), redfish (8%) and herring (33%). The seaweed harvest at 34,000 tons in 1979 was slightly less than 36,000 tons in 1978.

7. Subarea 5

The total nominal catch of all species increased from 529,000 tons in 1978 to 557,000 tons in 1979 (5%). Increases were noted for cod (4%), redfish (7%), red hake (40%), yellowtail flounder (45%), herring (28%), menhaden (37%) and squids (262%), whereas decreases occurred for haddock (11%), silver hake (63%), pollock (14%) and scallops (9%).

8. Subarea 6

The total nominal catch of all species increased from 801,000 tons in 1978 to 816,000 tons in 1979 (2%). Increases occurred for flounders (40%), menhaden (3%) and clams (15%), but these were largely offset by decreases for silver hake (8%), squids (70%) and scallops (16%).

## II. STOCK ASSESSMENTS

1. Cod in Subarea 1 (SCR Doc. 80/VI/72, 76, 113; SCS Doc. 80/VI/17)

a) Fishery trends

The provisional statistics reported for 1979 show the catch of cod to be about 50,000 tons, but there is strong evidence that this figure is very much a minimum figure, and the same is probably the case for the reported catches in 1977 and 1978. Consequently, the Committee, in its analysis of the stock situation at this meeting, has used estimates of catches higher than those recorded for these years. Uncertainty about the catches reported for earlier years is less critical because a major part of projected catches in the 1980's will come from new recruits.

Trends in recent catches and TACs are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 107 | 60 | 45 | 31 | ...[1] | ...[1] | ...[1] |
| Catch (000 tons) | 63 | 48 | 48 | 33 | 73[2] | 73[2] | 99[2] | |

[1] Catches limited to Greenlanders' fishery and to by-catch.
[2] Estimates used for assessment of the stock.

Despite the uncertainty about the actual nominal catches, the information available indicates that catches have increased substantially during 1976-79. The catch of 49,000 tons by the Greenland fleet in 1979 is about one-third higher than in 1978, with a substantial increase (doubling) in the inshore component of the fishery.

b) Trends in distribution, abundance and stock composition

The trend in the fishery over the last three years has been closely related to the 1973 year-class. This year-class has been rather heavily fished since age 3 and yielded good catch rates in periods when it formed in shoals in 1978 and especially in pre-spawning and spawning shoals in 1979, mainly in Div. 1C to 1E. This fishery on concentrations generated the impression among fishermen that the improvement in stock size was higher than indicated by the assessment. However, there seems to have been a southward displacement in the fishery on this year-class over the years, and emigration to East Greenland has contributed to an evident drastic decline of this year-class by 1980, especially in Div. 1C and 1D. In the northern divisions, the 1973 year-class is now at a very low level and has been replaced by the relatively good 1975 year-class and the 1977 year-class, both of which have been observed in the southern part of Div. 1B. This may mean a northward extension of the offshore cod fishery which during the most recent years has taken place only in the southern part of Div. 1C and southward. The residuals of the 1973 year-class may still be of some importance to the fishery in Div. 1E and 1F in 1980, but, even in this area, there will be younger year-classes with the 1975 year-class dominating the catches.

The catch rate of Greenland trawlers decreased from a high level of 3.3 tons per hour in 1978 to 2.4 tons per hour in 1979, and a further decrease to 1.7 tons per hour has been observed in the first quarter of 1980. In terms of the number of removals, the catch per hour decreased from 1,446 fish in 1978 to 1,136 in 1979. Total fishing effort, based on the catch rates of Greenland trawlers, decreased from 1977 to 1978 and increased in 1979, but the magnitude of these changes is complicated by the above-mentioned uncertainty about the nominal catches.

c) Assessment parameters

Mortality rates. Estimates of total mortality (Z) for 1977-79, derived from catch curves for the period, varied considerably between age-groups. For the major age-group 5, Z was as high as 1.17 in 1977 and was 0.65 in 1978. From a catch curve for 1977-79 adjusted for the strength of the 1973 year-class, the estimate of Z was 1.01, while a catch curve for age-groups 7-10 in 1978-79 gave a Z of 1.07. Deducting natural mortality (M = 0.20) and emigration rate (0.05) from the last-mentioned value of Z, the Committee considered the value of 0.82 as the best estimate of (terminal) F for 1979. This value of F is higher than those estimated for recent years on the basis of recorded catch and effort statistics. This in itself indicates that analyses carried out using the high estimates of catch would probably give more realistic results. Consequently, the analyses were performed using the upper limit of catch level for 1979, estimated to be 99,000 tons.

Partial recruitment. The same catch curves indicate that partial recruitment of age-group 4 corresponded to an F-value about one-third of that for fully-exploited age-groups, and for age-group 3 the relative F-value was about 0.02. The Committee could not find sufficient evidence to warrant using reduced F-values for older age-groups and therefore decided to apply the full F-value to all age-groups older than age 4.

Year-class estimates. The use of the high estimates of catches for 1977-79 in the analyses shows the size of the 1973 year-class at age 3 to be about 211 million fish, well above previous estimates which were in the range of 100-200 million fish. Estimates of recruitment at age 3 for 1978-82 are based on biological and environmental consideration and on estimates of discards. Among these year-classes, the 1975 year-class seems to be relatively good followed by the 1977 year-class, whereas the 1976 and 1978 year-classes appear to be poor. The 1975 year-class is tentatively estimated to be 115 million fish at age 3, the 1977 year-class about 90 million, and the 1976 and 1978 year-classes about 20 million fish each. Temperatures in 1979 were favorable

for the survival of cod larvae, and, although not many larvae were found in the plankton, the 1979 year-class is tentatively estimated to be about 75 million recruits at age 3.

d) Results of assessment

The EEC has requested advice on yield and spawning stock size for various fishing strategies: F = 0.1, F = 0.2, F = 0.6, and F = $F_{0.1}$. The yield-per-recruit curve, using the most up-to-date parameters (weight-at-age, partial recruitment, natural mortality, and emigration rate), show $F_{max}$ = 0.48 and $F_{0.1}$ = 0.25. The EEC request to base all projections on a catch in 1980 equal to the TAC cannot be completely met because the TAC does not apply to all components of the fishery. However, on the basis of preliminary catch statistics for the early months of 1980, it is anticipated that the catch in 1980 will be about 55,000 tons, and this figure is taken as the basis for forecasting the stock size and spawning biomass. The results of the analyses are given in Table 2 and illustrated in Fig. 1

These results, of course, are dependent on the actual stock situation and the estimated future recruitment. A constant level of recruitment is not likely ever to occur, but an illustration of yield-per-recruit and spawning biomass per recruit may, nevertheless, be of some guidance (Fig. 2). This illustration, as well as Table 2 and Fig. 1 clearly demonstrate the great difference in resultant spawning stock size for rather small changes in F. For example, the spawning biomass per recruit at F = 0.2 will be twice that at F = 0.4.

Table 2. Subarea 1 cod: projections of stock biomass, spawning stock and catch (000 tons) for 1981-84 at various fishing strategies.

| Year | Parameter | Options[1] 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|---|
| 1981 | Stock biomass | 268 | 268 | 268 | 268 | 268 | |
| | Spawning stock | 151 | 151 | 151 | 151 | 151 | |
| | Catch | 17 | 33 | 83 | 40 | 55 | (0.360) |
| 1982 | Stock biomass | 344 | 325 | 263 | 316 | 297 | |
| | Spawning stock | 165 | 150 | 100 | 142 | 127 | |
| | Catch | 24 | 42 | 81 | 50 | 55 | (0.304) |
| 1983 | Stock biomass | 384 | 343 | 233 | 325 | 300 | |
| | Spawning stock | 256 | 216 | 110 | 198 | 174 | |
| | Catch | 26 | 43 | 64 | 49 | 55 | (0.325) |
| 1984 | Spawning stock | 262 | 202 | 74 | 178 | 147 | |

[1] Option 1 with F = 0.1 in all years; Option 2 with F = 0.2 in all years; Option 3 with F = 0.6 in all years; Option 4 with $F_{0.1}$ = 0.25 in all years; Option 5 with catch of 55,000 tons in all years (F-values in parentheses).

Variation in the spawning stock size (age 6 and older) during 1972-80 relative to that in 1971 is indicated as follows:

| Year | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| Index | 100 | 71 | 39 | 44 | 28 | 13 | 11 | 7 | 43 | 29 |

The increase in the index in 1979 was due to the recruitment of the relatively good 1973 year-class to the spawning stock. There will likely be an increase in 1981 (to an index level of 55) when the 1975 year-class recruits to the spawning stock. Further increases could be achieved by fishing at low effort levels.

Although environmental factors play a major role in the year-class fluctuations of cod in this area, it should be remembered that no really strong year-class (250 million fish or more at age 3) has occurred since 1963, not even in years when temperature conditions were favorable. If the aim of management is to rebuild the stock to a level where annual catches of some hundred thousand tons can be taken, it is necessary to establish and maintain the spawning biomass above the present level. The occurrence of the relatively good 1973 year-class offered the possibility for increasing the spawning stock, but this opportunity was exchanged for 2-3 years of relatively

good fishing. Another opportunity to rebuild the spawning stock may occur in 1981-83 with the recruitment at age 6 of the 1975 and 1977 year-classes. Unless the sizes of these year-classes are very much underestimated, they cannot be used both for rebuilding the spawning stock and increased fishing.

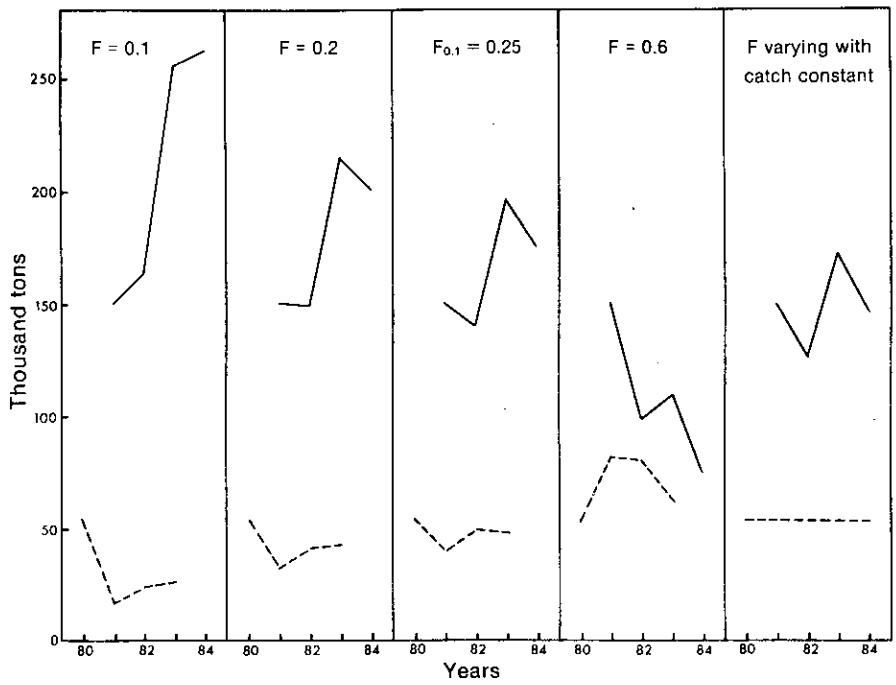


Fig. 1. Subarea 1 cod: projected spawning biomass (upper) and catch (lower) levels for various fishing strategies, assuming a catch of 55,000 tons in 1980. (Spawning biomass pertains to the beginning of the year indicated.)

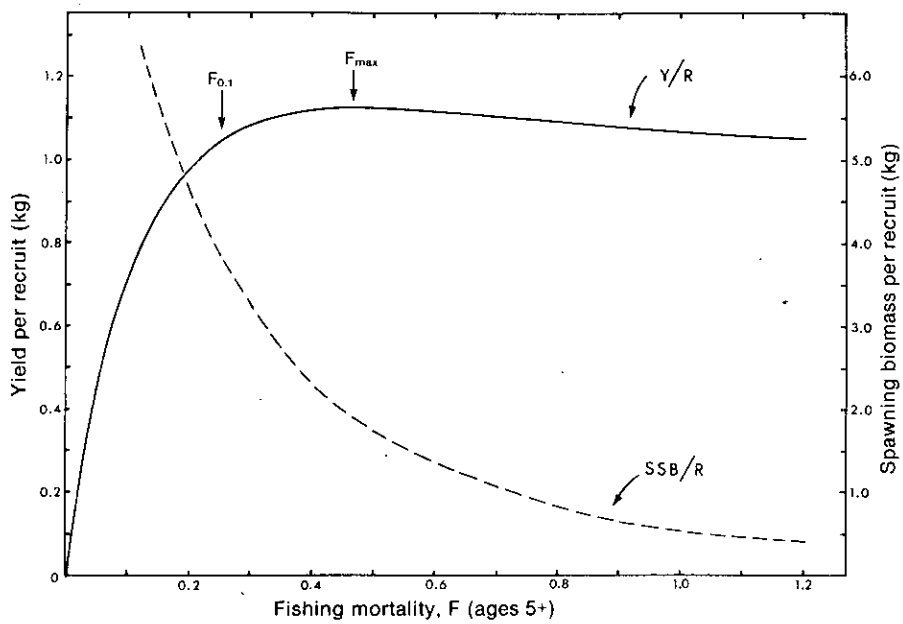


Fig. 2. Subarea 1 cod: yield per recruit and spawning stock biomass per recruit.

e) Mesh size assessment (SCR Doc. 80/VI/76

Although there was no specific request for a mesh assessment of the cod stock in Subarea 1, the Committee welcomed a paper on this subject. The assessment shows that an increase in mesh size from the present minimum of 130/120 mm manila/synthetic to mesh sizes up to 140-160 mm, and even higher mesh sizes at high levels of F, would result in an increase in yield-per-recruit in the range of 2-9%, depending on the level of F and the particular increase in mesh size. However, the increase in spawning stock size per recruit would be substantially greater, in the range of 9-40% for an increase in mesh size to 140-160 mm and F in the range of 0.2-0.4.

2. Cod in Divisions 2J, 3K and 3L (SCR Doc. 80/VI/61, 81, 89, 101; SCS Doc. 80/VI/18)

a) Fishery trends

The average nominal catches in the 1955-59, 1960-64, 1965-69, 1970-74 and 1975-79 periods were about 275, 500, 650, 425 and 195 thousand tons respectively. The increase in catch in the 1960's was largely the result of increased fishing effort, as large pre-spawning, spawning and post-spawning concentrations of cod were discovered and exploited, especially in Div. 2J. Management since 1973 has been by catch limitation. Recent nominal catches and TACs are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | 666 | 657 | 554 | 300 | 160 | 135 | 180 | 180 |
| Catch (000 tons) | 355 | 373 | 288 | 214 | 173 | 139 | 172[1] | |

[1] Provisional.

b) General production models

The Committee reviewed two general production model analyses of the stock (SCR Doc. 80/VI/81, 89). One based on catch rates of Portuguese trawlers for the 1958-77 period indicated an MSY of 470,000 tons, and the other based on standardized effort for the period 1958-80 indicated an MSY of 638,000 tons. The standardized catch rate for 1980 was based on limited data and has a wide variance associated with it. The lower 90% confidence limit of this catch rate was considered a more prudent estimate than the mean value. If this lower catch rate applies in 1981, as well as in 1980, the yield in 1981 at the effort level corresponding to 2/3 MSY would be about 220,000 tons.

c) Assessment parameters

Biological sampling of commercial catches (or landings) of various countries was used to estimate the age composition of removals in 1979. Cod of age-groups 4-7 predominated. Length frequencies of cod in USSR research vessel catches in April-May 1979 showed a trend toward larger modal sizes from south to north. Age-groups 4-6 were dominant in the catches of Canadian and French surveys in 1979. Survey results for the 1970's generally indicated that the 1972-74 year-classes were at least average (500 million recruiting at age 4), the 1975 year-class was somewhat below average, and the 1976 and 1977 year-classes were quite poor.

A partial recruitment pattern similar to that derived in 1978 was used in the cohort analysis, incorporating commercial age compositions for the years 1962-79. These values and the average weight-at-age values derived from 1979 sampling are as follows:

| Age | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|
| Partial recruitment | 0.15 | 0.50 | 0.63 | 0.80 | 0.90 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Average weight (kg) | 740 | 1120 | 1680 | 2490 | 3600 | 4460 | 5310 | 5860 | 7180 | 9020 |

Commercial catch rates (adjusted for gear, country, month and division effects) and estimated fishing efforts were available from an analysis of ICNAF catch and effort statistics for 1959-78. Information on catch rates in 1979 was obtained from the Canadian data base which contains preliminary data on the fishing activity of all vessels fishing within the 200-mile zone. A preliminary standardized catch rate for 1980 was derived from the catch rates of Canadian vessels in the winter of 1980 adjusted for seasonal trends. Regressions of fishing effort on fishing mortality and of stock biomass on standardized catch rates for the 1962-77 period, excluding the points for 1974, 1975 and 1976 which were considered anomalous, indicated a terminal F of 0.20 for 1979.

Catch-curve analyses of research vessel survey data indicated that the stock had been exploited during the 1970's at a level above $F_{max}$ (0.37). The average fishing mortality thereby derived (0.47) was consistent with estimates from cohort analysis.

Since all research vessel survey information indicated that the abundance of the 1976 and 1977 year-classes was very low, an arbitrary recruitment value of 125 million fish at age 4, slightly lower than the minimum estimate of age-group 4 in the 1962-79 period, was used for these year-classes. An average value of 500 million fish at age 4 was used as the size of all subsequent recruiting year-classes in the projections.

d) Projections of catch and spawning stock biomass

With terminal F = 0.2 in 1979, and with partial recruitment and the sizes of recruiting year-classes as indicated above, projections of catch and spawning stock biomass were made for 1980-87 at three levels of F, with an assumed catch of 180,000 tons in 1980 (Table 3). STACFIS points out that catch levels and stock sizes projected for 1983 and later depend substantially on the assumed sizes of the recruiting year-classes. An analysis of survival rates at age from USSR commercial age compositions projects an increase in abundance in 1980 and 1981 of age-groups 5-13 compared with their abundance in 1979.

Table 3. Cod in Div. 2J+3KL: projections of catch and spawning biomass (000 tons) for 1980-87 at three levels of fishing mortality. (Spawning biomass based on age-group 7 and older.)

| Year | F = 0.10 | | F = 0.16 | | F = 0.20 | |
|---|---|---|---|---|---|---|
| | Catch | Spawning biomass | Catch | Spawning biomass | Catch | Spawning biomass |
| 1980 | 180 | 800 | 180 | 800 | 180 | 800 |
| 1981 | 130 | 1300 | 200 | 1300 | 250 | 1300 |
| 1982 | 160 | 1800 | 230 | 1700 | 280 | 1600 |
| 1983 | 180 | 1800 | 260 | 1600 | 300 | 1500 |
| 1984 | 200 | 1800 | 280 | 1500 | 320 | 1400 |
| 1985 | 230 | 2100 | 310 | 1800 | 350 | 1600 |
| 1986 | 260 | 2500 | 350 | 2200 | 390 | 1900 |
| 1987 | 280 | 2700 | 370 | 2300 | 420 | 2100 |

e) Biological studies (SCR Doc. 80/VI/89)

STACFIS noted that the age of 50% maturity of cod for the stock area as a whole has been estimated from French survey data to be about 4.7 years. This new estimate is lower than the minimum age-group used in deriving the target spawning biomass of 1.2-1.8 million tons, but the Committee considered that this range was still appropriate as an indicator of the target.

A trawl selectivity study carried out in Div. 2J during the same survey in February 1980 indicates a selection factor of 3.81. These results, applied to the mean length (49.1 cm total length) and age (4.7 years) at 50% maturity indicates that a minimum codend mesh size of 130 mm (synthetic material) would substantially reduce the capture of immature cod.

3. Cod in Division 3M (SCR Doc. 80/VI/73)

STACFIS noted that this stock was assessed at the February 1980 Meeting (Part D, this volume). It also noted that the catch-at-age data from the Faroese longline fishery for cod in Div. 3M (dominant 1974 and 1975 year-classes with the 1973 year-class constituting a minor portion of the catch) are not consistent with the age composition of catches in 1980, as projected at the February 1980 Meeting. Since insufficient new data are available for a re-analysis of this stock, and considering that 1980 data from research and commercial sources will be needed for updating the assessment, STACFIS advises that the assessment of this stock with concomitant advice for management in 1981 should be deferred to a mid-term meeting early in 1981.

4. Cod in Divisions 3N and 3O

The assessment of this stock at the February 1980 Meeting (Part D, this volume) indicated a yield at $F_{0.1}$ of 26,000 tons for 1980. However, the Council emphasized that caution should be exercised in the interpretation of the cohort analysis and the projections presented for 3 reasons: firstly, there

was some doubt concerning the value of terminal F (0.25) used in the cohort analysis in that it might be too low; secondly, the total biomass predicted by 1982 was only 50-60% of that necessary for exploitation at the $F_{0.1}$ level; and thirdly, the stock in 1982 would consist mainly of fish of the 1974 and 1975 year-classes which were below the historical (1960's) average year-class size followed by relatively poor 1976 and 1977 year-classes. A cautious approach was therefore advised until there is clear evidence of stock rebuilding to the optimal biomass level.

No data was available at this meeting on the commercial fishery in Div. 3NO during the early months of 1980. The only new data presented was obtained from Canadian research vessel surveys in March-April 1980, indicating that catch rates were substantially lower than those from surveys in 1979, even though an increase in stock size was predicted when the stock was assessed at the February 1980 Meeting. The 1978 year-class appeared to be strong in both the 1979 and 1980 Canadian surveys but of rather less than average strength in the 1979 USSR survey. Since the 1976 and 1977 year-classes were poor, the population in 1981 could be dominated by the 1978 year-class as 3-year-old fish. Substantial exploitation of this year-class in 1981 would result in a loss in yield-per-recruit. STACFIS therefore advises that, in view of the uncertainties produced by the survey data, any decision on management for 1981 should be deferred until further data become available from other surveys during 1980 and from the 1980 commercial fishery.

5. Redfish in Subarea 1 (ICNAF Res. Doc. 79/VI/54, 59)

a) Fishery trends

Nominal catches have fluctuated widely over the period in which statistics have been reported to ICNAF, increasing from 150 tons in 1951 to a maximum of 61,000 tons in 1962 but decreasing generally thereafter to a low level of about 3,000 tons in 1971-74. Catches increased again in 1975 and 1976 to 31,000 tons in 1977. Catch figures for 1977, 1978 and 1979, although officially reported, may actually be overestimates of the actual catches (SCR Doc. 80/VI/72). Recent catches are as follows:

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

[1] Provisional.

b) Assessment

Two species of redfish occur in Subarea 1, *Sebastes marinus* and *S. mentella*. These species live at different depths with little overlapping. The fishery has been directed mainly towards *S. marinus*, and the assessments based on catch and effort data therefore refer to this species. This stock was assessed at the April 1979 Meeting of the Assessments Subcommittee (*ICNAF Redbook* 1979, page 74), and a reassessment was not considered warranted at the present meeting due to uncertainties about the catch and effort data for 1977, 1978 and 1979. The 1979 assessment consisted of general production model analyses of two sets of standardized effort data. The results from both series of data indicated an MSY level of about 10,000 tons and an equilibrium catch at 2/3 $F_{MSY}$ of about 9,000 tons. However, the correlation coefficient for the regression of catch-per-unit-effort on effort ($r = 0.63$) indicates that catch levels derived from the model have fairly large variances.

c) By-catch of redfish in the shrimp fishery

The shrimp fishery in the northern part of Subarea 1 is known to take substantial by-catches of small redfish, nearly all of which are discarded. The estimated amount of 10,000 tons corresponds to approximately 200 million fish. It is not possible at present to evaluate the effect of these by-catches on the exploited stock of redfish since the recruitment mechanism is not well understood and since there are indications that the by-catch of small redfish in the shrimp fishery may consist mainly of *Sebastes mentella* (SCR Doc. 79/XI/6).

As indicated at the 1979 meeting, STACFIS again points out that, since the spawning areas of the stock are not inside the NAFO Area but at East Greenland and in the Irminger Sea, studies of the stock and the fisheries in Subarea 1 should be considered in cooperation with ICES.

6. Redfish in Divisions 3L and 3N (SCR Doc. 80/VI/80, 112)

a) Fishery trends

Nominal catches declined from a high of 45,000 tons in 1959 to 14,000 tons in 1970 and increased to 30,000 tons in 1972. Nominal catches and TACS since 1973 are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 28 | 20 | 20 | 16 | 16 | 18 | 25 |
| Catch (000 tons) | 33 | 22 | 18 | 21 | 16 | 12 | 14[1] | |

[1] Provisional.

b) Abundance indices

Length frequencies from Canadian commercial sampling in 1979 indicate that the bulk of the catch consisted of 27-45 cm redfish in Div. 3L and 22-30 cm redfish in Div. 3N. Length frequencies from USSR commercial sampling in Div. 3N also show the catch to be mainly composed of 20-30 cm fish. Catch rates from Canadian research vessel surveys in 1978 and 1979 show a high abundance of small redfish in the 20-27 cm size range in Div. 3N. However, the small redfish in research frequencies from Div. 3L in 1978 were not evident in 1979.

c) Assessment

A general production model analysis, including data for 1978 indicated an equilibrium yield at MSY of 36,000 tons and at 2/3 $F_{MSY}$ of 32,000 tons. However, these yields should be viewed with caution because of the poor correlation between catch-per-unit-effort and effort and the possibility that the available yield from this stock has been overestimated by the model. TACs were decreased in the late 1970's because it was thought that catches in the range of 28,000-34,000 tons exceeded the MSY. However, the TAC was increased to 25,000 tons for 1980 which is above the historical average catch for the stock. Considering the problems associated with assessing this stock, STACFIS advises that the TAC for 1981 should remain at 25,000 tons.

d) Biological studies

The Committee reviewed a study on the use of the extrinsic gas bladder musculature as a method for separating *Sebastes fasciatus* and *S. mentella* (SCR Doc. 80/VI/112). The method shows some promise because the muscle passes over ventral ribs 2 and 3 in *S. mentella* and between ventral ribs 3-4 and 5-6 in *S. fasciatus*.

7. Redfish in Division 3M (SCR Doc. 80/VI/88)

a) Fishery trends

Redfish catches were quite low during the 1960's but increased to 42,000 tons in 1972. Nominal catches and TACs since 1973 are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 40 | 16 | 16 | 16 | 16 | 20 | 20 |
| Catch (000 tons) | 22 | 35 | 16 | 17 | 20 | 17 | 20[1] | |

[1] Provisional.

b) Abundance indices

Length frequencies from Canadian commercial sampling in 1979 indicate that the bulk of the catch consisted of 32-42 cm redfish as was also evident in 1978. Additionally, in May and June there was evidence of small redfish in the 18-20 cm size range and in June some 16-17 cm fish. Catch rates from Canadian research vessel surveys in 1978 and 1979 similarly indicated the dominance of these size groups in the stock, and the catch rates from the 1980 surveys show a relatively strong size-class of 20-26 cm fish which are beginning to recruit to the fishery.

c) Assessment

A general production model analysis indicated an equilibrium yield at 2/3 $F_{MSY}$ of 15,000 tons and the MSY of 16,000 to 17,000 tons depending on the number of years that fishing effort is lagged. Commercial catch rates declined from an average of 1.62 tons per hour in 1977 to 1.14 in 1978, and preliminary data for Canadian trawlers indicate a further decline to 1.05 tons per hour in 1979. However, the influx of small redfish to the fishery may have influenced the downward trend in catch rates. Considering the abundance of recruiting size-groups, as evidenced from the research surveys, STACFIS considers the stock to be in relatively good condition and therefore advises that the TAC for 1981 should remain at 20,000 tons.

8. Silver Hake in Divisions 4V, 4W and 4X (SCR Doc. 80/II/20, 46; 80/VI/74, 87, 106)

a) Fishery trends

This stock has been regulated by TACs since 1974 and also by area and gear restrictions since 1977, when the nominal catches have been substantially less than the TACs although the national USSR allocations have been almost totally utilized in these years. Recent TACs and catches are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 100 | 120 | 100 | 70 | 70 | 70 | 90 |
| Catch (000 tons) | 299 | 96 | 116 | 97 | 37 | 48 | 52[1] | |

[1] Provisional.

b) Biological studies

Age validation studies (SCR Doc. 80/II/20) show that the techniques established by ageing workshops held in 1976-78 are satisfactory. It was also noted that differences in estimating the age composition of removals by Canadian and USSR scientists have been decreasing (SCR Doc. 80/II/46, 80/VI/87).

c) Assessment parameters

Catch composition. Canadian estimates of catch composition by age for 1958-78 have been recalculated and updated from earlier assessments (SCR Doc. 80/VI/87). The age range has been increased from 1 to 6+ years of age in the earlier reports to 1 to 10+ years based on updated age-length keys. The catch-at-age of removals for 1979 was derived from monthly summaries of length frequencies obtained through the International Observer Program. STACFIS agreed to use for assessment the catch-at-age table in SCR Doc. 80/VI/87.

Natural mortality. In order to maintain consistency with previous assessments, it was agreed to use $M = 0.40$.

Weight-at-age. The values used for the assessment and also to determine the estimate of yield-per-recruit at $F_{0.1} = 0.65$ are as follows:

| Age (yr) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ |
|---|---|---|---|---|---|---|---|---|---|---|
| Weight (g) | 61 | 135 | 200 | 245 | 285 | 344 | 411 | 520 | 553 | 1189 |

Partial recruitment. The starting F-values for age-groups 2 to 10+ were adjusted to give the best fit with an adjusted series of effort data, and the resultant partial recruitment values are as follows:

| Age (yr) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10+ |
|---|---|---|---|---|---|---|---|---|---|---|
| Partial recruitment | 0.035 | 0.50 | 1.00 | 0.70 | 0.60 | 0.60 | 0.55 | 0.50 | 0.45 | 0.40 |

Terminal fishing mortality. A value of $F = 0.35$ for fully-recruited age-groups in 1979 was estimated from regressions of fishing mortality on effort and biomass on catch-per-unit-effort.

Recruitment. No firm estimates of recruitment at age 1 were available, but the shift away from catching ages 1 and 2 silver hake makes this parameter less important. However, for use in the assessment, recruitment at age 1 was chosen as 1,000 million fish, the geometric mean of the sizes of the 1974-78 year-classes at age 1.

d) Catch projection

The Committee considered two options in making the catch projections for 1981: (i) if the 1980 TAC of 90,000 tons is fully utilized in 1980, the projected catch at $F_{0.1} = 0.65$ in 1981 is 72,000 tons; (ii) if the 1980 TAC is not fully utilized and the catch is about 60,000 tons,

the projected catch at $F_{0.1}$ in 1981 is 81,000 tons. STACFIS therefore advises that the TAC for 1981 be in the range of 70,000-80,000 tons.

9. American Plaice in Division 3M

This stock has been regulated since 1974 and nominal catches during 1973-78 have been in the range of 1,000-2,000 tons. The catches reported are entirely by-catches of the cod and redfish fisheries in the area. The TAC has been set at 2,000 tons for each year except for 1978 when it was increased to 4,000 tons based on increased catch rates from surveys in 1977. However, these catch rates appeared to be anomolous and the TAC was reduced to 2,000 tons for 1979 and 1980. STACFIS advises that the TAC should remain at 2,000 tons for 1981.

10. American Plaice in Divisions 3L, 3N and 3O (SCR Doc. 80/VI/86, 110; SCS Doc. 80/VI/18)

a) Fishery trends

The highest reported nominal catch for this stock was 94,000 tons in 1967, but catches have been lower since then, averaging about 47,000 tons. Approximately 90% of the total catch in recent years have been taken in Div. 3L and 3N. Recent TACs and catches are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | 60 | 60 | 60 | 47 | 47 | 47 | 47 | 47 |
| Catch (000 tons) | 53 | 46 | 43 | 52 | 44 | 50 | 49[1] | |

[1] Provisional.

b) Abundance

Canadian research vessel surveys indicated a decrease in abundance (average number per haul) from 1978 to 1979, particularly in Div. 3N. However, while the catch rate (average weight per haul) declined in Div. 3N, there was an increase from 1978 to 1979 in Div. 3L. USSR research vessel surveys (SCS Doc. 80/VI/18) indicated opposite trends for the two divisions, with increased abundance (number and weight) in Div. 3N for 1979. Commercial catch rates from the Canadian otter-trawl fishery increased from 0.41 tons per hour in 1977 to 0.46 in 1978 and to 0.51 in 1979.

c) Assessment parameters

Catch composition. Length and age compositions and mean weight-at-age data were derived from Canadian commercial sampling during most months of 1979. Quarterly age-length keys for males and females separately were used to calculate the numbers of males and females caught by age-group, prior to their combination to give the total numbers of fish caught in Div. 3L and 3N.

Fishing mortality. The most reasonable estimate of this parameter in 1979 was derived from the regression of fishing mortality on directed fishing effort during 1965-77, giving a value of terminal F = 0.27 for fully-recruited age-groups in 1979.

Partial recruitment. Values for 1979 and for projection to 1981 were derived from the average F-values for 1976-78 from the virtual population analysis.

Recruitment. The number of 6-year-old American plaice assumed to be recruiting to the fishery in Div. 3LN in 1980 and 1981 was taken as the geometric mean of the numbers of age 6 fish in the population matrix for 1976-78.

d) Assessment results

Evidence from research vessel surveys and the virtual population analysis indicates fairly strong recruitment of three or four year-classes to this stock. However, the most recent surveys indicate improved recruitment prospects only in Div. 3L. Projection for Div. 3LN from the 1979 population structure with F = 0.27 for 1979 indicates that the removal of the 1980 TAC (47,000 tons) implies a fishing mortality of 0.23 (equivalent to $F_{0.1}$) on fully-recruited age-groups. Projection to 1981, with recruitment of 390 million fish at age 6, implies a catch of 48,000 tons in 1981 for Div. 3LN at $F_{0.1}$. Assuming that the proportion of the catch taken in Div. 3O (about 13%) would continue in 1980 and 1981 as in recent years, STACFIS advises a TAC of 55,000 tons for Div. 3LNO in 1981.

e) Discards

The results of observations on board of Canadian (Nfld) trawlers indicate that the discarding of

American plaice was substantial in 1978 and 1979 (SCR Doc. 80/VI/86). Estimated discard rates were 8.6% by weight (22.0% by number) of the catch in 1978, and 14.0% by weight (30.9% by number) in 1979. These values indicate that 4,100 tons (17 million fish) were discarded in 1978 and 6,700 tons (29 million fish) were discarded in 1979. This implies that the removals at the younger ages (to age 7) is underestimated by normal sampling of landings.

11. Witch Flounder in Divisions 2J, 3K and 3L (SCR Doc. 80/VI/108)

a) Fishery trends

Nominal catches increased from less than 5,000 tons in the mid-1960's to a high of 24,000 tons in 1973 but have since declined steadily to 4,100 tons in 1979. Catches and TACs since 1973 are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 22 | 17 | 17 | 17 | 17 | 17 | 17 |
| Catch (000 tons) | 24 | 16 | 12 | 11 | 8 | 7 | 4[1] | |

[1] Provisional.

The fishery is conducted primarily by gillnets in inshore waters and by otter trawls on the offshore grounds, mainly in Div. 3K. The inshore catch (mainly as by-catch in the cod fishery) has declined from 8,000 tons in 1971 to a few hundred tons in 1979 and the offshore otter trawl catch has also declined markedly. This decline is difficult to evaluate because offshore fishing effort has also decreased in recent years.

b) Assessment

Analyses of research vessel survey data and commercial age composition data over the past 12 years indicate that fishing mortality has been significantly greater than $F_{0.1}$ when catches averaged about 12,000 tons. Stock size estimates from stratified-random surveys indicate a minimum trawlable biomass of about 30,000 tons in Div. 3K and 1,000-1,500 tons in Div. 2J during the last two years. Biomass estimates of about 8,000 tons were calculated for Div. 3L over the last 5 years. The inadequacy of available data makes it difficult to reliably estimate the present stock size, but the biomass estimates indicate that the stock has been fairly stable over the last 4 years when catches averaged about 8,000 tons annually. STACFIS therefore advises that a TAC of 8,000 tons for 1981 would probably not affect the stability of the stock.

12. Witch Flounder in Divisions 3N and 3O (SCR Doc. 80/VI/95)

a) Fishery trends

Nominal catches increased from 4,700 tons in 1969 to a high of 15,000 tons in 1971 and declined to an average of 5,000 tons in 1975-79. Recent catches and TACs are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 10 | 10 | 10 | 10 | 10 | 7 | 7 |
| Catch (000 tons) | 7 | 8 | 6 | 6 | 6 | 3 | 3[1] | |

[1] Provisional.

b) Assessment

Research vessel surveys indicate that the fishable concentrations are located along the southwest slope of Grand Bank, mainly in Div. 3O. Estimates of minimum trawlable biomass from stratified-random surveys indicate levels up to 4,600 tons. A general production model analysis indicates that the equilibrium catch at 2/3 $F_{MSY}$ is about 4,000-5,000 tons. Analyses of age composition data over the past 10 years indicate that the average fishing mortality was around the $F_{0.1}$ level when catches were in the range of 5,000-6,000 tons but it may have been higher in more recent years. STACFIS also considered that the recent decline in catch-per-unit effort implies declining abundance, and therefore advises that the TAC for 1981 should not exceed 5,000 tons.

13. Yellowtail Flounder in Divisions 3L, 3N and 3O (SCR Doc. 80/VI/94; SCS Doc. 80/VI/18)

a) Fishery trends

The nominal catch peaked at 39,000 tons in 1972, declined to 8,000 tons in 1976 and gradually increased to 18,000 tons in 1979. Recent TACs and catches are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | 50 | 40 | 35 | 9 | 12 | 15 | 18 | 18 |
| Catch (000 tons) | 33 | 24 | 23 | 8 | 12 | 16 | 18[1] | |

[1] Provisional.

b) Abundance indices

The catch rate of Canadian otter trawlers has increased sharply and is now nearly at the level experienced in 1973. Canadian research vessel survey data for 1980 indicated increased abundance both in numbers and weight, but lower numbers of age-groups 4 and 5 were evident. USSR survey data also indicated an increase in abundance from 1978 to 1979.

c) Assessment parameters

Length and age compositions and mean weight-at-age data were derived from Canadian commercial sampling in 1979. Quarterly age-length keys and monthly catches were used to estimate the numbers caught by age-group. Partial recruitment values were derived from average F-values for 1976-78 from the virtual population analysis. Terminal F for 1979, used to initiate the virtual population analysis, was estimated from the regression of F for ages 6-10 (1969-76) on directed fishing effort of Canadian (Nfld) trawlers (OT-5), giving an average value for ages 6-9 of F = 0.55. Recruitment of age 4 fish, used to make stock projections for 1980 and 1981, was set at 120 million, the average recruitment for the 1976-78 period.

d) Assessment results

The average fishing mortality on fully-recruited age-groups in 1979 was at the $F_{0.1}$ level of 0.45. However, the 1980 TAC of 18,000 tons is projected to generate a somewhat lower F (0.37). As in previous reports, the Committee points out that the catch projections for 1980 and 1981 depend to some extent on the estimated number of age 4 recruits entering the fishery in these years. Based on the assumptions that the 1980 TAC will be fully utilized and that recruitment at age 4 will be average, STACFIS advises that a TAC of 21,000 tons in 1981 corresponds to fishing at the $F_{0.1}$ level.

14. Greenland Halibut in Subareas 0 and 1

a) Fishery trends

The nominal catch peaked at 25,000 tons in 1975 and has been less than 20,000 tons since then. Recent catches and TACs are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | - | - | 20 | 20 | 20 | 25 | 25 |
| Catch (000 tons) | 10 | 14 | 25 | 16 | 13 | 12 | 19[1] | |

[1] Provisional.

Information presented in SCR Doc. 80/VI/72 indicates that the reported catches for 1977-79 may be overestimates of the actual catches.

b) Assessment

A virtual population assessment in 1978 (ICNAF Res. Doc. 78/VI/53) indicated an 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. Lacking sufficient data to adequately assess the status of the stock in 1979, the same TAC was advised for 1980. Since no new data were presented at this meeting, STACFIS advises that the TAC remain at 25,000 tons for 1981.

15. Greenland Halibut in Subarea 2 and Divisions 3K and 3L (SCR Doc. 80/VI/96)

a) Fishery trends

Nominal catches ranged from 25,000 ton 30,000 tons duirng 1971-76, increased to 39,000 tons in 1978 and decreased to 34,000 tons in 1979. Although the total catch decreased in 1979, the inshore gillnet fishery has increased substantially from about 7,000 tons in 1976 to 25,000 tons in 1979, whereas the offshore trawl catches declined as a result of decreased allocations. Recent trends in TACs and nominal catches are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 40 | 40 | 30 | 30 | 30 | 30 | 35 |
| Catch (000 tons) | 29 | 27 | 29 | 25 | 32 | 39 | 34[1] | |

[1] Provisional.

b) Biomass surveys

Biomass surveys conducted in recent years indicate that Div. 2J and 3K are the areas of greatest abundance of this stock. Estimates of trawlable biomass from Canadian surveys in Div. 2J, 3K and 3L during the last two years were in the order of 200,000 tons. A research survey by German Democratic Republic in Div. 2G and 2H in 1978 indicated a trawlable biomass of about 100,000 tons. These surveys also indicate that recruitment to the stock is good and can be expected to remain favorable over the next few years, based on the abundance of pre-recruit year-classes. However, because of the short time series of data, it was difficult to assess quantitatively the effect of these apparently-good year-classes on future yields.

c) Assessment parameters

Catch-at-age data for 1975-79 were used to determine fishing mortalities and stock sizes. There was some uncertainty as to the value of terminal F that should be used in the analysis. Analysis of recent catch curves provided estimates of F which averaged 0.40. This estimate was considered to be biased upward due to increased recruitment in recent years and the emigration of older individuals, and the Committee agreed to use F = 0.35 as the most reasonable estimate of fishing mortality in 1979. Partial recruitment values were derived from a comparison of commercial and research vessel age composition data for 1979, because it was considered that average partial recruitment values would not realistically reflect the change in the commercial fishing pattern in recent years. For use in the projections, recruitment at age 5 was taken as the geometric mean of recruitment in 1976-78 (75 million fish), because it was not possible to obtain a realistic estimate from the short time series of survey data.

d) Assessment results

Projections for 1981, under the assumption that the 1980 TAC of 35,000 tons will be fully utilized, indicate a yield of about 55,000 tons fishing at $F_{0.1} = 0.53$. The Committee was concerned about the probable changes in partial recruitment estimates in the next year if the offshore trawl fishery is intensified and emphasized the need for this parameter to be closely monitored to observe any changes for future assessment. Noting the favorable condition of this stock and the promising recruitment prospects, STACFIS advises a TAC of 55,000 tons for 1981.

16. Roundnose Grenadier in Subareas 0 and 1 (SCR Doc. 80/VI/83, 100)

a) Fishery trends

Nominal catches have fluctuated between 3,000 and 12,000 tons during 1971-79. A TAC of 10,000 tons was introduced in 1975, increased to 14,000 tons in 1976 and subsequently reduced to 8,000 tons, based on an assessment in 1976. Recent catches and TACs are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | - | 10 | 14 | 8 | 8 | 8 | 8 |
| Catch (000 tons) | 5 | 12 | 5 | 9 | 3 | 6 | 7[1] | |

[1] Provisional.

b) Biological studies

The Committee reviewed an analysis of weight *versus* total length for roundnose grenadier in Subareas 0+1 and 2+3 (SCR Doc. 80/VI/83), which compared the mean weights of samples as submitted to the Secretariat in past years to mean weights calculated by applying empirical length-weight relationships. There were no significant differences between the observed and calculated mean weights for samples from Subareas 2+3, but the differences were significant for the samples from Subareas 0+1. However, when the length-weight relationship for Subareas 2+3 was applied to the Subareas 0+1 samples, no significant differences were noted. STACFIS urged that further studies should be conducted to resolve this discrepancy.

c) Assessment

The Committee reviewed an updated general production model analysis for the 1968-77 period, based on a modified effort standard (SCR Doc. 80/VI/100). The time series of effort data was interrupted in 1978 due to the lack of a directed fishery. The analysis indicated an MSY of 9,000 tons and a yield at 2/3 $F_{MSY}$ of 8,000 tons. Because these values were similar to those of previous assessments, and because there has been an apparent increase in catch-per-unit-effort up to 1977, STACFIS advises that the TAC for 1981 should remain unchanged at 8,000 tons.

17. Roundnose Grenadier in Subareas 2 and 3 (SCR Doc. 80/VI/84, 100)

a) Fishery trends

After peaking at 75,000 tons in 1971, the nominal catch fluctuated between 15,000 and 28,000 tons during 1972-78 and decreased to about 8,000 tons in 1979. A TAC of 32,000 tons was introduced in 1974, raised to 35,000 tons in 1977 and decreased to 30,000 tons for 1980 based on an assessment in April 1979. Recent catches and TACs are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 32 | 32 | 32 | 35 | 35 | 35 | 30 |
| Catch (000 tons) | 18 | 28 | 27 | 21 | 15 | 21 | 8[1] | |

[1] Provisional.

b) Biological studies

The Committee reviewed a paper on total length *versus* anal fin length for grenadiers (SCR Doc. 80/VI/84), in response to a recommendation from the 1979 Annual Meeting (*ICNAF Redbook* 1979, page 54). The results, based on the measurement of 2,347 individuals, showed a highly significant correlation between total length and anal fin length with very little difference between males and females. It was also shown that a highly significant correlation exists between anal fin length and pre-anal length. The Committee noted that a decision on the appropriate length measurement to be used would be made by STACREC.

c) Assessment

The Committee reviewed an updated general production model analysis for the 1967-78 period based on a modified effort standard (SCR Doc. 80/VI/100). Although the correlation between catch-per-unit-effort and effort is low, the analysis indicates an MSY of 30,000 tons and a yield at 2/3 $F_{MSY}$ of 26,500 tons. Although the TAC has not been fully utilized in recent years, catch rates have continued to decline. STACFIS accordingly advises that the TAC should be reduced to 27,000 tons for 1981.

18. Wolffish in Subarea 1 (SCR Doc. 80/VI/77)

a) Fishery trends

A longline fishery directed mainly on spotted wolffish in Div. 1A and 1B began in the mid-1940's and annual catches were fairly stable around 500-800 tons for several years. In the early 1950's, the longline fishery expanded to Div. 1C, and by 1957 the longline catch peaked at 4,500 tons. It fluctuated between 1,700 and 3,800 tons during the 1960's. The offshore trawl fishery began to land by-catches of wolffish (mainly striped) about 1950 and the nominal catch increased slowly during the next 10 years. From 1960 the trawl fishery expanded rapidly and the trawler catch of wolffish reached a peak of 3,700 tons in 1963.

The total catch of wolffish in Subarea 1 reached a level of 5,500 tons in 1957, which was sus-

tained for about 10 years, followed by a decline in the late 1960's to 3,000 tons and an increase in the mid-1970's to more than 6,000 tons. There was a steep decline in the Greenland fishery after 1975 and the total catch figures seem to follow that trend, but the reported statistics for the most recent years are considered not reliable.

b) Biological information

Because of the distribution of the two commercial species of wolffish, the traditional longline fishery has exploited mainly the spotted wolffish (*Anarhichas minor*) whereas the offshore trawl catches consist mainly of the striped wolffish (*Anarhichas lupus*), which has a more southerly distribution. Little is presently known about the growth and reproduction rates of these species, but the available literature indicates that they are rather slow-growing, especially the striped wolffish. The age of recruitment to the fishery is estimated to be about 10 years for striped wolffish and about 7 years for spotted wolffish.

c) General remarks

It is not possible to carry out a detailed assessment of the wolffish stocks until more biological data becomes available and the two species are separated in the reported catch statistics and sampled. However, the catch statistics for the inshore longline fishery indicate that a sustainable yield of 2,000-3,000 tons might be considered reasonable for the spotted wolffish, but, since the longline fishery has been relatively stable for many years, there seems to be no need at present to regulate this fishery by catch quota.

It is questionable whether a directed trawl fishery for striped wolffish can occur with economical benefit. Although Greenland trawlers have taken wolffish as the target species on some occasions, the number of areas where a reasonable catch rate can be achieved are very scattered. It is therefore more likely that wolffish will be taken as by-catch rather than in a directed fishery. However, if a directed trawl fishery for striped wolffish should develop, the historical catch statistics indicate that the sustainable yield might be about 3,000 tons.

Noting the limited biological information on the two species of wolffish and the absence of catch statistics for the two species separately, STACFIS

recommends (16)

*that the Standing Committee on Research Coordination (STACREC) study the feasibility of breaking down the catches of wolffish by species, and that the European Economic Community should note the necessity of such a breakdown for detailed assessment of wolffish in Subarea 1.*

d) By-catches

In sporadic directed fishing for wolffish by Greenland trawlers, by-catches of Greenland cod and Atlantic cod were recorded in 1976 to 1979. In Div. 1B and 1C, the by-catch of Greenland cod accounted for 23% by weight of the total catch and Atlantic cod only 3%, whereas in Div. 1D and 1E the by-catches were 3% for Greenland cod and 29% for Atlantic cod. The total effort during the directed trawl fishery on wolffish in the four years was less than 1,000 hours fishing, more than half of the time in Div. 1D.

The recorded by-catches of Greenland cod and Atlantic cod in the wolffish fishery occurred in a period when the cod fishery was very poor, being nearly absent in Div. 1B. If the cod stock increases to earlier recorded levels, it is likely that this species will account for a large part of the catches in a trawl fishery for wolffish although large fluctuations in by-catch are likely to occur.

19. Argentine in Divisions 4V, 4W and 4X (SCR Doc. 80/VI/107)

a) Fishery trends

The peak catch in recent years was 17,000 tons in 1974, after which nominal catches declined to 2,000-3,000 tons in 1977-79. Recent TACs and catches are as follows:

| | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|
| TAC (000 tons) | - | 25 | 25 | 25 | 20 | 20 | 20 | 20 |
| Catch (000 tons) | 1 | 17 | 15 | 7 | 2 | 2 | 3[1] | |

[1] Provisional.

The decline in catch has been attributed to the exclusion of third party fishing effort from the areas of disputed jurisdiction between Canada and USA, namely the Fundian Channel, where the highest concentrations of argentine are believed to be. The most recent chatches of argentine are mainly by-catches in the squid and silver hake fisheries along the edge of the Scotian Shelf.

b) Assessment

Data were presented which showed that argentine taken in 1977-79 were smaller than those in 1970-71, possibly because of the depth at which the silver hake and squid fisheries were carried out in the most recent period. As insufficient data were available to indicate any change in the status of the stock, STACFIS can only reiterate previous advice that the TAC for 1981 be set at 20,000 tons, the estimated MSY level in Div. 4VWX.

20. Capelin in Subareas 2 and 3

STACFIS noted the request of Canada to consider whether the analyses of the capelin stocks, carried out at the February 1980 Meeting (Part D, this volume), are sufficient to provide advice on management of these stocks in 1981. Considering the critical importance of recruitment to the exploitable stocks and the current inability to adequately predict such recruitment, STACFIS advises that it would be more appropriate to consider the status of the capelin stocks at a meeting early in 1981 when data from the 1980 fishery and research surveys become available.

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

a) STACFIS continues to support the management regime proposed by the Council at the February 1980 Meeting (Part D, this volume), and therefore advises that the TAC for 1981 should be maintained at the same level as for 1980 (150,000 tons), subject to adjustment on the basis of any significant new information forthcoming from the 1980 fishery. Given the unlikely prospect that the abundance of squid in 1981 can be predicted, the Committee agreed that a mid-term meeting in early 1981 to advise on management of the squid fishery in 1981 would not be necessary, but that a special 3-day session should be held immediately before the June 1981 Meeting of the Scientific Council to consider all of the biological information on squid that might be available at that time.

b) Commencement date for the fishery

No new information was available to indicate that a change in the 1 July commencement date of the squid fishery in Subareas 3 and 4 is necessary.

22. Shrimp in Subareas 0 and 1

STACFIS acknowledges the request of Canada and the EEC for advice on management of the shrimp stocks in 1981. However, considering the substantial contribution of shrimp recruitment to the annual yields and the current imprecision of predicting such recruitment, STACFIS advises that it is more appropriate to assess the shrimp stocks and advise on conservation measures for 1981 at a mid-term meeting early in 1981 when data for the 1980 fishery become available.

## III. GEAR AND SELECTIVITY

1. Selection Studies on Sivler Hake and Squid

There were no new data presented on trawl selectivity of these two species. However, the Committee reviewed two analyses of historical silver hake selection data (SCR Doc. 80/II/39, 80/VI/109), which showed such great variation that no firm conclusions could be drawn. It was noted that an increase in the mesh size would increase the escapement of young silver hake and thereby reduce the catch rate, but no quantitative estimates of the changes could be derived from the data. The Committee therefore emphasized the need for further analysis after the completion of the selection studies conducted in 1980, as recommended at the 1979 Annual Meeting (*ICNAF Redbook* 1979, page 83).

2. Selection Studies on Greenland Halibut

The Committee reviewed a paper on the first of a series of mesh selection experiments initiated in 1979 (SCR Doc. 80/VI/69). Noting that this first experiment was carried out using a codend mesh size of 120 mm, STACFIS

recommends (1)

*that selection studies on Greenland halibut be continued, using a range of mesh sizes including the current minimum mesh size in effect (130 mm).*

## IV. AGEING TECHNIQUES AND VALIDATION STUDIES

1. Further Progress on Ageing Silver Hake

The Committee noted that age validation studies on silver hake in Div. 4VWX (SCR Doc. 80/II/20) supported the results and techniques accepted at ageing workshops held during 1976-78. A comparison of age compositions used in the two most recent assessments (SCR Doc. 80/II/46, 80/VI/87) shows that ageing of silver hake has improved. STACFIS agreed that validation studies should be continued.

2. Guidelines for Cod Otolith Interpretation

STACFIS noted that these guidelines have not yet been documented in accordance with previous recommendations, and therefore

recommends (2)

*that the proposed guidelines for cod otolith interpretation be prepared and documented in time for the September 1980 Meeting of the Scientific Council.*

3. Progress on Ageing Squid from Statoliths

STACFIS noted with interest the progress being made in studies on the use of statoliths as indicators of age in *Illex* (SCR Doc. 80/II/1, 22), and urged that such studies be vigorously continued.

4. Redfish Age Validation

Papers on age determination by scales (SCR Doc. 80/VI/91) and age validation by otoliths (SCR Doc. 80/VI/79, 105) were reviewed. When age compositions of commercial-sized redfish from Subarea 1 (aged by scales) were compared with Gulf of St. Lawrence redfish (aged by otoliths), the mean size at age was greater in Subarea 1. This implies that redfish in Subarea 1 are faster-growing than those in the Gulf of St. Lawrence or that scales and otoliths give different interpretations of age. Age validation studies on redfish in the Gulf of Maine indicated good correspondence between the age determinations of a dominant year-class or year-classes of young redfish and the progression of modal groups in length frequencies. Furthermore, length frequencies of redfish in the Gulf of St. Lawrence indicate that dominant year-classes first evident in 1959 averaged 31-32 cm for males and 34-35 cm for females in 1974 after 15 years, indicating that these fish were at least 15 years old. Noting the problems associated with age determination in redfish, STACFIS

recommends (3)

*i) that scientists of the various laboratories search their data files for sampling data which would validate redfish ageing by otoliths or scales and document such data;*

*ii) that validation of ageing redfish by scales be presented; and*

*iii) that comparative ageing studies on the same redfish specimens be initiated by the exchange of material between Canadian and Federal Republic of Germany scientists.*

5. Ageing and Validation Studies on Other Species

a) Spiny dogfish (SCR Doc. 80/VI/51)

From samples taken in the Northwest Atlantic, ages were determined from longitudinal sections of the second dorsal spines. The presence of additional "false" rings was noted, these being more prevalent in females and in specimens younger than 12-18 years. A correction incorporating spine diameter is necessary if the method is used for older individuals. Growth data for males and females separately were provided in the study.

b) Roundnose grenadier (SCR Doc. 80/VI/92)

The Committee was informed that age validation studies were being pursued by scientists of the Federal Republic of Germany and the German Democratic Republic.

## V. OTHER MATTERS

1. Items for Consideration at Future Meetings of the Scientific Council

STACFIS endorsed the proposal that time be allotted at the September 1980 Meeting to consider one or more topics of general scientific interest. In particular, it was noted that analyses of the results of the larval herring surveys in the Gulf of Maine-Georges Bank area during 1970-79 were in progress

(SCS Doc. 80/VI/16) and that a more detailed report of the Larval Herring Task Force would be presented at the September 1980 Meeting. STACFIS also expressed the wish that various analyses related to the Flemish Cap Project would be completed and documented in time for that meeting.

STACFIS strongly supports the proposal that the opportunity be taken soon to review environmental conditions in the Northwest Atlantic during the 1970-79 decade, but notes that time may be a limiting factor in the preparation of papers for the September 1980 Meeting.

2. Adjournment

The Chairman expressed his appreciation to Dr F. Nagasaki who convened the *ad hoc* Working Group on Squid, to the rapporteurs for preparing initial draft reports of the various matters under consideration, to all participants for their cooperation during the meeting, and to the Secretariat for their usual efficient work.

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

Chairman: V. A. Rikhter

Rapporteurs: Various

The Committee met at Dartmouth, Nova Scotia, Canada, during 9-13 June 1980, to consider and report on matters referred to it by the Scientific Council (see Part H, this volume). Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany and France), German Democratic Republic, Japan, Poland, Spain, USSR and USA. As indicated in the Report of the Scientific Council, Dr V. A. Rikhter (USSR) was elected Chairman of this Committee to replace Dr A. S. Seliverstov (USSR) who recently resigned.

In considering the various agenda items, the Chairman appointed Dr W. G. Doubleday to convene the session dealing with Biological Surveys and Mr E. J. Sandeman to convene the session dealing with Environmental Research. Mr J. S. Beckett convened a meeting of the *ad hoc* Working Group on the International Observer Scheme, which was deferred from the February 1980 Meeting of the Scientific Council, and Mr T. Rowell was appointed convener of the *ad hoc* Working Group on Coordinated Squid Research. The Assistant Executive Secretary and several participants contributed to the preparation of the initial drafts of different sections of this report.

## I. STATISTICS AND SAMPLING

### 1. CWP Activities Relevant to NAFO Statistical Matters

a) Operation of the STATLANT program

On behalf of Mr L. P. D. Gertenbach, Secretary of the CWP (Coordinating Working Party on Atlantic Fishery Statistics), the Assistant Executive Secretary briefly reviewed the current operation of the inter-agency STATLANT program, noting that significant delays on the part of some countries in submitting their STATLANT reports hamper the provision of the most up-to-date statistics for assessments and also for publication.

b) Standard world list of 3-alpha identifiers (SCS Doc. 80/VI/14)

The development of a standard world list of 3-alpha species identifiers and its use in the most recent *FAO Yearbook of Fishery Statistics* (Vol. 46 for 1978) was noted. FAO is the maintenance agency for the world list, and procedures have been established for making additions to the list upon request by inter-governmental and national agencies, as the need arises, to record the catches of new species items. The list is intended only for use when dealing with commercial fishery statistics. It was noted that the NAFO list of species items represents an extract from the world list maintained by FAO.

c) Standards for fishing vessels, gear and effort (SCS Doc. 80/VI/10)

The Assistant Executive Secretary reviewed the international standards developed for fishing vessels, gear and effort, noting that those relevant to Northwest Atlantic fishery statistics have been used for many years and are published annually in the Statistical Bulletin. It was pointed out that some countries have not yet adopted all of the "effort level A" measures in reporting effort data for some gears, particular reference being made to longlines and gillnets. The recent use of "off-bottom" trawls in some areas for some directed fisheries was noted, and it was agreed that this matter be brought to the attention of the CWP, with a view to having this gear incorporated into the standard list. STACREC therefore

recommends

*that the Assistant Executive Secretary obtain from the Canadian scientists an account of the recent use of the "off-bottom" trawl, including a description of the trawl, for consideration at the 10th Session of the CWP, with a view to the possible incorporation of this gear in the standard list.*

d) Conversion factors (SCS Doc. 80/VI/6)

STACREC was informed that FAO, in collaboration with other intergovernmental agencies, has essentially completed the collection and compilation of detailed data on nationally-used weight conversion factors by species and type of product. Noting that the last published list of such factors was contained in *FAO Fish. Bull.*, No. 25 (1971), STACREC welcomed the completion of this updated list and hoped that its publication by FAO would not be long delayed.

e) Agenda for the 10th Session of the CWP (SCS Doc. 80/VI/15)

The Assistant Executive Secretary indicated that the 10th Session of the CWP will be held at

Madrid, Spain, during 22-29 July 1980, and that a wide variety of statistical matters will be discussed. As agreed at the 1979 Annual Meeting, NAFO will be represented by the Assistant Executive Secretary and by two Canadian nominees, Dr W. G. Doubleday and Mr D. A. Tilley. Normally the Chairman of STACREC would be attending this meeting, but in view of his very recent election as Chairman, Dr Rikhter indicated that he probably could not attend due to other commitments. The CWP Secretary has indicated in correspondence to the Secretariat that some national representatives at the 10th Session include Mrs N. B. Yanovskaya and Dr S. A. Studentsky from USSR and Dr E. G. Heyerdahl from USA.

f) Other matters (SCS Doc. 80/VI/5)

The Assistant Executive Secretary briefly reviewed the report of the *ad hoc* Consultation on Atlantic Fishery Statistics, held at Warsaw, Poland, during 28-29 September 1979, noting that all of the items considered provisionally at that meeting will again be dealt with at the July 1980 Session.

2. Fishery Statistics

a) Problems associated with publication of 1977 and 1978 statistics (SCS Doc. 79/XI/1)

Problems encountered by the Secretariat in documenting fishery statistics from cooperative arrangements between Canada and other countries are outlined in SCS Doc. 79/XI/1, which was presented to the November 1979 Meeting of the Scientific Council but deferred for consideration at this June 1980 Meeting. The problems related to the significant amount of time required for clarification of national STATLANT 21A and 21B reports for 1977 and 1978 to eliminate the possibility of double-counting and under-counting of nominal catches. To avoid confusion about future STATLANT reports, emphasis was placed on the accepted principle "that the flag of the vessel should be the determining feature which establishes the country to whose national production the catches and landings should be allocated, and that this should only be overridden when it is obvious that the wording of chartering and joint venture operation contracts indicates otherwise or when the interrelationships are too complicated to settle" (ICNAF Sum. Doc. 78/VI/2). As a result of the delays, *ICNAF Statistical Bulletin*, Vol. 27 for 1977, was published in November 1979, nearly a year behind schedule, and Vol. 28 for 1978 is expected to be published in August 1980, about 8 months behind schedule.

b) Fishery statistics for 1979 (SCS Doc. 80/VI/21)

STACREC noted that, for the first time in several years, the Secretariat has not been able to prepare the "advance release" of provisional nominal catches for 1979, due to the late receipt of STATLANT 21A reports from some countries and the absence of such reports from a few others, despite the clearly indicated deadline of 15 April for the submission of these summary reports. This tardiness has a consequent effect on the quality of the data used in the assessments. The Assistant Executive Secretary indicated that, since most of the outstanding data had just now been received, it should be possible to issue the "advance release" of 1979 nominal catches for distribution soon after this meeting.

c) Review of statistical requirements

Following a review of the NAFO species list, the need for the addition of several species items to the list was noted. In particular, STACREC

recommends (6)

*that the NAFO list of species be amended to include the two commercially-caught species of wolffish (Anarhichas lupus and A. minor), the two species of redfish (Sebastes marinus and S. mentella), blue ling (Molva byrkelange), and roughhead grenadier (Macrourus berglax), with their corresponding 3-alpha identifiers.*

d) Historical catch records (SCS Doc. 80/VI/11)

Some scientists indicated that they have found these 10-year tabulations of catches of selected species by stock area and country very useful and urged that the preparation of this document be continued on an annual basis.

e) Progress in updating statistics for earlier years

STACREC was informed that detailed catch and effort data for 1972-78 have been updated where necessary and exist as computer files. The processing of pre-1972 data is complicated by the lack of uniformity in the reporting forms and procedures used in the earlier years, although some progress has been made in processing the data for some countries. A complete file of nominal catch data in STATLANT 21A format exists for all years back to 1965.

f) Format of future NAFO Statistical Bulletin

STACREC reviewed the format of presentation of the tabular material in the Statistical Bulletin, preparatory to the publication of the first NAFO issue (Vol. 29) in early 1981, noting that there have been no significant changes after the major reorganization of the tables in Vol. 22. The Assistant Executive Secretary noted that the numerous requests for monthly catches of species not listed in Table 4 and not given separately in Table 5 indicate the possible need for a change in the format of Table 5, which is the only table providing detailed effort and catch data, the latter for a few selected species and for some groups of species. Significant among the species affected are Greenland halibut (now grouped under FLX), roundnose grenadier and wolffish (now grouped under GRO), argentine and capelin (now grouped under VFF), and squid and shrimp (now grouped under INV).

The Assistant Executive Secretary noted that a new format for Table 5 might be based on a computer program developed by the Secretariat, whereby the catches of all species items individually can, if necessary, be extracted from the table by country, gear, vessel class, division and month, together with associated data on fishing effort, if available. It was estimated that this new format for Table 5 would increase the size of the Bulletin substantially but that part of this increase would be offset by deleting Table 6 which is apparently seldom used. STACREC agreed in principle to the proposed format but indicated that some experimental computer runs should be undertaken with a view to deciding on the most appropriate order of sorting the data sets, and therefore

recommends (7)

*that the Secretariat circulate to Scientific Council members for comment sample listings of the proposed new format for Statistical Bulletin Table 5 and present the findings for decision at the September 1980 Meeting of the Scientific Council.*

3. Sampling Program

a) Sampling data for 1977 and 1978

Annual lists of sampling data received at the Secretariat are initially issued as summary documents to allow scientists to check the lists against data in their national archives and report any errors and omissions prior to publication of the lists. The issue of *ICNAF Sampling Yearbook*, Vol. 22 for 1977, based on data presented in ICNAF Sum. Doc. 79/VI/12, has been delayed due to the absence of USA sampling data. However, these data are now in hand and Vol. 22 will be issued as soon as the data have been processed.

The list of available sampling data for 1978 is given in SCS Doc. 80/VI/8. It was noted that this list is very incomplete. STACREC emphasized the need to have the NAFO data base as complete as possible and urged scientists, upon returning to their institutes, to have the 1978 list checked against national records to ensure that all available commercial sampling data are submitted to the Secretariat as soon as possible.

b) Acquisition and processing of detailed sampling data for 1979

Detailed length frequency data for 1979 on the new sampling form (CFS-1) are only now being received at the Secretariat and processed, but few, if any, age-length keys have as yet been reported. Also, there exists a large volume of sampling data collected by observers on board of fishing vessels operating within the 200-mile fishing zones of the coastal states. The Assistant Executive Secretary reported that much of the data accumulated at the St. John's laboratory will be supplied on magnetic tape as soon as the backlog of data has been processed.

c) Efficiency of sampling in 1978 (SCS Doc. 80/VI/13)

STACREC reviewed the "sampling efficiency" achieved in 1978, based on the data available in the NAFO data base. It was observed that the minimum sampling requirement, used as the basis for calculating the efficiency factors, was no longer applicable in view of the more detailed sampling requirements. In any case, it was noted that the adequacy (or inadequacy) of commercial sampling should be a matter for consideration by STACFIS, as the scientists involved in stock assessments are in the best position to point out the deficiencies pertinent to the individual stocks.

d) Acquisition of Greenland halibut sampling data

Following the recommendation from the 1979 Annual Meeting regarding this matter, the Assistant Executive Secretary through correspondence with some countries requested that existing data for Greenland halibut be submitted in time for use in the assessments, prior to the 1980 Annual Meeting. In December 1979, USSR scientists submitted length compositions and age-length keys for

the years 1969 to 1976 by division for Subareas 0 and 1, and indicated that data for Subareas 2 and 3 would be forwarded after ageing had been completed. STACREC requested the Secretariat to follow up on the need to have the outstanding data reported as soon as possible.

e) Partial length measurement for grenadiers (SCR Doc. 80/VI/84, 92)

STACREC considered the results of two studies, carried out at the request of STACRES and endorsed by the Scientific Council, regarding the most suitable partial length measurement for grenadiers (*ICNAF Redbook* 1979, page 54). It was noted that two possible methods of measurement were examined: (i) pre-anal length from the tip of the snout to the anterior edge of the anus; and (ii) anal-fin length from the tip of the snout to the base of the first anal fin-ray. Both methods gave satisfactory results in so far as the regressions of the respective partial lengths on total length were highly significant. It was noted that the "anal-fin length" was probably less subject to error than the "pre-anal" length in some specimens with distorted anuses due to being brought to the surface from very deep water. STACREC accordingly

recommends (9)

*that length measurements of both roundnose grenadier (Macrourus rupestris) and roughhead grenadier (Macrourus berglax) separated by sex be made and reported as partial lengths measured from the tip of the snout to the base of the first anal fin-ray (anal-fin length) in half-cm intervals.*

f) Processing of historical sampling data

The Assistant Executive Secretary reported that all available data for 1971-78 (except USA data for 1977 and 1978) have been computerized and can be supplied upon request to scientists and laboratories involved in the work of NAFO. Some data for 1970 and earlier years have been processed but the files are not as yet complete.

g) Revised outline of NAFO Sampling Program (SCS Doc. 80/VI/20)

As requested at the 1979 Annual Meeting, the Secretariat has updated the sampling program outline to reflect the changes relevant to the implementation of more detailed sampling requirements as indicated by the introduction of the two new sampling forms (CFS-1 and CFS-2). STACREC requested that the outline be further revised to take account of the new method for measuring grenadiers, and strongly urges all scientists to use the new forms or a similar format in reporting data to the Secretariat.

4. National Statistical Systems

The Assistant Executive Secretary reported that several countries had submitted descriptions following a request in early 1980. These include Federal Republic of Germany, France (M), France (SP), Italy, UK and USSR. It was noted that *ICES Cooperative Research Report,* No. 91, contained descriptions for Faroe Islands, German Democratic Republic, Iceland and Poland. The German Democratic Republic representative indicated that the report for NAFO was in preparation and would soon be forwarded to the Secretariat. Considerable variation in the contents of the various reports was noted, and it was proposed that, in order to achieve some degree of uniformity, the Secretariat should develop some guidelines in the form of an outline and request from those countries whose reports are considered inadequate more detailed descriptions of their systems of collecting and processing fisheries statistics.

5. Scientific Observer Program

The *ad hoc* Working Group on the Scientific Observer Program, established by STACRES and endorsed by the Scientific Council at the 1979 Annual Meeting (*ICNAF Redbook* 1979, pages 59 and 95; Part B, this volume), reported on the development of specific requirements for data collection. Noting that the Working Group had fulfilled its mandate according to its terms of reference, STACREC agreed to the procedures outlined and adopted, after minor amendment, the report as given in Annex 1. In particular, STACREC reiterates the Working Group's

recommendation (10)

*that bilateral parties involved in the International Observer Scheme identify the appropriate fisheries to be covered.*

STACREC requested the Secretariat to coordinate the final development of a suitable form for reporting set data, based on the items listed in the report of the Working Group. It was noted that biological sampling data will be reported on, or in the format of, the new length and age sampling forms (CFS-1 and CFS-2).

6. List of Fishing Vessels for 1977 and 1980

STACREC noted that the list of fishing vessels for 1977 was not issued until early 1980 due to late submissions from several countries. It was agreed that this publication should be continued and that the next issue would be a NAFO issue containing data on fishing vessels operating in the Northwest Atlantic in 1980. No change in the format of presentation was proposed. However, noting that the list may also be useful to inspection officers, it was agreed that the matter of format regarding vessel characteristics should be also considered by the Fisheries Commission at their September 1980 Meeting.

7. Other Matters Relevant to Statistics and Sampling

a) Discards (SCR Doc. 80/VI/86)

The Committee was informed that this paper had been considered by STACFIS.

b) Unspecified finfish catches

The Committee was informed that a substantial portion of the overall nominal catch of finfish reported each year by some countries consists of amounts not broken down by species. These quantities appear in the Statistical Bulletin under such groups as "Groundfish (NS)", "Pelagic fish (NS)", and "Finfish (NS)". It was noted that these quantities, at least for some countries, are estimates of quantities (a mixture of species that would otherwise be discarded) being reduced for fish meal. These unspecified amounts, if large, may have a serious effect on the results of the stock assessments. STACREC therefore

recommends (8)

*that countries reporting large quantities of unspecified finfish in their national statistics should conduct studies during the fishing operations with a view to providing an estimated breakdown of such quantities by species in future reports.*

## II. BIOLOGICAL SURVEYS

1. Review of Survey Activity in 1979

The Committee noted that the following documents contained materials relevant to biological surveys in 1979 and earlier years: SCR 80/II/13, 14, 17, 19, 26, 36, 37, 38, 40, 42, 43; 80/VI/93, 95, 96, 102, 104, 113; SCS 80/VI/12, 17, 18, 19, 22. Since many of these documents contained the results of investigations previously considered by STACFIS, only those documents containing information relevant to the agenda of STACREC were discussed. Such information, supplemented by additional details provided by the participants, enabled the compilation of the list of surveys carried out in the NAFO Area in 1979 (Table 1).

Changes in the level of survey activities were highlighted by participating scientists. The Cuban survey planned for 1979 was not carried out due to technical problems. The Federal Republic of Germany increased survey activity on cod and redfish in Subarea 1 and discontinued larval herring and plankton surveys in Subarea 5. The survey by the German Democratic Republic in Subarea 2 occurred later in 1979 than previously, so that the planned coverage of Subarea 0 and Div. 3K could not be carried out. Japan carried out extensive squid surveys in Div. 4VWX. The Polish groundfish survey carried out in Subarea 5 in 1978 was not repeated. USSR groundfish surveys and ichthyoplankton studies in Div. 3M were increased in 1979.

2. Survey Plans for 1980

Survey plans for 1980 and early 1981 are listed in Table 2. Attention was drawn to changes in 1980 plans from those of 1979. Problems with the Cuban research vessel may preclude the execution of Cuban surveys in the NAFO Area in 1980. Canada plans new combined acoustic and trawl surveys for redfish in Div. 4RST and for small pelagic fish in Div. 4TX, and surveys are also planned for juvenile silver hake in Div. 4VWX and for large pelagics in Subareas 5 and 6. Canada and USSR will cooperate in a "patch" study of larval silver hake in Div. 4WX in September. The USSR ichthyoplankton surveys in Div. 3M will be discontinued. Federal Republic of Germany plans no surveys in Subareas 5 and 6 in 1980. French plans include a new squid survey in Div. 4VWX in August, but the shrimp survey carried out in Subareas 0 and 1 in 1979 will not be repeated. Japan plans no surveys in the NAFO Area in 1980. USA plans include a new red crab survey in Div. 5Z.

3. Review of Proposed Manual on Groundfish Surveys

A revised draft of the manual was not available for review but will be provided by the editor at the September 1980 Meeting. The members of the Committee agreed to provide the editor by 30 July (a)

Table 1. Inventory of biological surveys conducted in the NAFO area during 1979.

| Sub-area | Div. | Country | Months | Survey purpose | No. of sets |
|---|---|---|---|---|---|
| A. Random-stratified surveys | | | | | |
| 2 | GHJ | GDR | 11-12 | Groundfish | 79 |
| | J | CAN(N) | 9-10 | " | 111[1] |
| | | " | 11-12 | " | 130[2] |
| | | GER,FR | 11-12 | " | 71 |
| 3 | KL | CAN(N) | 9-10 | Groundfish | ...[1] |
| | | " | 11-12 | " | ...[2] |
| | L | CAN(N) | 5-6 | " | 135 |
| | | " | 5-6 | " | 145 |
| | M | CAN(N) | 1-2 | " | 96 |
| | NO | CAN(N) | 4-5 | " | 90 |
| | O | CAN(N) | 6 | " | 85 |
| | Pn | CAN(N) | 1-2 | " | 84[3] |
| | | " | 9-10 | " | 69[4] |
| | Ps | CAN(N) | 2-3 | " | 84 |
| | | FRA | 3 | " | 53 |
| | | " | 10 | " | 60 |
| 4 | RS | CAN(Q) | 5-6 | Groundfish | 84 |
| | RST | CAN(N) | 1-2 | " | ...[3] |
| | | " | 9-10 | " | ...[4] |
| | T | CAN(M) | 9-10 | " | 74 |
| | VWX | CAN(M) | 3 | " | 118 |
| | | " | 7 | " | 145 |
| | | " | 10-11 | " | 126 |
| | | USSR | 9-10 | " | 74 |
| | X | USA | 4-5 | " | 34 |
| | | " | 11 | " | 31 |
| 5 | YZ | USA | 4-5 | Groundfish | 284 |
| | | " | 7-9 | " | 147 |
| | | " | 10-11 | " | 366 |
| | Z | USSR | 9-10 | " | 87 |
| 6 | ABC | USA | 3-4 | Groundfish | 155 |
| | | " | 7-8 | " | 127 |
| | | " | 9-10 | " | 151 |
| B. Other Surveys | | | | | |
| 0 | B | FRA | 9-10 | Shrimp | 16 |
| | | CAN(Q) | 9-10 | Shrimp | 51[5] |
| 1 | A | DEN(G) | 7 | Shrimp (trawl) | 2 |
| | | " | 7,8 | Shrimp (photo) | 2 |
| | | " | 6 | Shrimp (commercial) | 24 |
| | B | DEN(G) | 7,8 | Shrimp (trawl) | 5 |
| | | " | 7,8 | Shrimp (photo) | 7 |
| | | " | 5-12 | Shrimp (commercial) | 261 |
| | | " | 7 | Plankton | 6 |
| | | CAN(Q) | 9-10 | Shrimp | ...[5] |
| | | FRA | 9-10 | Shrimp | 35 |
| | C | DEN(G) | 1,7 | Shrimp & Groundfish | 4 |
| | | " | 7 | Shrimp (trawl) | 1 |
| | | " | 7 | Plankton | 7 |
| | | " | 10 | Shrimp (commercial) | 2 |
| | D | DEN(G) | 1,2,6,11 | Shrimp & Groundfish | 9 |
| | | " | 2,6 | Shrimp (trawl) | 2 |
| | | " | 9 | Shrimp (commercial) | 1 |
| | | " | 1,2 | Cod (acoustic) | - |
| | | " | 2,7 | Plankton | 6 |
| | | " | 1 | Capelin | 4 |
| | E | DEN(G) | 1,6 | Shrimp & Groundfish | 5 |
| | B-F | GER, FR | 4-5 | Groundfish | 48 |
| | | " | 10-11 | " | 50 |
| 2 | GH | CAN(N) | 8 | Groundfish | 142 |
| | H-J | CAN(N) | 9 | Mesh selection | 55[6] |
| | J | CAN(N) | 2-3 | Tagging cod & G. halibut | 124[7] |
| | | " | 10-11 | Capelin | ? |
| | | FRA | 1-2 | Cod | 4 |
| | | USSR | 9-11 | Groundfish | 203[8] |
| 3 | K | CAN(N) | 2-3 | Tagging cod & G. halibut | ...[7] |
| | | " | 9 | Mesh selection | ...[6] |
| | | " | 10,11 | Capelin | ? |
| | | FRA | 2 | Cod | 18 |

| Sub-area | Div. | Country | Months | Survey purpose | No. of sets |
|---|---|---|---|---|---|
| B. Other Surveys (continued) | | | | | |
| 3 | K | GDR | 2-3 | Cod | ? |
| | | USSR | 9-11 | Groundfish | ...[8] |
| | KLMNO | USSR | 3-6 | Groundfish | 312 |
| | L | CAN(N) | 10 | Cod feeding | 58 |
| | | " | 10-11 | Mesh selection | 105 |
| | | FRA | 2 | Cod | 11 |
| | LNO | CAN(N) | 8-9 | Groundfish | 120 |
| | | USSR | 4-6 | Hydroacoustics (capelin) | - |
| | LMNO | USSR | 3-6 | Ichthyoplankton | 208 |
| | N | CAN(N) | 6-7 | Capelin | ? |
| | NOPs | FRA | 8 | Tuna | - |
| | Ps | CAN(N) | 9-10 | Tagging (flatfish) | 32 |
| | P | FRA | 2 | Cod | 25 |
| 4 | R | FRA | 1 | Cod | 38 |
| | RST | CAN(N) | 7-8 | Shrimp & Groundfish | 136 |
| | S | CAN(Q) | 7-8 | Crabs | 114 |
| | T | CAN(Q) | 9-10 | Crab assessment | 70 |
| | | " | 3-6 | Ichthyoplankton | 32 |
| | | " | 7-8 | " | 94 |
| | | " | 9-10 | " | 24 |
| | | CAN(M) | 7-9 | Scallops | ? |
| | | " | 6-7 | Mackerel eggs | 132 |
| | VWX | CAN(M) | 1-2 | Ichthyoplankton | 37 |
| | | " | 4 | Ichthyoplankton | 124 |
| | | " | 5 | Ichthyoplankton | 78 |
| | | " | 9-10 | Ichthyoplankton | 91 |
| | | " | 11-12 | Ichthyoplankton | 118 |
| | | " | 1 | Hydroacoustics | - |
| | | " | 3 | Hydroacoustics | - |
| | | " | 10 | Hydroacoustics | - |
| | | " | 8 | Pollock | ? |
| | | JAP | 10-11 | Squid | 99 |
| | | " | 11 | Squid | 168 |
| | | USSR | 2-4 | Squid | 297 |
| | | " | 2,5 | Groundfish | 199 |
| | | " | 3-4 | Ichthyoplankton | 106 |
| | | " | 8-9 | Ichthyoplankton | 251 |
| | WX | CAN(M) | 3 | Haddock | 62 |
| | | " | 6 | Squid | 94 |
| | | " | 7 | Comparative fishing | 61 |
| | | " | 12 | Squid | 24 |
| | X | CAN(M) | 2,4 | Juvenile herring | 31 |
| | | " | 3 | Larval herring | 114 |
| | | " | 7-8 | Larval herring | 415 |
| | | " | 10-11 | Larval herring | 115 |
| | | " | 6,10 | Scallops | ? |
| | | USSR | 5,10-12 | Ichthyoplankton | 27 |
| 5 | YZ | GER,FR | 2-3 | Herring (coordinated) | 125[9] |
| | | " | 9-10 | Herring (coordinated) | 93[10] |
| | | POL | 10 | Apex predator studies | 11 |
| | | " | 11 | Larval herring, plankton | 33 |
| | | USA | 4,5 | Ichthyoplankton | 136 |
| | | " | 10-12 | Ichthyoplankton | 151 |
| | Z | CAN(M) | 5-6 | Scallops | ? |
| | | GDR | 4-5 | Herring (coordinated) | 115[11] |
| | | GER,FR | 10-11 | Ichthyology (cont. slope) | ? |
| | | USA | 1 | Clams | 12 |
| | | " | 2-3 | Ichthyoplankton | 34 |
| | | " | 6-7 | Ichthyoplankton | 51 |
| | | " | 4-5 | Scallops | 111 |
| | | USSR | 6-8 | Ichthyoplankton | 266 |
| | | " | 9 | Silver hake | 48 |
| 6 | A | GDR | 4-5 | Herring (coordinated) | ...[11] |
| | | GER,FR | 2-3 | Herring (coordinated) | ...[9] |
| | | " | 9-10 | Herring (coordinated) | ...[10] |
| | ABC | GER,FR | 10-11 | Ichthyology (cont. slope) | ? |
| | | POL | 10 | Apex predator studies | 17 |
| | | " | 11 | Shark (sonic tagging) | - |
| | | USA | 2-4 | Ichthyoplankton | 80 |
| | | " | 4-5 | Scallops | 201 |
| | | " | 5 | Ichthyoplankton | 72 |
| | | " | 6-7 | Ichthyoplankton | 72 |
| | | " | 10 | Ichthyoplankton | 71 |
| | | " | 11-12 | Ichthyoplankton | 9 |

NOTE: The footnoted numbers indicate situations where the number of sets given overlapped subareas; the number of sets is entered in one subarea and the symbol "..." followed by the corresponding footnoted digit indicates the other subarea to which the overall number of sets also applies.

a list of survey manuals not existing in the laboratories of member countries, (b) a brief description of the history of groundfish surveys carried out in the NAFO (ICNAF) Area, including fixed station and line surveys, and (c) a description of methods of intercalibrating survey abundance indices with cohort analysis for estimating catchability at age. Such information will be incorporated into the revised draft.

Table 2. Biological surveys planned for the NAFO area in 1980 and 1981.

| Country | Type of survey | Area | Dates |
|---|---|---|---|
| A. Surveys Planned for 1980 | | | |
| CAN(M) | Groundfish | 4T | Sep 3-Oct 3 |
| | " | 4VWX | Mar 3-28 |
| | " | 4VWX | Jul 2-28 |
| | " | 4VWX | Sep 29-Nov 14 |
| | Redfish | 4VWX | Nov 24-Dec 5 |
| | Redfish & silver hake | 4VWX | Jan 14-25 |
| | Herring (larval) | 4T | May-Jun |
| | " (juvenile) | 4T | Sep-Oct |
| | " (larval) | 4X | Mar 3-21 |
| | " (acoustic) | 4X | Jul 28-Aug 15 |
| | " (larval) | 4X | Aug 11-29 |
| | " (larval) | 4X | Nov 3-21 |
| | Mackerel (eggs) | 4T | Jun 9-Jul 18 |
| | Large pelagics | 3-5 | Aug-Sep |
| | Squid (*Illex*) | 4VWX | Aug 18-29 |
| | Scallops | 4X,5Ze | Jul 28-Aug 8 |
| | " | 5Ze | May 12-Jun 6 |
| | Multispecies studies | 4VWX | Oct 14-24 |
| | Comparative fishing | 4VWX | Jul 2-28 |
| | Ichthyoplankton | 4VWX | Feb 4-29 |
| | " | 4VWX | May 5-Jun 27 |
| | " | 4VWX | Sep 2-26 |
| | " | 4VWX | Nov 17-Dec 19 |
| | Hydroacoustics | 4WX | Feb 18-28 |
| CAN(N) | Groundfish (rand. strat.) | 3LNO | Apr 10-Jun 3 |
| | " (deepwater) | 3LNO | Apr 29-May 15 |
| | " (rand. strat.) | 4RS | Sep 5-22 |
| | " (rand. strat.) | 2J+3k | Oct 4-21 |
| | " (rand. strat.) | 2J+3K | Nov 20-Dec 9 |
| | " and shrimp | 4RS | Aug 27-Sep 8 |
| | G. halibut (tagging) | 3K | Jun 26-Jul 16 |
| | " & hydrography | 0-2 | Sep 10-Oct 2 |
| | Flatfish (juveniles) | 4R | Aug 27-Sep 9 |
| | " " | 3LN | Sep 29-Oct 10 |
| | Salmon tagging | 3LNO | May 7-Jun 2 |
| | Capelin survey | 3LN | Jun 11-Jul 7 |
| | " " | 2+3K | Oct 23-Nov 18 |
| | Shrimp survey | 2GHJ | Jul 9-Aug 4 |
| | " " | 4RST | Nov 4-21 |
| | Squid survey | 3LNO | Jun 4-24 |
| | " " | 2J+3K | Nov 27-Dec 12 |
| | Hydrography, ichthyoplankton | 3M | Apr 2-14 |
| | " " | 3M | May 17-Jun 9 |
| | " , plankton | 3LM | Jul 18-Aug 12 |
| CAN(Q) | Herring (tagging) | 4S | Sep 12-Oct 5 |
| | " ( " ) | 4T | May 15-21 |
| | " (juveniles) | 4T | Aug 15-Sep 15 |
| | Capelin (acoustic) | 4T | Apr 28-May 7 |
| | Crabs | 4T | May 15-30 |
| | " | 4ST | Jul-Aug |
| | " | 4T | Oct 1-16 |
| DEN(G) | Cod (acoustic) | 1CDE | Feb-Apr |
| | Groundfish & shrimp | 1CDE | Feb-May |
| | " " | 1CDE | Nov-Dec |
| | Capelin | 1D | Feb-Mar |
| | " | 1D | Nov-Dec |
| | Shrimp (trawl survey) | 1AB | Aug |
| | " (photo) | 1AB | Aug |
| | " (commercial) | 1B | Jan-Nov |
| | Plankton | 1BC | Jul |
| | " | 1D | Jan-Apr |
| | " | 1D | Jun-Sep |
| FRA | Cod survey | 2J+3KL | Jan 29-Feb 27 |
| | " " | 3P+4R | Jan 7-27 |
| | Cod tagging | 3Ps | Oct 15-25 |
| | Groundfish (rand. strat.) | 3Ps | Mar 1-25 |
| | " ( " " ) | 3Ps | Sep 28-Oct 13 |
| | Squid (rand. strat.) | 3Ps | |
| | ( " " ) | 4VWX | Aug 26-Sep 26 |

| Country | Type of survey | Area | Dates |
|---|---|---|---|
| A. Surveys planned for 1980 (Cont'd) | | | |
| GDR | Groundfish (rand. strat.) | 2GHJ | Oct-Nov |
| GER,FR | Groundfish | 1CDE | Apr 26-May 21 |
| | " | 1B-F | Jun 9-Jul 25 |
| | " | 1B-F | Oct 20-Nov 19 |
| | " (rand. strat.) | 2J | Nov 20-Dec 20 |
| POL | Groundfish | 5Z | Feb 11-16 |
| | Ichthyoplankton | 5YZ | Feb 18-26 |
| | " | 5Z,6A | Feb 28-Mar 10 |
| | Apex predator studies | 6ABC | Mar 10-30 |
| USA | Groundfish (trawl) | 4X | Apr 30-May 8 |
| | " ( " ) | 4X | Sep 8-Nov 19 |
| | " ( " ) | 5YZ | Mar 29-May 8 |
| | " ( " ) | 5YZ | Jul 11-Aug 22 |
| | " ( " ) | 5YZ | Sep 8-Nov 19 |
| | " ( " ) | 6ABC | Mar 13-Apr 10 |
| | " ( " ) | 6ABC | Jul 11-Aug 22 |
| | " ( " ) | 6ABC | Sep 9-Nov 19 |
| | Red crab assessment | 5Z | May 6-9 |
| | Clams assessment | 5Z+6 | Jan 3-Feb 10 |
| | " " | 5Z+6 | Aug 18-Sep 3 |
| | Scallop assessment | 5Z+6 | May 19-Jul 2 |
| | Gear test (bottom trawl) | 5Z | May 9-16 |
| | " " ( " " ) | 5Z | Jun 27-Jul 3 |
| | " " ( " " ) | 5Z | Jul 7-9 |
| | " " ( " " ) | 5Z | Nov 24-29 |
| | Ichthyoplankton | 4-6 | Feb 27-Apr 5 |
| | " | 4-6 | May 21-Jun 20 |
| | " | 4-6 | Sep 24-Oct 29 |
| USSR | Groundfish | 2J+3K | Oct-Dec |
| | " | 3KLMNO | Mar-Jul |
| | Groundfish & silver hake | 4VWX | Oct-Nov |
| | Ichthyoplankton | 4VWX | Aug-Oct |
| | " | 5Ze | Apr-Sep |
| | Hydroacoustics | 3LNO | May-Jun |
| B. Surveys in early 1981 | | | |
| CAN(M) | Groundfish | 4VWX | Feb 23-Apr 3 |
| | Silver hake (juveniles) | 4VWX | Jan 5-16 |
| | Mackerel | 4VWX | Feb |
| | Herring (larval) | 4X | Mar 2-20 |
| | Large pelagics | 6 | Feb-Mar |
| | Squid | 4VWX | Jan 12-Feb 24 |
| | Multispecies studies | 4VWX | Feb 2-13 |
| | Ichthyoplankton | 4VWX | Jan 19-Feb 20 |
| | Seals (aerial survey) | 4 | Jan |
| CAN(N) | Groundfish (rand. strat.) | 3M | Jan 28-Feb 18 |
| | " ( " " ) | 3Ps | Mar 2-12 |
| | " ( " " ) | 3Pn4RS | Jan 5-26 |
| | Cod tagging | 3KL | Mar 12-30 |
| | Squid survey | 3+4 | Feb 20-Mar 11 |
| POL | Ichthyoplankton | 5Z | Sep-Oct |
| USA | Groundfish | 4X | |
| | " | 5YZ | Mar 12-May 16 |
| | " | 6ABC | |
| | Red crab assessment | 5Z | Mar 23-Apr 13 |
| | Gear test (bottom trawl) | 5Z | Jan 5-31 |
| | Ichthyoplankton | 4-6 | Feb 13-Mar 19 |
| | " | 4-6 | Mar 17-Apr 16 |
| | " | 4-6 | May 20-Jun 26 |

4. Review of Survey Stratification Schemes

Danish scientists reported that the stratification scheme for groundfish surveys in Subarea 1 was being revised and that documentation would be available in the near future. No other revisions to stratification schemes were reported.

5. Progress in Improving Survey Methods (SCR Doc. 80/II/44)

STACREC noted that a paper entitled "Modelling of fish schools for calibration of the echo integrator" had been discussed by STACFIS at the February 1980 Meeting. No further contributions were presented at this meeting.

6. Feasibility of Developing Common Species Codes for Survey Data

The Assistant Executive Secretary reported that laboratories in Canada, Federal Republic of Germany, France, Italy, Poland, USSR and USA replied to his request for information on survey data coding schemes. He indicated that those with no codes who contemplated using the FAO 3-alpha species identifiers will find that there is no provision for many species of no commercial importance. Participants from the Canadian laboratories at St. Andrews, New Brunswick, and St. John's, Newfoundland, and the USA laboratory at Woods Hole, Massachusetts, indicated that, although the codes for processing research vessel survey data were under revision at their respective laboratories, standardization between laboratories did not appear feasible due to considerations of national coordination (in the case of Woods Hole) and considerations of limiting changes to minimize the cost of adjusting existing data files.

The Committee considered that universal standardization of codes of survey data was not feasible at the present time and therefore examined the possibility of using a translation program and coding scheme designed for data exchange only. Participating scientists reported that exchange of survey data has consisted of some unprocessed data and final products only. The Assistant Executive Secretary indicated that a coding system and translation programs would be necessary if the NAFO Secretariat were to establish a survey data base. The Committee concluded that no further action should be taken on the development of this coding system at the present time, but that the issue could be reopened in the context of a NAFO survey data base at a later time.

7. Special Survey Needs

a) Itensification of surveys for cod stocks in Div. 3M, 3N and 3O

The Committee observed that the intensity of surveys in Div. 3M, 3N and 3O had increased since 1978, and therefore

recommends (11)

*that the effectiveness of the existing survey activity for cod in Div. 3M, 3N and 3O be evaluated in order to determine future survey needs in these divisions.*

b) Status of shrimp surveys in Subareas 0 and 1

Danish scientists reported that the 1978 recommendation of STACRES regarding the need for extensive trawl and photographic surveys in Subareas 0 and 1 (*ICNAF Redbook* 1979, page 20) had been implemented with regard to the photographic surveys in Subarea 1 but that expansion of the trawl surveys has been deferred to 1981. France reported that a trawl survey for shrimp in Subareas 0 and 1 had been carried out in 1979 but that no comparable survey is planned for 1980.

## III. ENVIRONMENTAL STUDIES

1. Review of Environmental Survey Work for 1979

The Committee was informed that the absence of a summary report on environmental conditions in 1979 by MEDS was due to misunderstanding that the item would be considered at the September 1980 Meeting. However, a preliminary review of environmental data, derived from the available documentation, indicated the following trends.

a) Subarea 0 (SCS Doc. 80/VI/22)

Survey work reported by France indicated a correlation between the thermal conditions and the distribution of the northern deepwater shrimp.

b) Subarea 1 (SCR Doc. 80/VI/58; SCS Doc. 80/VI/17, 22)

Survey work, reported by Denmark, France and Federal Republic of Germany, generally showed higher water temperatures in 1979 than in 1978, both on Fylla Bank and in the deeper areas west of the bank. Despite the warmer water in 1979, the volume of plankton in the Fylla Bank section was less than in 1978 when temperatures were considerably lower. Ice conditions in the subarea were close to or slightly less than normal. Relationships between water temperatures and the distribution of shrimp were also shown for this subarea.

c) Subarea 2 (SCR Doc. 80/VI/58, 59, 60, 102, 103; SCS Doc. 80/VI/18, 19)

Survey work, reported by Canada, Federal Republic of Germany, German Democratic Republic and USSR, indicated that thermal conditions during much of 1979 did not depart significantly from normal. However, temperatures in the 50-200 m layer in November appeared to be slightly lower than in the corresponding period in 1978. USSR researches indicated that fluctuations in water temperature in the Northwest Atlantic are inversely correlated with those of the Barents Sea. Of particular interest, as well, is the forecast that negative water temperature anomalies will occur in the Seal Island section in 1981.

d) Subarea 3 (SCR Doc. 80/VI/59, 60; SCS Doc. 80/VI/18, 22)

Survey work reported by Canada, France and USSR showed that April water temperatures in Div. 3K, 3L, 3M and 3N were about 1°C lower in 1979 than in 1978. Extensive ichthyoplankton sampling was carried out by USSR. Extensive hydrographic data was also collected in the Flemish Cap area (Div. 3M) and is reported by the Working Group on the Flemish Cap Project (SCS Doc. 80/VI/9).

e) Subarea 4 (SCR Doc. 80/VI/68; SCS Doc. 80/VI/18, 22)

Survey work was noted in documents by France, USA and USSR and reported verbally by Canada. USA observations from monthly maps of surface water temperature showed colder-than-average water from Cape Hatteras to Nova Scotia in February, associated with below-normal air temperature. This pattern disintegrated in April and by June warm temperature anomalies were present between 41°N and 46°N. USSR observations from July to November indicated that subsurface water temperatures on the Scotian Shelf were 2-3°C lower than in 1978, with a strong cline in surface temperature from southwest to northeast. Joint USSR-Canadian ecological surveys were continued in August-September and the ichthyoplankton and zooplankton samples and hydrographic measurements from these surveys are being processed. The Scotian Shelf Ichthyoplankton Program continued for its third year with 8 survey cruises. Measurements of surface currents off southwest Nova Scotia indicate excursions of shelf water related to the passage of Gulf Stream eddies.

f) Subareas 5 and 6 (SCR Doc. 80/VI/64, 65, 66, 67, 68, 93, 104)

Survey work was noted in documents by Federal Republic of Germany, German Democratic Republic and USA and reported verbally by Canada and Poland. Contoured diagrams of bottom temperatures from vertical temperature sections showed that the timing of maximum bottom temperatures in 1979 was similar to that in 1978 but later than in 1974-77. Temperatures at bottom depths of 200-400 m were generally similar to those in 1977 but about 1°C higher than in 1978. USA studies on warm-core eddies indicated that they could be clearly detected by the presence of high water temperature and changes in the shelf-slope front at the bottom. Simultaneous observations on two eddies were made from fishing vessels. Poorly-defined eddies having strong currents associated with them were observed. Eddy production in 1979 was higher than in the preceding 5 years.

2. MEDS Progress Report for 1979

STACREC agreed to defer this agenda item for consideration at the September 1980 Meeting when the report by MEDS will be available. STACREC also agreed that provision be made under this agenda item to include a summary review of environmental conditions in 1979. It was suggested that Dr R. Trites (Canada) be asked to assist MEDS in preparing this summary report.

3. Report of Working Group on the Flemish Cap Project (SCS Doc. 80/VI/9)

STACREC reviewed the report of the January 1980 Meeting of the Working Group, noting in particular that a number of moored current meters, together with guard buoys, had been lost in the Flemish Cap area, presumably through fishing activity. In an attempt to avoid the recurrence of this sort of problem, STACREC

recommends (12)

*that the Fisheries Commission consider how the fishing fleets might best be made aware of the location of moored scientific equipment in the NAFO Area.*

STACREC noted that a number of papers relevant to the Flemish Cap Project are scheduled for completion in September, and agreed that the *ad hoc* Working Group on the Flemish Cap Project meet during the September 1980 Meeting of the Scientific Council.

The Committee noted a most useful document on the identification of species from the ichthyoplankton of Subarea 3 (SCR Doc. 80/VI/90) and commended it to the Flemish Cap Working Group.

4. Task Force on the Larval Herring Program in Gulf of Maine-Georges Bank Area (SCS Doc. 80/VI/16)

The Committee reviewed the preliminary report of the Task Force on the Larval Herring Program, noting that a more comprehensive review of the data was planned for September 1980. Accordingly, STACREC

recommends (13)

*that the Task Force on the Larval Herring Program should meet on 3-4 September 1980, in conjunction with the Scientific Council Meeting at St. John's, Newfoundland, to review further the analyses of the time series of larval herring data and to evaluate the data base with empahsis on factors affecting the recruitment process of herring.*

It was suggested that the results of the Environmental Working Group at its meeting in Aberdeen, Scotland, in 1975 (*ICNAF Redbook* 1975, pages 95-108) could be used as a standard, specifically for comparison of progress to date in the evaluation of hypotheses on factors influencing recruitment in sea herring (SCS Doc. 80/VI/16, Task Force Recommendation No. 4).

5. Cooperative Research on Distribution of Larval and Juvenile *Illex*

A USSR study (SCR Doc. 80/VI/98) suggested a close relationship between the distribution of larval and juvenile *Illex* and the water masses extending from the edge of the continental shelf to the northern edge of the Gulf Stream. It was pointed out, however, that the figures used in this paper do not correspond with Canadian figures derived from the same data. It was suggested that Canadian and USSR scientists should review the data used in this paper to resolve any discrepancies.

In view of the Scientific Council's recommendations for squid research (SCS Doc. 80/II/1), STACREC considered that the surveys conducted by more than one country should be coordinated to study the distribution of larval and juvenile *Illex* and the influence of environmental conditions on distribution and abundance, and agreed to establish an *ad hoc* working group, consisting of oceanographers and other relevant disciplines, with Mr T. Rowell (Canada) as Convenor, to consider and develop a coordinated research program for investigating these problems. The Working Group on Coordination of Squid Research met briefly to examine the status of cooperative studies on *Illex* and arrived at the following conclusions:

a) Coordinated surveys should be conducted throughout Subareas 3 to 6 to determine the distribution of larval and juvenile *Illex* on and off the continental shelf. The surveys should be carried out during the late-winter to late-spring period and should include the collection of all relevant oceanographic data. The surveys should be integrated with currently ongoing survey programs such as MARMAP, Ocean Pulse, Groundfish surveys, etc.

b) The following table indicates the possible research vessel availability and disposition throughout the area for 1981.

| Period | Duration | Vessel (Country) | Subareas | Research |
|---|---|---|---|---|
| Jan-Feb | 4-6 weeks | *Albatross* (USA) | 5+6 | MARMAP on-shelf and possible extension to off-shelf areas |
| Feb-Mar | 3 weeks | *Gadus Atlantica* (Canada) | 3 | Larval and juvenile surveys, shelf edge to Gulf Stream |
| Feb-Mar | 6 weeks | *A. T. Cameron* (Canada) | 4 | " " |
| Feb-Jun | 16 weeks | 1 vessel (USSR) | 3+4 | " " |
| May | 4 weeks | 1 vessel (Japan) | 3+4 | Juvenile survey on and off the shelf |
| May-Jun | 3 weeks | 1 vessel (Canada) | 3 | " " |

It is apparent that Subareas 5 and 6 will not be sufficiently covered without realignment of available vessel time or the commitment of additional vessel time. It is possible that other programs, such as MARMAP, Ocean Pulse and Groundfish surveys conducted by USA may be capable of providing such additional requirements. It is advised that all member countries planning research

vessel activity in the area should consider their possible involvement in the program.

STACREC agreed that an appropriate time to consider these matters would be at the time of the September 1980 Meeting of the Scientific Council, and urged that scientists involved in the program should be prepared to discuss and finalize details for standardization of survey design, survey equipment, data collection and data exchange. Accordingly, STACREC

recommends (14)

*that a special 2-day meeting of the ad hoc Working Group on Coordination of Squid Research with Mr T. Rowell (Canada) as Convener, be scheduled immediately before the September 1980 Scientific Council Meeting at St. John's, Newfoundland, to consider final vessel availability and program planning relating to the surveys for larval and juvenile Illex in 1981.*

6. Other Matters Relevant to Environmental Studies

a) Review of relevant documents (SCR Doc. 80/VI/60, 111)

The Committee reviewed two contributions, which are concerned with identifying suitable models and methods describing the empirical and theoretical relationships that may exist between fish stock, environment and recruitment. In the paper by V. A. Borovkov (SCR Doc. 80/VI/60), a hypothesis is outlined on the influence of atmospheric circulation on the thermal and dynamic condition of the Labrador Current and its possible effect on year-class strength of the Labrador cod stock. An analysis, based on available relevant records and the assumption that the strength of year-classes is primarily influenced by environmental conditions within the period of embryonic development and early larval stages before active feeding, resulted in the construction of a regression model aimed at tentatively predicting the recruitment of cod 4 to 5 years in advance.

The contribution by R. C. Hennemuth, J. E. Palmer and B. E. Brown (SCR Doc. 80/VI/111) contains a statistical description of recruitment in 18 selected stocks by examining them empirically as to frequency distribution which subsume the total effect of all factors (including environmental factors) influencing the process of recruitment. This review of recruitment data indicates that a hard line cannot be drawn distinguishing pelagic and demersal stocks on the basis of recruitment variability or the presence of dominant year-classes. Furthermore, there are great similarities in the probability distribution functions of widely differing stocks. The approach of studying these functions as more data are accumulated may provide useful guidelines in understanding the influence of recruitment on fish populations and fisheries.

b) Proposed topics for future consideration

The Committee noted with great interest that the development and increasing use of remote sensing methods (e.g. satellite-tracked buoys, etc.) for continuously registering various marine environmental factors (conditions) may also provide possible applications in the field of fishery science. In order to obtain more information about these new techniques, STACREC

recommends (17)

*that a special session with invited lectures on remote sensing methods and their possible application to fishery science be arranged during the meeting of the Scientific Council in September 1981, and that Dr R. Trites be asked to convene this session.*

The Committee noted the desirability of documenting a review of environmental conditions for the 1970-79 period, and

recommends (18)

*that a special session to review environmental conditions in the 1970-79 decade be held at the time of the September 1981 Meeting of the Scientific Council, and that a convener be appointed at the forthcoming September 1980 Meeting of the Council.*

## IV. TAGGING ACTIVITIES

1. Review of Tagging Activities in 1979

Tagging activities in 1979, as reported to the Secretariat, were reviewed (SCS Doc. 80/VI/7). It was also noted that the document contained a list of USSR activities in 1976-78. Several members of the Committee indicated that they found this type of compilation very useful and urged that the previously-agreed procedure of reporting tagging activities to the Secretariat for information and distribution to other member countries be continued.

## V. OTHER MATTERS

### 1. Adjournment

The Chairman expressed his appreciation to Dr W. G. Doubleday and Mr E. J. Sandeman for convening the sessions dealing with biological surveys and environmental studies, and to Mr J. S. Beckett and Mr T. Rowell for convening working group sessions on the scientific observer program and on squid research respectively. He thanked the rapporteurs and all participants for their cooperation during the meeting, and the Secretariat for their usual efficient work.

# ANNEX 1. REPORT OF *AD HOC* WORKING GROUP ON THE INTERNATIONAL SCIENTIFIC OBSERVER PROGRAM

Convener: J. S. Beckett (Canada)

The Working Group, with participation by representatives of Canada, European Economic Community and Poland, and the Chairman of the Scientific Council, met on 2 June 1980 at NAFO Headquarters, Dartmouth, Nova Scotia, to fulfil its mandate from the 1979 Annual Meeting regarding the development of specific requirements for data collection (*NAFO Proc.* 1979, page 115). The Convener noted that the timing of the meeting, originally scheduled to be held during the time of the February 1980 Meeting of the Scientific Council, was deferred at the request of Canada.

The Working Group took notice of its terms of reference and agreed to use them as the basis of its agenda. These were (i) to review recent sampling data collection and identify specific data needs by stock and area; (ii) to recommend what data should be collected, as a minimum, by an observer on board a vessel, and to identify other data that could be collected should the particular situation permit, with due attention to the need to avoid revealing details on the commercial aspects of fishing operations; (iii) to develop the format of data collection; and (iv) to recommend procedures for the transmittal and dissemination of the scientific data.

## 1. Review of Recent Data and Identification of Specific Needs

The Working Group examined the analyses of sampling efficiency for 1978 data, prepared by the Secretariat (SCS Doc. 80/VI/13), and noted that, whereas the level of sampling on a aggregated basis might appear to have exceeded the minimum level established some years ago by STACRES (*ICNAF Redbook* 1974, page 71), there were in fact major deficiencies in many stock/vessel class/country/quarter categories. It was apparent that these deficiencies reflected, in many cases, the difficulties of assigning national scientific observers to the fishing fleets on a year-long basis. Taking into account the bilateral nature of the international observer scheme, the Working Group

recommends (10)

*that bilateral parties involved in the International Observer Program identify the appropriate fisheries to be covered.*

## 2. Data to be Collected

The data collected are to be used for scientific purposes only. Access to relevant fishing records and the cooperation of the vessel's crew will be necessary for the observer to collect these data.

### a) Vessel identification

There was considerable discussion as to whether vessels should be identified on the data sheets. It appeared that such identification would not cause problems because the data are to be used strictly for scientific purposes. However, it was agreed that, if identification becomes a difficulty in gaining acceptability of the record forms, vessel characteristics (tonnage, length and horsepower) should be substituted.

### b) Fishing gear

The gear used should be identified by type using the NAFO abbreviations, particular attention being given to special modifications. It was suggested that "off-bottom" trawls should be identified by the provision of appropriate coding.

### c) Mesh size

The actual mesh size was recognized as an important element of the data and must be recorded. The use of a codend liner and the type of topside chafing gear should be recorded. For gears other than towed gears, the appropriate measure (e.g. hook size for line gears) will be substituted.

### d) Set data

It was concluded that the observer should maintain a complete set record rather than only the data that might not be recorded in the fishing logs of the vessels, as the scientific analyses could be significantly delayed if the essential material was distributed between two separate data bases. The set record should include: the position, time and water depth at the start and end (when available) of each set; the fishing depth of the gear (different from bottom depth for such gears as midwater trawl and drift nets); the speed of tow; and other measures of fishing effort as applicable to the particular gear used.

e) Catch composition

Estimates of the catch by weight should be recorded for each species, together with estimates of the quantities reduced by species and discarded by species. The quantity reduced is especially important where vessel catch is calculated from production or where size sampling is only possible after the catch has been sorted into the portions to be processed and reduced and/or discarded.

f) Biological sampling

This should be carried out for all commercial species at a suggested frequency of one sample per day, irrespective of species. Recognizing that NAFO commercial fishery length and age sampling forms are not suitable for work ("tally") sheets, observers should be free to use the work forms to which they are accustomed prior to transferring the summed data to the NAFO forms. When it is not possible to sample the total catch, sampling of discards and fish destined for reduction, in addition to retained catches, should be sampled for length and age composition by species.

g) Other observations

The observer should record observations appropriate to a fuller understanding of the scientific data, including such items as gear handling techniques to increase escapement of small fish through the trawl meshes at the surface, comments on fish loss during hauling, observations on the viability of escaping and discarded fish, gear loss or damage if significant to catch rate considerations, and the presence of other fishing vessels. Some of these observations might be made directly on the set data sheets, whereas others of a more general nature might be included in a short summary report, prepared by the observer and copied (as with other data records) to the captain upon request. This report should note the general area of fishing activity, the number of observations made, and difficulties experienced in carrying out the purposes of the program due to vessel configuration, etc., particularly where suggestions can be made for the benefit of observers in similar future situations. The observer should also collect ancilliary scientific data, such as weather, water temperatures (if vessel equipped to measure), whale sightings, etc.

3. Format of Data Collection

A suggested data record for set details is appended. Development of the final format should be co-ordinated by the Secretariat, and the instructions for completing the form should include the provision of a copy for the vessel's captain.

4. Procedures for Transmittal and Dissemination of the Data

Vessel captains are, under the program, entitled to obtain copies of whatever records they wish. The complete data record should be sent to the designated scientific institution in the country of the vessel. Biological sampling data should be sent to the NAFO Secretariat for incorporation in its data base. Length frequency data should be forwarded to the Secretariat within 60 days after the observer returns to his home base. Age-length keys should be received by the Secretariat as they become available but not later than 30 April of the year following the calendar year of collection. The responsibility for age reading should be included in the bilateral agreement.

## NAFO INTERNATIONAL SCIENTIFIC OBSERVER SCHEME

### Set and Catch Data Record 19

| | | | |
|---|---|---|---|
| Vessel name | | Observer | |
| Country (flag) | | Country of Observer | |
| Trip number | | Surface T°C | |
| Set number | | Towing speed | |
| Side number | | Sea state | |
| Vessel type | | Start latitude | |
| Vessel horsepower | | End latitude | |
| Gear type | | Start longitude | |
| Net material | | End longitude | |
| Chafing gear | | Start depth (m) | |
| Mesh size - codend | | End depth (m) | |
| - chafer | | Start time GMT | |
| Hook size (longlines) | | End time GMT | |
| Directed species | | Observed/log. | |
| Day | | Fishing depth (m) | |
| Month | | NAFO area | |
| Year | | | |

| Species | | Estimated weight of catch (kg) | | | | Check(✓) Directed species | L/A samples taken ? |
|---|---|---|---|---|---|---|---|
| | | Retained | | | | | |
| Name | Code | Processed | Reduced | Total | Discards | | |
| | | | | | | | |
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Comments:

## NOTES FOR COMPLETION

In order to facilitate data-processing, it is essential that all of the information required for each sample be entered in the appropriate spaces on the form.

1. Year. Record the last digits of the calendar year in the space provided at the top of the form.

2. Country, Vessel name, Side number, and National registration number should always be recorded to ensure proper identification of the samples.

3. Gear. Record the appropriate abbreviation for the gear type used, based on the ICNAF Gear Classification for reporting sampling data. In the case of otter trawls used in certain fisheries (e.g. squid), special modifications to the gear (e.g. off-bottom chain, off-bottom bobbin, etc.) should be indicated in a note at the bottom of the form. The primary abbreviations are as follows:

| | |
|---|---|
| OTB - Bottom otter trawl (side and stern | LL - Longlines (set) |
| OTM - Midwater otter trawl (side and stern | LHP - Handlines and pole-lines |
| PTB - Bottom pair trawl (2 boats) | FPN - Uncovered pound nets |
| PTM - Midwater pair trawl (2 boats) | FWR - Weirs, barriers, fences, etc. |
| SN - Seine net (Danish and Scottish seines) | DRB - Boat dredges |
| SB - Beach seines | HAR - Harpoons |
| PS - Purse seines | MISC - Miscellaneous (e.g. cast-nets and dip-nets) |
| GN - Gillnets (set and drift | |

4. Mesh size. In the case of trawls, seine nets, gillnets and poundnets, record the actual mesh size; for line gears record the hook size; and for dredges record the ring size.

5. Chafer. Indicate type in use, if any, and whether a liner fitted.

6. Date. Record the month and day for each sample taken by observers at sea. In the case of port sampling on a trip basis, record the month and day of landing.

7. Time of set. Use Greenwich Mean Time.

8. NAFO Division. Record the appropriate division (or subdivision, where applicable).

9. Fishing depth (m). Indicate the mean fishing depth.

10. Species caught. Record the name of the species sampled, supplemented by the NAFO 3-alpha code.

11. Directed species. Indicate with check (√) the species which was intended as directed catch.

12. L/A sample taken. Indicate whether a length (L) or age (A) sample was taken, and indicate number of fish sampled.

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

Chairman: R. G. Halliday

Rapporteur: V. M. Hodder

The Committee met at Dartmouth, Nova Scotia, Canada, in three sessions during 3-13 June 1980, to consider and report on matters referred to it by the Scientific Council (see Part H, this volume). The members in attendance were: J. Messtorff (EEC), J. P. Minet (EEC), A. T. Pinhorn (Canada), V. A. Rikhter (USSR), and A. Paciorkowski (Poland) was appointed to replace P. Kolarov (Bulgaria) who was not present at this meeting of the Council. The Chairman of the Scientific Council (R. H. Letaconnoux) also attended the sessions.

1. Consideration of Publication Requirements

a) Statistical Bulletin and Sampling Yearbook

The Committee reaffirmed its recommendations of the 1979 Annual Meeting that these publications be continued on a regular basis with the same color of cover and in the same general format as the corresponding ICNAF publications, except that they will be designated as NAFO publications, with a note on the title page of each indicating that previous volumes in the series were issued as ICNAF publications. The first issue of NAFO Statistical Bulletin will be Vol. 29 and the first issue of NAFO Sampling Yearbook will be Vol. 24, with revisions to their contents as agreed by STACREC.

b) List of Fishing Vessels

Noting the recommendation of STACREC that the triennial publication of this series should be continued, STACPUB agreed that the cover and general format should remain unchanged, except that it be designated as a NAFO publication starting with List of Fishing Vessels for 1980, to be issued in 1981. It was noted that the Fisheries Commission may wish to express its opinion on the content and propose some changes.

c) Reports of Scientific Council Meetings

The Committee agreed that the color of the cover (red) and the general format of presenting the reports should be continued as in the ICNAF Redbook series, except that it will be designated as a NAFO publication entitled "Scientific Council Report", which will be issued annually and contain the reports of all Scientific Council meetings held within the calendar year. Since this series will be issued in December of each year, the calendar year to which the reports apply is sufficient to identify each issue. The only exception will be the first issue which will contain the reports of all Scientific Council meetings held in 1979 and 1980. It was suggested that the list of participants should be arranged so that the participants can be identified with the particular meetings which they attended.

d) Other scientific publications and editorial policy relating to them

At the first Annual Meeting in June 1979, it was agreed that the Scientific Council of NAFO required publications which fulfilled the roles that the Research Bulletin, Selected Papers, and Special Publications played for STACRES of ICNAF, but all decisions on the nature and form of these publications were deferred to this Annual Meeting. In preliminary discussion, it was agreed that decisions on the successors to these ICNAF publications and on editorial policy were closely interrelated and should be considered together. Discussion centered on the nature of a suitable primary publication, but there was insufficient time at this meeting to make considered decisions on what were viewed as matters of great importance to the work of the Scientific Council. Consequently, it was agreed that STACPUB should meet again at the time of the September 1980 Meeting of the Council to resolve the question of publication policy and that the STACPUB members should come prepared to discuss the following matters:

i) the sectors of the scientific community to be served by Scientific Council publications and hence the scope of a primary journal;

ii) suitable titles for a primary and a secondary publication;

iii) the suitability of various editorial arrangements;

iv) scope of, and methods for, solicitation of papers;

v) desirability and methods of expanding distribution; and

vi) factors affecting costs associated with the proposals brought forward.

As an interim measure, and noting that sufficient papers were now in hand for publication in 2-3 months, it was agreed that these should be published in an issue similar to the ICNAF Research Bulletin, continuing the numbering of that series but designating the issue as a NAFO publication.

2. Status of Working Papers

The Committee viewed with concern the continued practice of some scientists in presenting substantial data and analyses as working papers. It was emphasized that all data analyses relevant to the advice provided by the Scientific Council should be available for public viewing and therefore presented as research documents. Thus, the relevant research documents dealing with assessments and the report of the Scientific Council should be sufficient for providing the basis of reconstructing the final analyses on which the advice is based.

The Working Paper series, as initially intended, was established to provide a means for the rapid communication of ideas which emerge from the discussions during the meeting or of pieces of relevant information not otherwise contained in research documents. As such, working papers, because they are not available to the public, must not be referred to in meeting reports or in research documents. STACPUB strongly emphasizes that, if the working paper series is continued, there should be strict adherence to the purpose for which it was initially intended.

3. Papers Nominated for Possible Publication

The members of STACPUB individually reviewed all research documents presented to the November 1979, February 1980 and June 1980 Meetings of the Scientific Council. Following discussion on the merits of each, STACPUB requested the Secretariat to invite the authors of the following documents to submit suitably revised manuscripts for consideration with a view to possible publication in one of the NAFO publication series: SCR 79/XI/1; 80/II/1, 5, 22, 28, 29, 30; 80/VI/51, 71, 76, 77, 90, 97, 98, 99, 105, 111 and 112. It was noted that about half of these papers would require substantial revision, and that their acceptance for publication would ultimately depend on the quality of the revised manuscripts.

4. Adjournment

The Chairman thanked the Committee members for their interest and cooperation and expressed his appreciation to the support rendered by the Secretariat.

# APPENDIX IV. RULES OF PROCEDURE FOR THE SCIENTIFIC COUNCIL (REVISED ON 13 JUNE 1980)

## REPRESENTATION

Rule 1

1.1 Each Contracting Party shall notify the Executive Secretary as far as possible in advance of any meeting of the names of its representatives, alternates, experts and advisers who will attend.

1.2 The Scientific Council may invite any non-Member Government and any international, public or private, organization to be represented at meetings of the Scientific Council or its subsidiary bodies by an observer or observers.

## VOTING

Rule 2

2.1 Observers, experts and advisers may address plenary or subsidiary body meetings, but shall not be entitled to vote under Article X, paragraph 2.

2.2 Votes, in accordance with Article X, paragraph 2, shall be taken by a show of hands, by roll call, in the English alphabetical order of the names of the Contracting Parties, or by ballot, as determined by the Chairman.

2.3 In the case of an emergency between meetings, a vote may be taken by mail or other means of communication.

## CHAIRMAN AND VICE-CHAIRMAN

Rule 3

3.1 The Chairman and Vice-Chairman shall take office at the conclusion of the annual meeting at which they are elected.

3.2 The powers and duties of the Chairman shall be:

a) to declare the opening and closing of each meeting;
b) to preside at meetings;
c) to rule on points of order, subject to the right of any representative to request that any ruling of the Chairman shall be submitted to the Scientific Council for decision by vote;
d) to call for and announce the results of votes, under Article X, paragraph 2;
e) to determine, after consultation with the Executive Secretary, the provisional agenda for the annual and special meetings;
f) to arrange for the appointment of the members of subsidiary bodies as required;
g) to sign a report of the proceedings of each meeting of the Scientific Council, for transmission to Contracting Parties, their representatives, and others concerned;
h) generally, to make such decisions and give such directions to the Executive Secretary as will ensure, especially in the interval between meetings, that the business of the Scientific Council is carried out efficiently and in accordance with the decisions; and
i) to act as Chairman of the Executive Committee.

3.3 The powers and duties of the Vice-Chairman shall be:

a) to exercise the powers and duties prescribed for the Chairman when he is unable to act; and
b) to act as Chairman of the Publications Committee.

3.4 If the office of the Chairman is vacated, the Vice-Chairman shall become Chairman for the balance of the term.

3.5 The Chairman, or Vice-Chairman when acting as Chairman, shall not vote under Article X, paragraph 2, and another representative of his delegation shall exercise this function.

3.6 If the offices of the Chairman and Vice-Chairman are vacated, the Chairman of the Standing Committee on Fisheries Science shall exercise the powers and duties prescribed for the Chairman, and the first order of business at the next meeting shall be the election of a Chairman and Vice-Chairman for the balance of the term.

## ORDER OF BUSINESS

Rule 4

4.1 A provisional agenda for each annual or special meeting of the Council or any of its subsidiary bodies shall be prepared by the Executive Secretary, in accordance with the instructions from the Chairman, or the Chairman of the relevant subsidiary body, and be dispatched by the Executive Secretary to all Contracting Parties, their representatives, and invited observers, not less than 60 days before the date fixed for the opening of the meeting.

4.2 Except as provided in paragraph 4.3, the subject matter of a request for scientific advice from a coastal state, in accordance with Article VII, or from the Fisheries Commission, in accordance with Article VIII, shall be included in the provisional agenda for the relevant meeting of the Scientific Council. A memorandum containing the terms of reference prescribed in Article VII shall be circulated by the Executive Secretary to the representatives of all Contracting Parties, together with the corresponding provisional agenda.

4.3 The Scientific Council, by unanimous vote, may waive the necessity of the 60-day advance notice of the subject matter of a request for scientific advice.

## COMMITTEES

Rule 5

5.1 There shall be the following standing committees:

a) The Standing Committee on Fisheries Science which shall:

i) provide a forum for consultation and cooperation among the Contracting Parties with respect to the study, appraisal and exchange of scientific information and views relating to the fisheries of the Convention Area, including environmental and ecological factors affecting these fisheries; and
ii) provide scientific advice as required, in accordance with the provisions of Article VI(c) and VI(d) of the Convention.

b) The Standing Committee on Research Coordination which shall:

i) develop and recommend to the Scientific Council policies and procedures for the collection, compilation, and dissemination of statistical and sampling information on the living resources and fisheries of the Convention Area and environmental information from oceanographic investigations;
ii) coordinate the compilation and maintenance of statistics and records and their dissemination, including liaison with coastal states in the Convention Area;
iii) coordinate the planning and execution of international cooperative research in cooperation with coastal states in the Convention Area; and
iv) encourage and promote cooperation among the Contracting Parties in scientific research designed to fill gaps in knowledge pertaining to matters identified by the Standing Committee on Fisheries Science.

c) The Standing Committee on Publications which shall:

i) develop, coordinate and keep under review the publication and editorial policy and procedures of the Scientific Council and make recommendations thereto on these matters; and
ii) be chaired by the Vice-Chairman, and consist of five other members appointed by the Scientific Council.

5.2 Except as provided in paragraph 5.1, each Standing Committee shall consist of scientists, one from each Contracting Party, who may be assisted by experts and advisers, and have a Chairman who shall be elected by the Scientific Council, in accordance with the provisions of Article X, paragraph 2, to serve for two years. The Executive Secretary shall be an *ex officio* member, without vote.

5.3 There shall be an Executive Committee, composed of the Chairman and Vice-Chairman of the Scientific Council and the Chairmen of the Standing Committees. The Executive Secretary shall be an *ex officio* member of the Executive Committee. This Committee shall keep under general review the planning and execution of the Scientific Council's program and ensure that the Scientific Council's organization effectively and efficiently meets the needs of the scientific program, facilitate coordination with other organizations, and provide advice to the Chairman of the Scientific Council on

a) the timetable for the work of the Committees and Working Groups, and
b) input by the Scientific Council to the work of the General Council.

5.4 The Scientific Council may establish such other subsidiary bodies as required.

5.5 Except as provided in these Rules, each subsidiary body shall establish its own Rules of Procedure.

SECRETARIAT

Rule 6

6.1 The Scientific Council and its subsidiary bodies shall, in the exercise of their functions and duties, use the services of the Secretariat.

6.2 The Executive Secretary shall prepare and transmit the provisional agendas in accordance with Rule 4.1.

6.3 The Executive Secretary shall receive the credentials of representatitves and observers at annual and special meetings and report thereon to the Scientific Council as required.

LANGUAGE

Rule 7

7.1 English shall be the official and working language of the Scientific Council and its subsidiary bodies, but, if desired, any other language may be used, on condition that persons doing so will provide interpreters. All official publications and communications of the Scientific Council shall be in English.

RECORDS AND REPORTS

Rule 8

8.1 Summary records of each plenary and other session shall be drafted and distributed as soon as possible to the participants by the Executive Secretary.

8.2 Summary minutes of the proceedings of the meetings of all subsidiary bodies shall be furnished to the Scientific Council by the Executive Secretary.

8.3 Summary records, reports, resolutions, recommendations, and other decisions adopted shall be transmitted as soon as possible after each meeting to the Contracting Parties, their representatives, and observers, by the Executive Secretary.

8.4 An annual report containing the proceedings of each meeting of the Scientific Council, together with reports of all subsidiary bodies, and such other information as considered desirable, shall be prepared by the Chairman, in consultation with the Executive Secretary, and published.

FINANCIAL

Rule 9

9.1 The Scientific Council shall not incur any expenditure except in accordance with a budget approved by the General Council.

## APPENDIX V. TRIBUTE TO L. R. DAY UPON HIS RETIREMENT

Mr Lew Day: On this occasion of your retirement in a few days, I address you not only as a civil servant of our international organization but also as a friend who has served ICNAF and now NAFO since 1963. From about 1940 until that time you worked as a biologist, moving from fresh to salt water, starting with salmon and then continuing with herring but also producing papers on such diverse topics as redfish larvae and the big white shark. However, you devoted a great amount of work to the herring and published many papers on that species.

During these years, you have also experienced the problems of managing a biological station, having reached the position of Assistant Director at St. Andrews, a post which you had upon joining ICNAF in 1963. I am sure that when you decided to be a candidate for the position of Executive Secretary, being vacated by Dr E. Poulsen, you did not enter the competition merely as another job but rather as a position where you could play a role in promoting cooperation among countries fishing in the Northwest Atlantic.

As a scientist, you have always understood the needs of the Organization and particularly those of your scientific colleagues engaged in a perpetual hunt for more numerous and detailed data. You have closely followed the work of STACRES, taking note of the evolution in research and forecasting future needs. Always smiling, calm and efficient, surrounded by a staff apparently chosen along the same criteria, your favorite expression in response to any request was "no problem". Over the years you have developed an efficient system, being able in a short time to transform reams of plain paper into documents and meeting reports, even though the scientists were not always satisfied with their content.

Scientists are always in pursuit of good data to use in elaborating concepts and methodology, but in fisheries science data of good quality are often not easily obtained. However, in their difficult quest for information required to provide good scientific advice, the ICNAF/NAFO scientists have always received the total support of the Secretariat and the benefit of a good system of coordination and dissemination of information among the fisheries research institutes participating in the work of ICNAF. In doing so, you perfectly reflect what Dr Needler called "the spirit of ICNAF". For the scientists, that spirit was the expression of a collective effort for the promotion of marine research through friendly competition and good will among the participants. In that respect, your personal qualities have played an important role, which we all sincerely appreciate.

On behalf of all members of the Scientific Council, let me thank you very sincerely and wish you and Mrs Day the best for the years to come. We wish you good health, good friends and good days in St. Andrews.

13 June 1980

R. H. Letaconnoux, Chairman
Scientific Council of NAFO

# PART F

REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, September 1980

CONTENTS

# REPORT OF SCIENTIFIC COUNCIL

## Annual Meeting, September 1980

Chairman: R. H. Letaconnoux Rapporteur: V. M. Hodder

The Scientific Council and its three Standing Committees met at St. John's, Newfoundland, Canada, during 3-8 September 1980 to consider and report on the various matters listed in its agenda (see Part H, this volume), some of which were deferred from the June 1980 Meeting (Part E, this volume). Representatives attended from Bulgaria, Canada, Cuba, European Economic Community (EEC), Japan, Poland and Union of Soviet Socialist Republics (USSR), and observers were present from United States of America (USA), the International Council for the Exploration of the Sea (ICES) and the Intergovernmental Oceanographic Commission (IOC) (see Part H, this volume).

The reports of the Standing Committees, as adopted by the Council at this meeting, are given in Appendix I (STACFIS), Appendix II (STACREC) and Appendix III (STACPUB). Brief summaries of these reports and other matters considered by the Council are given below.

### I. FISHERY SCIENCE (APP. I)

1. Georges Bank-Gulf of Maine Larval Herring Program

The Council noted that the Task Force on the Larval Herring Program, with Dr M. D. Grosslein (USA) as Convener, met during 3-4 September 1980, in accordance with a recommendation from the June 1980 Meeting (page 67, this volume), and reviewed 20 papers covering a wide range of studies related to all stages of herring recruitment in the Georges Bank-Gulf of Maine area, including inventories of the 1971-78 data base and the status of data processing. Some new research results included (i) a growth model for larval herring based on increments in otolith size, (ii) analysis of stomach contents of 7,000 herring larvae relative to the composition of copepod populations on Georges Bank, (iii) an experiment on vertical distribution of herring larvae which showed wide distribution in the entire water column to a depth of 70 m (a significant factor in larval transport), (iv) comparison of two independent estimates of egg-production potential for the Georges Bank spawning stock based on virtual population analysis (VPA) estimates and larval production estimates from the time series of larval survey data, (v) the apparent absence of herring spawning on Georges Bank in 1979 as indicated by the lack of larval production, (vi) highly significant correlation between recruitment to the herring stock in Div. 4WX and two environmental variables (sea level and southwest winds), (vii) herring spawning as late as 15 November and migration into an estuary in the Gulf of Maine as late as February, and (viii) condition factors, and estimates of abundance and critical winter mortality for larval herring from 15 years of research in a Gulf of Maine estuary.

The Council noted the significant progress made in evaluating the results of the larval herring program, and endorsed the recommendations of STACFIS related to the work of the Task Force (Appendix I), including the publication of relevant data inventories and papers, future data analyses, and the ongoing research related to herring recruitment.

2. Analyses Related to the Flemish Cap Project

The Council noted that the *ad hoc* Working Group on the Flemish Cap Project, with Mr R. Wells (Canada) as Convener, met on 5 September 1980, and reviewed the results of research presented in 10 papers containing information relevant to the area. A summary of historical biological information and the oceanographic data accumulated by the Marine Environmental Data Service (MEDS) substantially form the historical data base for the area. Some new research results included (i) confirmation of the discreteness of the cod stock from a study of variation in vertebral averages, (ii) indication of a recent decrease in abundance of juvenile redfish based on their incidence in cod stomachs, (iii) low abundance of cod larvae and much higher abundance of redfish larvae in 1978 and 1979 with an indication of high mortality of redfish larvae between April and July 1979, (iv) coincidence of the zones of high chlorophyll a concentration in 1979 with the distribution of early stages of *Calanus finmarchicus*, (v) support for the existence of a weak anticyclonic gyre on Flemish Cap from analysis of data from drifting satellite-tracked buoys and moored current meters, with an apparent 4-day periodicity in the current pattern and a strong semi-diurnal tidal signal.

The Council noted that further analysis of the historical data base of biological and oceanographic information was required and that there was a need for an annual review of ongoing data collections. The Council accordingly endorsed the recommendation of STACFIS (Appendix I) that the *ad hoc* Working Group on the Flemish Cap Project should meet during the June 1981 Meeting to review further progress in data analysis and any forthcoming research results.

3. Guidelines for Cod Otolith Interpretation

The Council noted that Mr R. Wells had, in accordance with a recommendation from the June 1980 Meeting, prepared a paper on the interpretation of ages from cod otoliths (SCR Doc. 80/IX/156) together with annotated photographs of 95 cod otoliths examined at the Cod Ageing Workshop held at St. John's, Newfoundland in February 1977. The paper was referred to STACPUB for possible publication in the Council's "Studies" series.

## II. RESEARCH COORDINATION (APP. II)

1. Fishery Statistics

The Council noted that STACREC had considered a proposed new format for Table 5 of the NAFO Statistical Bulletin and the proposed revisions to country abbreviations for use in future statistical tabulations, and agreed to endorse the two recommendations on these items. It was observed that the second recommendation referred to a proposal by the Coordinating Working Party on Atlantic Fishery Statistics (CWP) that all of its participating organizations should use standardized country abbreviations in their statistical tabulations when space is limited.

The Council was informed that a restructuring of the CWP as a truly international body of experts outside the aegis of FAO was proposed and that the new CWP would come into effect upon agreement to the new terms of reference by four of the participating organizations. Noting the recommendation of STACFIS on this matter, the Council agreed to the terms of reference for the Future Structure of the CWP, as set out in Annex 2 to Appendix II, and requested the Assistant Executive Secretary to inform the Secretary of the CWP (Mr L. P. D. Gertenbach) of this decision.

The Council noted the concern expressed by STACREC regarding deterioration in the national reporting of fishery statistics through the STATLANT system, particularly the STATLANT 21B reports which provide the basis for the Statistical Bulletin and much of the assessment work, and agreed to transmit to the Contracting Parties of NAFO, through the General Council, its grave concern about this matter (GC Doc. 80/IX/11).

2. Proposed Manual on Groundfish Surveys

The Council noted that the editor (Dr W. G. Doubleday) had finally been able to present a revised, but still incomplete, draft of the proposed manual (SCS Doc. 80/IX/31), and fully endorsed the recommendation of STACREC that the editor solicit from scientists comments for improving the draft and submit a completed draft manual to the Secretariat for distribution well in advance of the June 1981 Meeting.

3. Coordination of Squid Research

The Council noted that the *ad hoc* Working Group on Squid Research, with Mr T. Rowell (Canada) as Convener, met on 2 September 1980 and considered research objectives and vessel availability relating to surveys for larval and juvenile *Illex* in the first half of 1981. The Council strongly endorsed the proposal for coordinated squid research in 1981 as given in Annex 3 to Appendix II.

The Council agreed that one day would be required, in addition to the three days already allocated for the special session on "Squid Biology and Distribution" at the June 1981 Meeting, to review the preliminary results of the 1981 surveys, and agreed that the Working Group should meet for four days in the week preceding the Scientific Council Meeting in June 1981, with Mr T. Rowell as Convener.

4. Environmental Studies

The Council noted that the major gap in the STACREC Report of the June 1980 Meeting (page 98, this volume) was filled by the presentation of the MEDS progress report for 1979 (SCR Doc. 80/IX/149), a summary of which is given in Appendix II (Section IV(1)). Some improvement was noted in the national reporting of current oceanographic data to MEDS, but the acquisition of historical data series from various national representatives was much slower than anticipated. The Council further notes that the section on environmental conditions in the NAFO Area during 1979, given in Appendix II of this report, supplements a similar summary in the STACREC Report of the June 1980 Meeting.

Because of the planned "review of environmental conditions in the Northwest Atlantic during the 1970-79 decade" at the September 1981 Meeting of the Council, the need to have the historical data base updated as soon as possible was emphasized, including data not only for 1970-79 but also for earlier years. The Council urges that national representatives for oceanographic data exchange should ensure that as much as possible of the outstanding data noted in the relevant tables of ICNAF Res. Doc. 79/VI/118 and SCR Doc. 80/IX/149 and any other outstanding historical data series are submitted to MEDS (or to the NAFO Secretariat) as soon as possible.

## III. PUBLICATIONS (APP. III)

1. Publications and Editorial Policy

The Council noted that STACPUB had completed provisionally its consideration of editorial policy relating to its scientific publications and endorsed the proposal for the establishment of a primary scientific journal entitled "Journal of Northwest Atlantic Fishery Science", starting with Volume 1 to be issued in 1980. Subsequently, the number of issues per annual volume will depend on the number of suitable quality papers submitted, with two issues being planned for 1981. An editorial board will be established consisting of an editor and four associate editors to ensure that contributed papers are subjected to refereeing and quality editing prior to publication. The Assistant Executive Secretary was designated as Editor, and the four associate editors will be selected from a list of established scientists in the fields of biological oceanography, vertebrate fisheries biology, invertebrate fisheries biology, and biomathematics.

The Council also endorsed the proposal that a secondary scientific publication, entitled "Scientific Council Studies" (similar to the ICNAF Selected Papers series) will be issued annually or more frequently as needed. The series will contain papers selected from the Council's "research document" series and contributions covering special topics (e.g. symposia papers, manuals, etc.) initiated by the Scientific Council.

2. Other Matters

The Council endorsed the proposals of STACPUB (Appendix III) relating to the development of an ichthyoplankton identification manual for the Northwest Atlantic, the coordination of research information for the NAFO area as a whole, and a new format for NAFO Statistical Bulletin Table 5 to replace Tables 5 and 6 of the ICNAF Statistical Bulletin series. The Council also noted that eight papers, presented as research documents to this meeting, were nominated for possible publication in the Council's "Studies" series.

## IV. COLLABORATION WITH OTHER ORGANIZATIONS

1. NAFO Participation in the Tenth Session of the CWP

The Council noted that the Tenth Session of the CWP was held at Madrid, Spain, during 22-29 July 1980, with the Assistant Executive Secretary (Mr V. M. Hodder) and two Canadian nominees (Dr W. G. Doubleday and Mr D. A. Tilley) participating on behalf of the Council. Dr Doubleday was unanimously elected Chairman for the Session. Some matters of direct relevance to the Council (SCS Doc. 80/IX/29) were considered by STACREC, and agreement was reached on those requiring attention at this meeting (see Appendix II).

2. Proposed NAFO/ICES Research on Redfish in Subarea 1 and East Greenland

The Council was informed that the General Secretary of ICES had been contacted regarding the proposed NAFO/ICES study on redfish, initiated at the June 1980 Meeting (page 68, this volume). A response received in late August 1980 indicated that the matter would be considered at the Statutory Meeting of ICES in October 1980, following which the NAFO Secretariat would be advised of the decision.

## V. FUTURE SCIENTIFIC MEETINGS

1. Mid-term Meeting for Assessment of Seals and Shrimp

The Council noted the Canadian request for advice on the scientific basis for management in 1981 of the seal stocks within national fishery limits, and the EEC request for a meeting in early October 1980 to assess the status of the shrimp stocks in Subareas 0 and 1. Because data for most of 1980 are essential for the assessment of shrimp, it was strongly emphasized that a meeting earlier than mid-November 1980 would not be feasible. Consequently, the Council agreed to meet during 18-22 November 1980 at NAFO Headquarters, Dartmouth, Canada, to assess the status of the seal and shrimp stocks.

2. Mid-term Meeting for Assessment of Capelin and Cod

The Council noted that STACFIS had not been able to provide advice for management in 1981 of the capelin stocks in Div. 2+3K and 3LNO, and the cod stocks in Div. 3M and 3NO, and agreed to meet during 17-21 February 1981 at NAFO Headquarters, Dartmouth, Canada, to review the status of these stocks.

3. Regular Meeting in June 1981

The regular meeting of the Scientific Council and its Standing Committees (STACFIS, STACREC and STACPUB) will be held at NAFO Headquarters, Dartmouth, Canada during 9-20 June 1981. Preceding this meeting, a special session on "Squid Biology and Distribution", with Mr T. Rowell as convener, will be held during 3-6 June 1981 and the *ad hoc* Working Group on the Flemish Cap Project (convener to be appointed) will meet on 8 June 1981. Both of these groups will report to STACFIS.

4. Annual Meeting in September 1981

The following topics were noted for consideration at the Annual Meeting of the Council to be held at NAFO Headquarters during 9-14 September 1981:

a) Review of environmental conditions in the Northwest Atlantic during the 1970-79 decade, with Mr E. J. Sandeman as Convener.

b) Remote sensing methods and their possible application to fisheries science, with Dr R. W. Trites as Convener.

c) Further analysis of the Georges Bank-Gulf of Maine larval herring program, with Dr M. D. Grosslein as the Task Force Convener.

## VI. OTHER MATTERS

1. Provisional Report of the June 1980 Meeting

The Council reviewed the report of its meeting at Dartmouth, Canada during 3-13 June 1980 (SCS Doc. 80/VI/25, + Revised addendum). The report was formally approved after several amendments, the most significant being the addition of the sentence "such a paper or papers must be submitted to the NAFO Secretariat at least 30 days before the commencement of the Scientific Council meeting during which the paper(s) would be expected to be considered" to paragraph c(i) of the section entitled "Guidelines for the Application of Rule 1.2 in the Event of a Request for an Invitation to Attend a Meeting of the Scientific Observer". All amendments will be incorporated into the Report of the June 1980 Meeting prior to its publication in the Council's "Report" series.

2. Possible Need for Amendment to Rule 5.1 of the Rules of Procedure (Page 110, this volume)

Some members of the Council noted that there is some confusion regarding the Standing Committees to which the existing *ad hoc* Working Groups and the Larval Herring Task Force should report, as they usually discuss matters which overlap the objectives set out in Rule 5.1 for STACFIS and STACREC, namely, reviews of research results and coordination of research activities. The Council agreed that this matter should be considered by the Executive Committee and discussed at the June 1981 Meeting. Meanwhile, it was agreed as a temporary measure that the Task Force on the Larval Herring Program, the *ad hoc* Working Group on the Flemish Cap Project and the *ad hoc* Working Group on Squid Research should operate under the aegis of STACFIS.

## VII. ADJOURNMENT

The Chairman expressed his appreciation to the Canadian Government and to the scientists of the Northwest Atlantic Fisheries Center for arranging the excellent meeting facilities, to the NAFO Secretariat for their efficiency in preparing for and servicing this meeting, to the chairmen and rapporteurs of the Standing Committees and the conveners of Working Groups including the Larval Herring Task Force, and to all participants for their cooperation and contributions. The meeting adjourned at 1630 hours on 8 September 1980.

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

Chairman: G. H. Winters

Rapporteurs: Various

The Committee met at St. John's, Newfoundland, Canada, on 6 September 1980 to consider and report on matters referred to it by the Scientific Council (Part H, this volume), relating specifically to the work of the Task Force on the Georges Bank-Gulf of Maine Larval Herring Program and the *ad hoc* Working Group on the Flemish Cap Project. The Committee also reviewed a variety of scientific papers not directly relevant to stock assessment advice. It was agreed that the Task Force and Working Group reports be incorporated as part of this STACFIS report to avoid duplication in summarization of the discussions. Scientists attended from Canada, EEC (Denmark, Federal Republic of Germany, and France), Japan, USA and USSR.

## I. GEORGES BANK-GULF OF MAINE LARVAL HERRING PROGRAM

### 1. Introduction

In accordance with a June 1980 recommendation of the Scientific Council (page 67, this volume), the Task Force on the Georges Bank-Gulf of Maine Larval Herring Program was convened by Dr M. D. Grosslein (USA) on 3-4 September 1980, with Dr D. M. Ware (Canada) and Mr E. L. Dalley (Canada) as rapporteurs. Although the principal focus of the Task Force was on completion of analyses of the data from the ICNAF larval herring surveys in 1971-78, with emphasis on factors affecting the recruitment process in herring, discussions also included other relevant research. Thirteen papers were presented on various aspects of the larval herring data base, and 7 other papers related to herring recruitment in the Gulf of Maine were considered. The papers covered a wide range of studies on all life-history stages of herring, as well as inventories of the 1971-78 data base and the status of data-processing. The Task Force evaluated the new material in relation to testing hypotheses about factors controlling recruitment, and considered (i) further data analysis required, (ii) publication of data inventories and papers, and (iii) ongoing and future research related to herring recruitment. The results of the discussions are briefly summarized below and recommendations for future work are emphasized.

### 2. Review Papers and Progress Reports (SCR Doc. 80/IX/125; SCS Doc. 80/IX/30)

Because of the size and scope of the data base and the scattering of published information throughout the literature, it has been difficult to keep track of progress in analysis of the data from the larval herring program. Attention was drawn to several progress reports which provide general summaries of the status of data-processing and analysis and fairly complete bibliographies. The results of larval herring studies in the Georges Bank area, based on data from the 0.505-mm mesh Bongo net samples in 1968-77, are summarized in ICNAF Res. Doc. 79/VI/112, which has a reasonably complete bibliography on larval herring studies up to that time. Another paper (Northeast Fishery Center, Woods Hole, Lab. Ref. Doc. No. 79/60, 230 p.) contains a description of the basic sampling protocols for the ICNAF larval herring surveys and plots of the larval herring catch data (0.505-mm mesh samples) for the entire time series by individual cruises. It was noted that the report of the previous meeting (28 April-1 May 1980) of the Task Force (SCS Doc. 80/IX/30) contains a summary of the status of processing and analysis of data, together with the previously unpublished report of the workshop on larval herring studies held at Gdynia, Poland, in June 1977. The Task Force reviewed a progress report on the 1978 Georges Bank larval herring patch study (SCR Doc. 80/IX/125), which includes information on the status of data-processing and papers in progress. Finally, it was noted that a recent review paper on herring in the Georges Bank-Gulf of Maine region, containing a large bibliography (about 800 references), is available from Dr C. Sindermann, Northeast Fishery Center, Sandy Hook Laboratory, Highlands, New Jersey, 07732, USA (Tech. Series Report 23, 449 p.). STACFIS noted that the Scientific Council may wish to consider publication of this paper in one of its series.

### 3. Inventories of Larval Herring Data Base (SCR Doc. 80/IX/126, 137, 140, 141, 148)

Several papers, outlining the status and location of the available data from the 1971-78 ICNAF larval herring time series, were presented. A general inventory of all physical-chemical-biological data was prepared by MEDS (Marine Environmental Data Service, Canada), including separate station plots for each type of data from each survey (SCR Doc. 80/IX/148). More detailed, but preliminary, inventories of biological data for the ICNAF time series were presented in SCR Doc. 80/IX/140 and 80/IX/141. It was agreed that a format similar to that of the MEDS inventory would be very useful, and the Task Force convener agreed to try to complete a comprehensive biological inventory in the coming year. An inventory of physical oceanographic data from the 1978 larval herring patch study on Georges Bank was presented in SCR Doc. 80/IX/126, and a preliminary inventory of larval herring surveys of the Bay of Fundy and western Nova Scotia areas, listing 90 cruises during 1960-80, was presented in SCR Doc. 80/IX/137. In order to promote wider use of these valuable data sets, STACFIS

recommends (1)

*i) that NAFO distribute the MEDS inventory of data from the ICNAF larval herring program (SCR Doc. 80/IX/148) after a final search for some outstanding hydrographic data; and*

*ii) that MEDS explore the possibility of producing an inventory of the western Nova Scotia larval herring series in the same format as that used for the ICNAF series from the Georges Bank-Gulf of Maine region.*

4. Growth and Feeding of Larvae and Abundance of Prey (SCR Doc. 80/IX/124, 130, 131, 132, 134)

A mean growth curve was described for herring larvae (SCR Doc. 80/IX/131) from hatching to near metamorphosis, utilizing otolith increments in relation to size and age of larvae from both laboratory and field samples. Although there is some uncertainty about the rate of deposition of otolith increments for early larval stages and the variability in the age of larvae with a given number of increments, the resulting curve closely matches growth estimates derived from analysis of length frequency modes. It was noted that larval growth increments based on otoliths appear to be more precise and that otolith data may be particularly useful in detecting length specific mortality differences (e.g. Lee's phenomenon).

Dominant prey and feeding incidence of herring larvae by season and time of day were described from analysis of gut contents of more than 7,000 larvae from the Georges Bank-Gulf of Maine region in 1974-76 (SCR Doc. 80/IX/134). Morphological condition indices of larvae were also recorded. The data are considered adequate for description of the relative importance and composition of prey but not for absolute estimates of food consumption because of regurgitation. The adequacy of abundance estimates of larval herring prey in the ecosystem was evaluated from the 0.333 mm and 0.165 mm mesh Bongo net samples (SCR Doc. 80/IX/130, 132). The 0.165-mm zooplankton samples contain all but the nauplii and smallest copepodite stages of small copepod species found in the diet of larval herring and, therefore, can provide useful indices of density of larval prey for all but the smallest larvae. However, the 0.333 mm samples can only be used for estimates of prey abundance for larger larvae. Because only a small number of the 0.165-mm zooplankton samples have been analyzed, it was noted that more complete sorting would be required to evaluate seasonal and annual differences in larval prey densities. A review of literature on copepod length-weight relationships was presented (SCR Doc. 80/IX/124) and methods for estimating biomass of dominant copepods in the Georges Bank area were described.

5. Distribution of Herring Larvae and Associated Zooplankton (SCR Doc. 80/IX/133)

Partial analysis of data from a 1978 study of the vertical distribution of herring larvae off Cape Cod revealed that the larvae were widely distributed throughout the water column from near surface to bottom at 70 m (SCR Doc. 80/IX/133), a factor critical to hypotheses about larval transport by currents. There is relatively little information on vertical distribution of larvae in the Gulf of Maine region, but it is believed that such distribution may vary with area and season as well as size of larvae. Consequently, STACFIS urges that scientists publish all available data on this subject as soon as possible. Dr J. Graham agreed to summarize his findings in the western Gulf of Maine during the coming year.

STACFIS was informed that the geographic distribution of herring larvae in the entire Gulf of Maine region has been monitored on the US MARMAP surveys since 1977. The survey in the autumn of 1979 again showed no evidence of herring spawning on Georges Bank.

Dr M. D. Grosslein showed sample plots of zooplankton in the 0.333-mm mesh Bongo net samples from the ICNAF series for Georges Bank and from the US MARMAP series for the entire region from Cape Hatteras to western Nova Scotia. It was noted that these data will be useful in following major seasonal and annual shifts in zooplankton composition and abundance on Georges Bank and will help in the evaluation of feeding conditions for herring larvae, both for the ICNAF time series and in future studies.

6. Spawning of Georges Bank-Gulf of Maine Herring (SCR Doc. 80/IX/135)

Preliminary results of a study by Stefan Grimm (Sea Fisheries Institute, Gdynia, Poland) were briefly discussed. He analyzed bottom water temperatures only in those parts of Georges Bank and Nantucket Shoals where small larvae (<8 mm long) were found in an attempt to determine whether timing of spawning was related to temperature. No clear relationship emerged from the analysis, but it was noted that all major spawning sites in the area are near temperature fronts characterized by cold water, suggesting that a more comprehensive analysis of the available data on temperature and spawning times for the entire Georges Bank-Gulf of Maine region should be attempted to provide a more definitive evaluation of the role of temperature.

The size and structure of the herring spawning stocks (at 1 October) on Georges Bank and in western Gulf of Maine during the 1960's and 1970's were derived from VPA stock estimates and all available data on age-at-maturity (SCR Doc. 80/IX/135). Significant increases in growth, maturation rate and fecundity occurred with decrease in stock biomass, and these density-dependent changes were taken into account in estimating the potential annual egg production of the Georges Bank stock in 1962-77 and the Gulf of Maine stock in 1968-79. There was some question about the adequacy of the fecundity data, and

it was noted that gonad weights should be looked at to help confirm measures of absolute change in egg production potential. Also, it was noted that some further refinements in VPA estimates might be desirable (e.g. use of a vector of increasing natural mortality coefficient with age). However, the paper was considered to be a very significant contribution and should be published as soon as possible, pending a final search for all existing data on growth, maturity and fecundity in relation to population abundance. When compared with the larval production data, these data will provide a quantitative basis for evaluating major changes in egg mortality and hatching success. STACFIS noted that a similar analysis of changes in spawning stock and egg production potential for the western Nova Scotia stock would be very useful for comparison with the other two stocks.

7. Pre-recruit Abundance and Mortality Relative to Spawning Stock Size and Recruitment (SCR Doc. 123, 129, 131, 135, 139)

Analysis of larval production, growth rates and mortality rates for the 1971-77 spawning seasons in the Georges Bank-Nantucket Shoals area is presented in SCR Doc. 80/IX/129. This analysis used data from the 0.333-mm mesh Bongo net samples and incorporated corrections to mortality estimates based on the growth curve reported in SCR Doc. 80/IX/131. Ratios of egg production estimates from VPA data to estimates of numbers of larvae at hatching ranged from about 1 to 14 over the 1971-76 period, suggesting large variation in egg survival, but it is not possible to confirm this without actual estimates of egg mortality. These data indicate that larval surveys can only be expected to detect relatively large changes in herring spawning stocks with any high degree of certainty. Estimates of initial larval abundance were compared with subsequent year-class strength (recruitment at age 3), but no firm inferences could be drawn in view of the short time series due to the collapse of the herring stock on Georges Bank.

The results of a 15-year study of larval herring in an estuary and near-shore areas of the western Gulf of Maine suggested that herring larvae went through a density-dependent phase of mortality in the autumn and a density-independent phase in the winter, indicating that these factors represented major determinants of year-class survival (SCR Doc. 80/IX/123). However, changes in the temporal pattern of spawning, and the occurrence of several distinct groups of larvae late in the season in recent years, appear to have altered the relationships between larval abundance and mortality indices and subsequent recruitment. The recent appearance of late-spawned larvae in western Maine estuaries as late as January and even February may be related to the unusual dispersal of larvae from other spawning areas and warrants further careful study. No relationship was apparent between relative condition factors of larvae and subsequent recruitment. It was suggested that a simple (absolute) index of condition might provide a better basis for comparing results of different years.

Several pre-recruit abundance indices and environmental variables, considered relevant to larval dispersal, were examined in relation to year-class estimates derived from cohort analyses of the herring stock in Div. 4WX in the 1963-75 period (SCR Doc. 80/IX/139). The pre-recruit indices included the results of spring larval herring surveys in the Bay of Fundy and weir catch rates in coastal waters of New Brunswick and Nova Scotia. The weir catch rates are correlated with year-class indices, but the spring larval survey indices do not appear to be promising because the strong 1976 year-class was associated with only average larval abundance. However, a highly significant statistical relationship was found between year-class strength and two environmental variables (sea level and southwest winds). Further study is needed to clarify the possible cause-and-effect relationships between the variables and to ensure that it is not a spurious correlation. Some insight into the problem may be gained from a comparison of over-winter mortality indices for larvae of the Nova Scotia stock and environmental data.

There was general discussion on the need for detailed comparisons of the time series of data for the 3 major herring stocks in the Georges Bank-Gulf of Maine region, in terms of spawning areas and timing, growth, maturity, gonad weight, fecundity, spawning biomass, egg production potential, larval production and growth-mortality-condition indices. Such comparisons may enhance interpretation of the complex array of possible variables with a view to sorting out those which are most consistently related to recruitment. Much of the data for the Nova Scotia stock already exist in various reports, and it was agreed that a paper containing detailed analyses similar to those for the Georges Bank and western Gulf of Maine areas (SCR Doc. 80/IX/135) would greatly facilitate the comparisons. Therefore STACFIS

recommends (2)

*that significant efforts be made by Canadian scientists to prepare, for consideration at the September 1981 Meeting, a summary of changes in spawning stock size and structure, egg and larval production, and overwinter larval mortality for the western Nova Scotia herring stock during the 1960's and 1970's, for comparison with similar data now available for the Georges Bank and western Gulf of Maine stocks.*

8. Recent Oceanographic Studies on Georges Bank (SCR Doc. 80/IX/138)

Dr R. Schlitz reported briefly on estimates of mean advection on Georges Bank, noting that current meter studies since 1975 have shown strong evidence of a persistent clockwise circulation on the bank.

A closed gyre has not been confirmed, especially at the eastern part of the bank, but steady currents have been observed flowing easterly on the northern side and southwesterly on the southern side of the bank. Some drifting buoys have moved rapidly off the shelf to the southeast while others have gone southwest. Dr R. Trites noted that, while a gyre may enhance retention of larvae on the bank, larval transport did not appear to be closely related to residual currents. Also, it was noted that short-term events (e.g. storms or warm-core eddies) may be more important insofar as transport losses of larvae are concerned. Evidence of movement of shelf water from the bank, based on satellite photographs, should be examined in relation to larval density and distribution for the ICNAF data series. However, in view of the scarcity of herring larvae on Georges Bank during the 1978 patch study, further experiments at sea may be required to adequately test hypotheses about larval drift and currents and, in particular, to determine the extent to which herring larvae are passive drifters.

A two-year study of flow through the northeast channel separating Georges Bank and Browns Bank (SCR Doc. 80/IX/138) indicated a steady inflow into the Gulf of Maine in summer, large fluctuations with a net inflow in winter, and low transport in spring. These results pertain to large-scale, long-term variations in water exchange, which may influence fish recruitment through effects on plankton production.

9. Hypotheses on Recruitment Mechanisms (SCR Doc. 80/IX/142)

A proposed meta-theory for a study of herring recruitment, involving the biological nature of herring stocks and the factors determining their absolute abundance (SCR Doc. 80/IX/142), was not sufficiently elaborated at this meeting to provide a basis for critical evaluation. However, it was noted that historical shifts in spawning throughout the Gulf of Maine should be examined more carefully from the standpoint of possible insight into the role of natural factors controlling distribution and abundance.

10. Further Analyses of Existing Data

The status of additional existing data was discussed, with the objective of further evaluation of those data sets which offer the greatest potential for achieving insight into the herring recruitment process. It was noted that a great deal of recent tagging data was available and that a review and summary analysis of these data should be completed as soon as possible to clarify the possible effects on recruitment estimates of mixing between stocks. Accordingly, STACFIS

recommends (3)

*that Canadian and USA scientists review the results of the ICNAF International Herring Tagging Program and prepare a suitable summary for consideration at the September 1981 Meeting.*

It was pointed out that some additional synthesis of published data on herring stock identity would be desirable, such as parasite incidence, biochemical indices, growth patterns and meristics. STACFIS therefore

recommends (4)

*that efforts be made to summarize, for consideration at the September 1981 Meeting, all relevant data on herring stock separation for the entire Gulf of Maine region, using information on parasites, biochemical analyses, growth and meristics.*

The general point was emphasized that synthesis and publication of all available data on the herring stocks of the Gulf of Maine region would enable comparisons of the characteristics of the 3 stocks (e.g. unusually strong or weak year-classes in the same year), and thus provide some insight into migratory patterns and other characteristics which may enhance interpretation of incomplete data for the stocks in some parts of the region.

11. Need for Continuing Research

The ongoing field studies were briefly reviewed. It was noted that the monitoring of larval production and over-winter mortality was continuing for all 3 stocks to follow major changes in larval production and dispersal. Therefore, STACFIS

recommends (5)

*that the ongoing monitoring programs (US MARMAP on Georges Bank and offshore Gulf of Maine waters, State of Maine autumn and spring surveys in inshore waters, and Canadian autumn and spring surveys in the Bay of Fundy and southwest Nova Scotia areas) should be maintained, and the results reported on an annual basis to enhance the ability to follow changes in larval herring production and dispersal.*

It was agreed that the monitoring of certain biological characteristics of the stocks should be continued to expedite the study of density-dependent effects. STACFIS therefore

recommends (6)

*that maturity growth and fecundity be examined in the coming year to investigate the question of density-dependence of these factors for herring stocks of the Gulf of Maine region.*

The importance of tagging experiments for elucidating migratory patterns and stock interrelationships was emphasized, and STACFIS

reccomends (7)

*that tagging studies on the Gulf of Maine herring stocks should be continued.*

In the preparation of documents for consideration at future meetings, scientists are urged to summarize their results in as near final form as possible to expedite the development of general inferences and conclusions by the Task Force.

## II. FLEMISH CAP PROJECT

### 1. Introduction

As agreed at the June 1980 Meeting of the Scientific Council (page 69, this volume), the *ad hoc* Working Group on the Flemish Cap Project was convened by Mr R. Wells (Canada) on 5 September 1980, with Mr J. T. Anderson (Canada) as rapporteur, to evaluate the results of research activities by participants in the Flemish Cap Project. It was noted that 26 research documents, issued to date in 1980, were pertinent to the Flemish Cap region, but many of these were reviewed at the two previous meetings of STACFIS in 1980 (Parts D and E, this volume) and as working papers at the January 1980 Meeting of the *ad hoc* Working Group, and are not considered further at this time. Emphasis was placed on results presented in the following 10 papers: SCR Doc. 80/IX/127, 128, 143, 145, 150, 151, 152, 153, 154 and 157.

### 2. Historical Data Inventory (SCR Doc. 80/IX/152)

A historical data summary, comprising lists of data on hydrography, plankton, ichthyoplankton and adult fish collected since 1949 by participants in the Flemish Cap Project, was presented (SCR Doc. 80/IX/152). The usefulness of this inventory as an aid in planning and development of research priorities on Flemish Cap was emphasized. The existence of detailed historical data on adult cod and redfish was noted, including the availability of data on age and growth of cod from Canadian research vessel surveys prior to 1970. It was pointed out that historical data for cod collected by USSR would be useful in filling data gaps presently existing in the Flemish Cap time series.

### 3. Adult Fish (SCR Doc. 80/IX/143, 145)

From observations on 21 year-classes of cod produced during 1940-68 on Flemish Cap (SCR Doc. 80/IX/145), the small fluctuations in vertebral averages indicated small variation in the factors responsible for determining vertebral number during the egg and larval stages. The incidence of juvenile redfish (<10 cm long) observed in cod stomachs from Flemish Cap was low in 1978, high in 1979 and extremely low in 1980 (SCR Doc. 80/IX/143). Juvenile redfish appeared to be most abundant at 200-300 m, and the importance of monitoring the early juvenile stages was emphasized. Presently, the only index of juvenile redfish abundance being used is derived from analysis of predation by cod, and the continuation of this work was recommended. Predation by redfish on juvenile cod was also considered to be an important aspect of the study on factors affecting year-class strength, and it was noted that information on this aspect is forthcoming. A brief report of USSR investigations on Flemish Cap during the last half of 1979 and the first half of 1980 indicated that cod abundance was low and the abundance of beaked redfish was at a satisfactory level.

### 4. Ichthyoplankton (SCR Doc. 80/VI/62, 90; 80/IX/150, 153)

A study on ageing of redfish larvae from Flemish Cap by otoliths (SCR Doc. 80/IX/153) indicated daily growth increments of 0.14-0.17 mm per day for larvae of 11.0-24.5 mm in length, the larger larvae having larger daily increments. A study on distribution and abundance of cod and redfish larvae on Flemish Cap (SCR Doc. 80/IX/150) indicated a low level of cod abundance, with redfish larvae being the most abundant larvae in the 1979 ichthyoplankton samples. Abundance estimates for redfish larvae in April 1979 were virtually identical to those for April 1978 (SCR Doc. 80/VI/62). The results indicated that the spawning of redfish larvae begins in late March, mostly over the southwestern slopes of the bank. Peak spawning occurs all around the Flemish Cap in late April and early May, with maximum concentration in the area to the north of the bank. Differences in abundance estimates of redfish larvae from surveys in July 1978 and July 1979 indicate possible high mortality of larvae spawned in April 1979. It was noted that detailed analysis of USSR ichthyological research activity on Flemish Cap during the last half of 1979 and the first half of 1980 will be presented in the near future.

With regard to the identification of fish larvae, attention was drawn to the many illustrations of eggs and larvae in SCR Doc. 80/VI/90, which was endorsed as a useful reference in larval fish studies.

5. Phytoplankton and Zooplankton (SCR Doc. 80/IX/151, 154)

Analysis of chlorophyll α and primary production data collected in April-May 1979 (SCR Doc. 80/IX/154) indicated the Flemish Cap to be an area of enhanced production. Maximum production was apparent in a large area surrounding much of the bank generally over depths greater than 200 m, with low production over the central part of the bank. Preliminary studies on *Calanus finmarchicus* in 1979 (SCR Doc. 80/IX/151) indicated that early copepodite abundance was coincident with the zones of high chlorophyll α concentration.

6. Hydrography (SCR Doc. 80/IX/127, 128)

Preliminary analyses of drifting satellite-tracked buoys (SCR Doc. 80/IX/127) and moored current meter data (SCR Doc. 80/IX/128) support the hypothesis of a weak anticyclonic gyre on Flemish Cap. There was noticeable existence of a 4-day periodicity in the current pattern and indication of a strong semi-diurnal tidal signal. All six buoys placed on the Flemish Cap in 1979 drifted from the area in a southeasterly direction.

7. Future Work (SCS Doc. 80/VI/9)

STACFIS noted that detailed examination of hypotheses and study objectives was undertaken by the Working Group at its meeting in January 1980 (SCS Doc. 80/VI/9), and that further review was unnecessary at this time. It was noted that the historical time series still lacked a review of physical hydrography on Flemish Cap, and it was agreed that Mr S. Akenhead will coordinate a compilation and review of existing hydrographic data for consideration at the June 1981 Meeting. It was pointed out that full evaluation of the Flemish Cap Project required analysis of all outstanding data since the commencement of the program, and STACFIS strongly

recommends (8)

*that high priority should be placed on the analysis of all existing biological and hydrographic data, relevant to the objectives of the Flemish Cap project, for consideration at the June 1981 Meeting.*

STACFIS expressed its appreciation to Mr R. Wells, who indicated a desire to be relieved of the convenership of the Working Group, and reluctantly agreed that consideration be given to the appointment of a new convener at the June 1981 Meeting.

## III. OTHER MATTERS

1. Review of Guidelines for Cod Otolith Interpretation

STACFIS noted that Mr R. Wells had complied with a recommendation from the June 1980 Meeting in presenting a paper on the ageing of cod based on photographs of otolith sections examined at the Ageing Workshop on Cod in February 1977. It was suggested that the otoliths and photographs might be placed in the care of the Secretariat for examination by interested laboratories. STACFIS agreed that this paper should be included in the list of contributions intended for publication in the Scientific Council's Studies series. To be of maximum benefit the reproduction of the photographs should be of a quality adequate to discriminate ageing details.

2. Review of Other Relevant Papers (SCR Doc. 80/IX/118, 144, 155)

A paper on juvenile cod in eastern Newfoundland waters (SCR Doc. 80/IX/144) related abundance indices of age 0+ and 1+ cod from inshore areas surveyed during 1959-64 to estimates of numbers of ages 4 and 5 cod from cohort analysis of the stock in Div. 2J+3KL and to catches of age 3 cod in USSR small-fish trawl surveys in Div. 3K and 3L. Some positive correlations were found between the inshore abundance indices and subsequent recruitment to the fishery in the offshore areas. Some points for future surveys were noted.

A paper on size selective predation by Atlantic cod in the Newfoundland area (SCR Doc. 80/IX/155) indicated that the length range of cod preying intensively on adult capelin and sand lance is approximately 40-70 cm, the minimum length being 35 cm and the upper limit being imprecise. The intensity of predation was noted to be highly variable. Discussion centered on the possible effect of regurgitation on the results for fish caught in gillnets, and on the appropriateness of the particular stomach fullness index used.

A paper on the drift of yellowtail eggs and larvae in the Northwest Atlantic (SCR Doc. 80/IX/118), based on general water circulation patterns and ichthyoplankton surveys, indicated major spawning

localities on Grand Bank, Scotian Shelf and Georges Bank with lesser spawning on St. Pierre Bank and Browns Bank. It was noted that variation in current strength around these locations influences year-class strength of the species.

In view of the limited time available for further discussion of scientific contributions, the following papers dealing mostly with stock assessment advice were deferred for consideration at future meetings of STACFIS in 1981: SCR Doc. 80/IX/114, 115, 116, 117, 119, 120, and 122.

3. Future Meetings of STACFIS

The Committee noted the requests by coastal Contracting Parties for scientific advice on harp and hooded seals and on shrimp in Subareas 0 and 1 for 1981. It was emphasized that the earliest time when scientific advice can be provided for shrimp in Subareas 0 and 1 is mid-November 1980 and that deferrals beyond this time would be very conducive to better analyses of the accumulated data. It was also noted that mid-November would be an appropriate time to consider advice on harp and hooded seals for 1981.

With regard to the 4 stocks for which the provision of advice was deferred by the Scientific Council at its June 1980 Meeting, namely, cod in Div. 3M and 3NO and capelin in Div. 2+3K and 3LNO, STACFIS considered that mid-February 1981 would be the earliest time when scientific advice for 1981 can be provided.

4. Adjournment

The Chairman expressed his appreciation to Dr M. D. Grosslein who convened the Task Force on the Larval Herring Program, to Mr R. Wells who convened the *ad hoc* Working Group on the Flemish Cap Project, to the rapporteurs and participants for their cooperation during the meeting, and to the Secretariat for their usual efficient work.

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

Chairman: V. A. Rikhter

Rapporteur: V. M. Hodder

The Committee met at St. John's, Newfoundland, Canada, on 6 September 1980 to consider and report on matters referred to it by the Scientific Council (Part H, this volume), relating to the work of the *ad hoc* Working Group on Coordination of Squid Research and various matters deferred from the June 1980 Meeting. It was agreed that the report of the Working Group be incorporated as part of this STACREC report to avoid duplication in summarization of the discussions. Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, and France), Japan, Poland, USA and USSR.

## I. FISHERY STATISTICS

1. Proposed Format of Statistical Bulletin Table 5

In accordance with a recommendation from the June 1980 Meeting (page 66, this volume), the Secretariat surveyed the Scientific Council members concerning their preference for a new Table 5 format based on three sample listings of catch and effort data: (A) data sets sorted by division, gear, tonnage, country and main species; (B) data sets sorted by division, country, gear, tonnage and main species; and (C) data sets for each country sorted by division, gear, tonnage and main species. The results of the survey, based on 15 replies from Bulgaria, Canada, Cuba, Denmark, France, Federal Republic of Germany, Japan, Poland, UK, USSR and USA indicated that 27% preferred (A), 54% prefereed (B), and only 20% preferred (C). STACREC therefore

recommends (9)

*that the Secretariat use format (B), with the data sets sorted by division, country, gear, tonnage and main species (see Annex 1), in the first NAFO Statistical Bulletin as the replacement for Table 5 format in the ICNAF Statistical Bulletin.*

2. Proposed Revision to Country Abbreviations (SCS Doc. 80/IX/29)

The Committee noted that the CWP, at its Tenth Session in July 1980 (FAO Fish. Rept. No. 242), recommended that regional organizations producing statistical bulletins should, for uniformity, adopt a standard set of abbreviations for countries and proposed that the ISO (International Organization of Standards) list be used (ISO 3166, Second Edition, 1980). The country abbreviations currently relevant to the NAFO Area are as follows:

| Country name | Proposed abbreviation |
|---|---|
| Bulgaria | BGR |
| Canada (Maritimes) | CAN-M |
| Canada (Quebec) | CAN-Q |
| Canada (Newfoundland) | CAN-N |
| Cuba | CUB |
| Denmark | DNK |
| Faroe Islands | FRO |
| France | FRA |
| German Democratic Republic | DDR |
| Germany, Federal Republic of | DEU |
| Greenland | GRL |
| Iceland | ISL |
| Ireland | IRL |
| Italy | ITA |
| Japan | JPN |
| Norway | NOR |
| Poland | POL |
| Portugal | PRT |
| Romania | ROM |
| St. Pierre and Miquelon | SPM |
| Spain | ESP |
| Union of Soviet Socialist Republics | SUN |
| United Kingdom | GBR |
| United States of America | USA |

It was noted that the recent changes in the status of some country components (e.g. St. Pierre and Miquelon) may necessitate changes in the abbreviations to be used, and that the Secretariat should obtain confirmation regarding use of the abbreviations. STACREC accordingly

recommends (10)

*that the Secretariat, in all future statistical tabulations, where space is limited, use the ISO list of standard country abbreviations, subject to confirmation by the states concerned.*

3. Classification of Fishing Gear for Statistical Purposes (SCS Doc. 80/IX/29)

The Committee noted that the CWP had made some amendments to the International Standard Statistical Classification of Fishing Gear (ISSCFG) but that none of the revisions affected those currently used by NAFO. The Committee agreed that this matter be considered at its June 1981 Meeting.

4. Allocation of Catches by Nationality (SCS Doc. 80/IX/29)

The Committee noted the recommendation of the CWP regarding the principle of allocation of catches by nationality for fishing statistics accruing from cooperative arrangements between coastal states and other countries, and agreed that this matter be considered at its June 1981 Meeting when the complete report of the CWP would be available.

5. Future of the CWP (SCS Doc. 80/IX/29)

The Committee was informed by the Chairman of the CWP's Tenth Session (Dr W. G. Doubleday) that a reorganization of the structure of the CWP as a truly inter-agency body of experts was proposed and that the new terms of reference for the future inter-agency organization had been developed (see Annex 2). It was pointed out that the new CWP would come into effect upon ratification of the term of reference by four of the participating organizations. STACREC accordingly

recommends (11)

*that the Scientific Council agree to the terms of reference for the Future Structure of the CWP, as set out in Annex 2.*

6. Deterioration in National Reporting of Fishery Statistics (SCS Doc. 80/IX/27)

The Committee noted that the Secretariat had produced the advance release of annual nominal catches in 1979 (SCS Doc. 80/IX/27) about a month after the June 1980 Meeting. Normally, this document should be issued in advance of or at the time of the June Meeting, based on the submission of STATLANT 21A statistics with a deadline of 15 April. The Committee also noted that STATLANT 21B reports (detailed catch and effort data) of several countries were still outstanding despite the 30 June deadline. These data are urgently required so that the Secretariat can proceed with the production of NAFO Statistical Bulletin, Vol. 29 for 1979. STACREC

recommends (12)

*that the Scientific Council transmit to the Contracting Parties of NAFO, through the General Council, its concern about the deterioration in national reporting of fishery statistics through the STATLANT system, particularly with regard to the STATLANT 21B returns which provide the basis for the Statistical Bulletin and much of the assessment work.*

This matter was brought to the attention of the General Council in GC Doc. 80/IX/11.

## II. BIOLOGICAL SURVEYS

1. Review of Proposed Manual on Groundfish Surveys (SCS Doc. 80/IX/31)

In presenting the revised draft of the groundfish surveys manual, Dr W. G. Doubleday, as Editor, informed the Committee that he was unable to finalize the draft due to the lack of response to the Council's request at the June 1980 Meeting that member countries provide the Editor by 30 July 1980 with a list of survey manuals now existing in laboratories of member countries, a brief description of the history of groundfish surveys carried out in the Northwest Atlantic, and a description of methods on intercalibrating survey abundance indices with cohort analysis for estimating catchability at age. The Editor indicated that some information on these topics might be obtained from the papers to be presented at a Canadian workshop on surveys in November 1980.

In brief discussion on certain sections of the proposed manual, it was pointed out that a better rationale for choosing stratified-random surveys over the traditional fixed-station surveys might be

required, as the former may not be the best method in all cases. Some flexibility in station-selection procedures within strata might be needed, because the percentage of trawlable bottom decreases greatly from south to north. In view of the limited time available for further discussion, STACREC

recommends (13)

*that the Editor contact appropriate scientists in the various laboratories requesting comments for improving the draft manual on groundfish surveys, and, taking into consideration any relevant information from the Canadian workshop on surveys to be held in November 1980, prepare a revised draft for further consideration at the June 1981 Meeting of the Committee.*

It was agreed that the revised draft should be submitted to the Secretariat for distribution well in advance of the June 1981 Meeting.

## III. COORDINATION OF SQUID RESEARCH

### 1. Introduction

In accordance with a recommendation of the Scientific Council (page 68, this volume), the *ad hoc* Working Group on Coordination of Squid Research was convened by T. W. Rowell (Canada) on 2 September 1980 to consider final vessel availability and program planning relative to surveys for larval and juvenile *Illex illecebrosus* in early 1981. Scientists attended from Canada (T. Amaratunga, E. G. Dawe, R. K. Mohn, T. W. Rowell, H. J. Squires, R. W. Trites, D. Waldron, D. M. Ware), EEC (J. P. Minet, France), Japan (H. Hatanaka), USSR (V. A. Rikhter, G. V. Goussev), and USA (V. C. Anthony, M. D. Grosslein). As the basis for discussion, the Group considered the following items: (i) background information, (ii) development of hypotheses and research objectives, (iii) definition of biological and oceanographic research components, (iv) definition of availability of vessels, specialized gear, and scientific personnel, and (v) development of a cooperative research proposal for 1981, involving studies to be conducted, periods and areas of study, national involvements, data collection and analysis responsibilities, and coordination of research review and reporting mechanisms.

### 2. Background Information

Previously reported information on the distribution, migration and life cycle of *Illex illecebrosus* indicated the following:

a) *Illex* are widely distributed in the Northwest Atlantic, their distribution on the continental shelf being limited to the warmest period of the year. During their residency on the continental shelf, they range from late juvenile to maturing adult stages.

b) *Illex* occuring on the Scotian Shelf and in more northern waters are believed to live approximately one year, starting from a single protracted spawning period in late winter.

c) Spawning areas of *Illex* are presumed to be in waters beyond the continental shelf, with the possibilities of demersal and pelagic spawning being noted. Since the buoyancy of egg masses is unknown, it is impossible to infer vertical distribution.

d) Rhynchoteuthion larvae transform into the juvenile form at a mantle length of about 6 mm, and large numbers of this stage and larger juveniles were found in slope water bordering the Gulf Stream during the Canada-USSR surveys by the *R/V Belogorsk* in February-May 1979.

These observations brought to focus the possible effects of environmental conditions on the distribution of larvae and juveniles. It was noted that, since the slope and Gulf Stream water masses are highly mobile, they were important in the rapid transport of larvae and juveniles. It was also noted that warm-core eddies, which commonly exist for 4-6 months with their vertical influence extending to depths exceeding 300 m, may play a role in larval and juvenile distribution. The present information indicates that larvae and juveniles are associated with the slope water bordering the northwestern edge of the Gulf Stream. It was suggested that Gulf Stream and Sargasso Sea waters should also be sampled in future surveys.

### 3. Hypotheses

In view of the dynamics of the water masses, it was realized that many factors could influence the distribution and abundance of *Illex* larvae and juveniles. Consequently, several hypotheses were generated regarding possible spawning locations and distribution of larvae and juveniles, based on the behavior of these water masses and the known biology of *Illex*.

a) Adults move to the edge of the continental shelf and spawn demersally in deep water. Larvae are transported at depth or undergo vertical migration and are then transported in near-surface layers to the northwestern border of the Gulf Stream. Juveniles later migrate to the continental shelf.

b) Adults move offshore to spawn pelagically near the northwestern border of the Gulf Stream. Larvae remain in the region and juveniles migrate to the continental shelf at unknown depths.

c) Adults move offshore through or under the Gulf Stream and spawn in the Sargasso Sea. Larvae and juveniles move shoreward through or under the Gulf Stream or by warm-core eddy transport, with the juveniles eventually reaching the continental shelf.

d) Adults move offshore to spawn pelagically in the Gulf Stream, with subsequent migration of juveniles to the continental shelf.

e) Adults move to deep water at the edge of the continental shelf in Subareas 5 and 6 and spawn demersally. Larvae move outward to the northwestern edge of the Gulf Stream either at depth or in the surface layers. A portion of the larvae and juveniles are transported northward to areas bordering the Scotian Shelf and Grand Bank from which they migrate shoreward.

4. Research Objectives

Discussion centered on the basic research requirements necessary for better long-term management of the squid resource, and two primary objectives were emphasized:

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

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

Since the factors associated with spawning and the distribution of larvae and juveniles are poorly understood, it was agreed that empahsis should be placed on surveys aimed at realization of the first objective noted above. The detailed proposal, developed by the Working Group for research in early 1981, is given in Annex 3. Although the proposal is limited to studies in 1981, continuation of similar research in subsequent years will be necessary in order to achieve the established objectives.

5. Data Collection, Analysis and Review

Because the data being collected will be shared by the various participants in the program, it is necessary to establish protocols to ensure compatibility. While data collection formats will be standardized, it was agreed that data analyses will be the responsibility of participating scientists. Although the research proposal relates specifically to 1981, there is a commitment, in principle, on the part of participating countries to continue research according to the established objectives beyond 1981. However, finer definition of research requirements for 1982 and subsequent years is dependent on an early review of the results of the 1981 program. To facilitate this, it is considered essential that a full exchange of data and a preliminary discussion of results take place immediately after the completion of the 1981 surveys. STACREC therefore

recommends (14)

*i) that the 3-day special session on "squid biology and distribution", planned for the June 1981 Meeting, be extended by one day to facilitate preliminary consideration of the results of the 1981 squid surveys; and*

*ii) that participating countries should ensure that scientists involved in the program be available to attend this meeting.*

The Committee agreed that a more complete review of the results of the 1981 surveys and the development of the program for 1982 should be undertaken later in 1981, possibly at the time of the September 1981 Meeting of the Scientific Council.

## IV. ENVIRONMENTAL STUDIES

1. MEDS Progress Report for 1979

The Committee noted that consideration of this item was deferred from the June 1980 Meeting because MEDS was unable to complete its report for presentation at that time. Highlights of the information in the progress report for 1979 (SCR Doc. 80/IX/149) are given below.

a) Inventory of reported data collections in 1979

The Committee noted that the Marine Environmental Data Service has been active in acquiring,

processing and archiving oceanographic data collected in the NAFO Area in 1979. Inventory forms listing data collections were received from Denmark, Poland, Federal Republic of Germany and USSR. Information on other data collections were found in national research reports, Canadian cruise reports and through personal communications. A list of data collections, reported for 1979 but not yet received by MEDS, is given in SCR Doc. 80/IX/149 (table 1), indicating that data for more than 3,100 stations in 1979 are still outstanding.

b) Data received and processed for 1979

An inventory of oceanographic data received and processed for 1979 is given in SCR Doc. 80/IX/149 (table 2). The data for 114 cruises comprise 3,031 hydrographic stations and 4,543 BT stations. The bulk of these data were collected by Canadian vessels, but data for about 1,000 hydrographic stations were received from USSR. If the information noted in (a) above represents the bulk of the outstanding data, it is apparent that MEDS has received about 70% of the data collected in the NAFO Area in 1979, compared with less than 30% of the 1978 data reported by MEDS at the June 1979 Meeting (ICNAF Res. Doc. 79/VI/118).

c) Acquisition of 1978 data

In *ICNAF Redbook* 1979 (page 103), there is a listing of data reported as being collected in 1978 but not received by MEDS up to June 1979. A review of MEDS holdings for 1978 indicates that only the Danish data have been processed since June 1979, although a small quantity of outstanding 1978 data was in hand but not fully processed. It appears that some of the national representatives are not being prompt in submitting their data to MEDS, and that this lack of promptness in preparing the data for submission within a reasonable period after the end of each cruise makes the historical data more difficult to acquire.

d) Progress in acquiring historical data

In its report to the 1979 Annual Meeting (ICNAF Res. Doc. 79/VI/118, table 4), MEDS listed known historical data collections in 1959 to 1977 not yet in its files. Since then, data from cruises by *Knipovich* in May 1962, *Persius III* in October-December 1972 and June-September 1973, and *Protsion* in April-June 1973 (about 1,000 stations) have been received. USSR scientists reported at this meeting that data from cruises of *Protsion, Persius III, Ayaks* and *Odyssey* in 1975 (see *ICNAF Redbook* 1979, page 105) have recently been dispatched to the NAFO Secretariat. However, data for about 70 cruises remain outstanding.

Considerable progress was reported by USSR in compiling and submitting outstanding data to World Data Center B, but the major task of unifying the data format is very time-consuming and it is difficult to forecast when the job would be completed. In situations where data are being routed to MEDS via other data centers, it was agreed that the national representatives will, at the time of submission to their data center, dispatch a letter to MEDS or the NAFO Secretariat indicating this action. The letter of information should contain the cruise number, name of vessel, dates of cruise, and type of data. This will enable MEDS to acquire the data quickly, since experience has shown that the world data centers can best provide data in response to specific requests.

The Committee noted the need to have the MEDS data base as complete as possible prior to the special session on "Environmental Conditions in the Northwest Atlantic during the 1970-79 Decade", scheduled for September 1981, in order that the best possible analysis can be undertaken. Consequently, it was agreed that, in the preparation of outstanding data sets for submission, highest priority be given to data for standard sections as far as possible in the past, and that second highest priority be given to ensuring that the 1970-79 data base is as complete as possible.

e) The Flemish Cap Project and IGOSS

The Committee noted that the data products discussed at the June 1979 Meeting (*ICNAF Redbook* 1979, page 105) have been compiled by J. Gagnon in a paper entitled "Real-time oceanographic data transmitted during the 1979 Flemish Cap international experiment" (SCR Doc. 80/IX/157). This document displays cruise tracks in microfiche and lists the messages received from the cruises.

2. Environmental Conditions in the NAFO Area in 1979

The Committee noted that MEDS has again attempted to provide a summary of environmental conditions in 1979. The late receipt of some data and the absence of others for 1979 has hampered the work of MEDS in being able to provide fuller coverage of the area. The following highlights are based on data available for the 9 sections listed in Table 1. Machine-contoured diagrams of these sections are given in appendix B of SCR Doc. 80/IX/149.

a) Subarea 1

The data for one Fyllas Bank section received by MEDS for 1979 has not yet been fully processed.

Table 1. Standard sections sampled in 1979.

| Section | Dates | MEDS ID | SCR Doc. 80/IX/149 Track | Figure |
|---|---|---|---|---|
| Seal Island | Aug 4-5 | 180579007 | 24 | B1-3 |
| | Nov 1-2 | 90SU79003 | 41 | B4-6 |
| | " 2-3 | 90SU79003 | 41 | B7-9 |
| | " 23-24 | 180579012 | 29 | B10-12 |
| White Bay | May 23-24 | 90GE79017 | 37 | B13-15 |
| | Aug 6-7 | 180579007 | 24 | B16-18 |
| N. Bonavista | May 21-22 | 90GE79017 | 37 | B19-21 |
| | Jul 31-Aug 1 | 180579007 | 24 | B22-24 |
| W. Bonavista | May 26-27 | 90GE79017 | 37 | B25-27 |
| E. Bonavista | May 19-21 | 90GE79017 | 37 | B28-30 |
| USSR-7A | Apr 30 | 180579020 | 31 | B31-33 |
| | Aug 8-9 | 180579007 | 24 | B34-36 |
| Flemish Cap | Mar 16-19 | 180579019 | 30 | B37 |
| | Apr 21-22 | 180579020 | 31 | B38 |
| | May 3-5 | 180579021 | 32 | B39 |
| | May 27-Jun 2 | 90GE79017 | 37 | B40-42 |
| | Jul 27-30 | 180579007 | 24 | B43-45 |
| SW Grand Bank | Aug 10-11 | 90GE79017 | 37 | B46-48 |
| USCG-3 | Apr 21-25 | 90GE79017 | 37 | B49-51 |
| | Aug 12-13 | 180579007 | 24 | B52-54 |

b) Subarea 2

Seal Island. This section was occupied four times in 1979. There was a slightly larger volume of cold water (<-1°C) than the average conditions reported by Templeman in ICNAF Special Publication No. 10 (pages 17-31). In contrast to the average, this cold water was not continuous across the shelf in 1979, but otherwise temperature conditions were not substantially different from the average. The November data for this section in 1979 can only be compared with data for 1978. There appears to be little difference apart from the presence of more water colder than 0°C in 1979. Data for this section, occupied about a day apart in early November 1979, show substantial changes in the colder water, thus indicating considerable short-term variability.

c) Subarea 3

White Bay. This section was sampled in May 1979, but there are no published data collected in May of previous years for comparison. The section was sampled at about the same time in August of 1978 and 1979, but no striking differences are apparent between the two years.

USSR-7A. This section is not a standard NAFO section, but it was sampled twice in 1979 and frequently in previous years. Although considerable data exist for comparisons, neither Templeman nor the MEDS report of last year presents or discusses data from this section.

W. Bonavista. This section was sampled in May 1979, whereas in 1978 it was sampled in August. The strong stratification observed in the August section is not apparent in the May section.

E. Bonavista. In May 1979, water from the inshore branch of the Labrador Current is evident at about 100 m on the shelf. The warm water present at about 200 m in 1978 was absent in 1979.

N. Bonavista. This section was sampled in May 1979 but there are no other published data for this period. The inshore branch of the Labrador current is clearly visible at about 100 m on the shelf. Data for this section in August 1979 indicate no striking departures from the average conditions reported by Templeman or from those in 1978, except for slightly cooler than average surface conditions.

Flemish Cap. This section was sampled on five occasions in 1979 but no historical data for four of the sections sampled in March to May are available for comparison. Data for the section in late July indicate temperature conditions on the Grand Bank similar to the average conditions reported by Templeman, but bottom temperatures on Flemish Cap in 1979 were about 0.5°C higher than average and also higher than those in 1978.

USCG-3. This section was sampled in April and August 1979 but only the August sample can be compared with historical data. Very little difference can be seen except that the colder water on the shelf slope does not penetrate as deeply in 1979 as shown by Templeman.

SW Grand Bank. Bottom temperatures in August 1979 were about 1°C higher than in 1978, but surface temperatures appear to have been about the same in both years.

3. National Representatives Responsible for Data Exchange

The Committee was informed of two changes in the list of national representatives responsible for reporting to MEDS the oceanographic data collected within the Northwest Atlantic. The updated 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 (F. Nagasaki), Norway (R. Leinebo), Poland (S. Grimm), USSR (V. Ponomorenko), UK (P. Edwards), and USA (R. Ochinero).

The Committee noted that oceanographic activity by the various countries conducting research in the NAFO Area was sustained in 1979, but that MEDS continues to have some difficulties in fulfilling its role as a regional data center. It is clear that data collected in past years have not all been submitted to MEDS, although some improvement was noted between 1978 and 1979. The Committee noted that MEDS has continued to increase its awareness of oceanographic collections in order to determine the completeness of its files, and again urges that the national representatives forward to MEDS (or the NAFO Secretariat) data inventories and the actual data as promptly as possible after the termination of each cruise.

4. Other Relevant Papers

Oceanographic results presented in SCR Doc. 80/IX/121 and 136 will be considered at the June 1981 meeting of the Committee.

## V. OTHER MATTERS

1. Future Meetings of STACREC

The Committee noted that its next meeting would probably be in June 1981, when major items for consideration include the report of the 10th Session of the CWP, the revised draft of the groundfish surveys manual, and the MEDS progress report for 1980.

2. Adjournment

The Chairman expressed his appreciation to Mr T. Rowell and members of his working group for their comprehensive report on coordination of squid research during the first half of 1981, to Dr R. Trites who kindly agreed on short notice to preside during consideration of the MEDS progress report for 1979, to Dr W. G. Doubleday as editor of the groundfish survey manual for preparing and introducing an almost-complete revised draft. He thanked the rapporteur and all participants for their cooperation during the meeting and the Secretariat for their usual efficient work.

## ANNEX 1. FORMAT OF NEW TABLE 5 FOR NAFO STATISTICAL BULLETIN (SAMPLE B)

| DIV | COUNTRY | GEAR | TON | MSP | SPECIES | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | NK | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | FAROES | OTB | 4 | PAN | N PRAWN | - | - | - | - | - | - | - | - | - | 8 | - | - | - | 8 |
| | | | | | TOTAL | - | - | - | - | - | - | - | - | - | 8 | - | - | - | 8 |
| | | | | | A. HOURS FISHED. | - | - | - | - | - | - | - | - | - | 83 | - | - | - | 83 |
| 1A | DEN-G | OTB2 | 3 | PAN | N PRAWN | - | - | - | - | 8 | - | - | 1 | 1 | - | - | - | - | 10 |
| | | | | | TOTAL | - | - | - | - | 8 | - | - | 1 | 1 | - | - | - | - | 10 |
| | | | | | A. HOURS FISHED | - | - | - | - | 21 | - | - | 3 | 4 | - | - | - | - | 28 |
| | | | | | B. DAYS FISHED | - | - | - | - | 2 | - | - | 1 | 2 | - | - | - | - | 5 |
| 1A | DEN-G | OTB2 | 4 | PAN | N PRAWN | - | - | - | - | - | - | - | - | 2 | - | - | 9 | - | 11 |
| | | | | | TOTAL | - | - | - | - | - | - | - | - | 2 | - | - | 9 | - | 11 |
| | | | | | A. HOURS FISHED | - | - | - | - | - | - | - | - | 46 | - | - | 27 | - | 73 |
| | | | | | B. DAYS FISHED | - | - | - | - | - | - | - | - | 6 | - | - | 3 | - | 9 |
| 1A | DEN-G | OTB2 | 5 | PAN | N PRAWN | - | - | - | - | - | - | - | 2 | - | - | - | 42 | - | 44 |
| | | | | | TOTAL | - | - | - | - | - | - | - | 2 | - | - | - | 42 | - | 44 |
| | | | | | A. HOURS FISHED | - | - | - | - | - | - | - | 10 | - | - | - | 100 | - | 110 |
| | | | | | B. DAYS FISHED | - | - | - | - | - | - | - | 1 | - | - | - | 10 | - | 11 |
| 1A | DEN-G | NK | 2 | MIX | COD | - | 3 | 6 | 1 | 1 | 6 | 116 | 117 | 39 | 43 | 16 | - | - | 348 |
| | | | | | G HALIBUT | 128 | 385 | 329 | 239 | 263 | 660 | 783 | 437 | 312 | 120 | 56 | 83 | - | 3795 |
| | | | | | A HALIBUT | - | - | - | - | - | - | 4 | 3 | 2 | - | - | - | - | 9 |
| | | | | | G COD | 4 | 15 | 37 | 36 | 10 | 25 | 101 | 158 | 189 | 29 | 16 | 1 | - | 621 |
| | | | | | R GRENADIER | - | 2 | 6 | 8 | 6 | 3 | 4 | 2 | 1 | - | - | - | - | 32 |
| | | | | | WOLFFISHES | - | - | 1 | 4 | 1 | 1 | 62 | 143 | 185 | 56 | 7 | - | - | 460 |
| | | | | | A SALMON | - | - | - | - | - | - | - | 20 | 17 | 3 | 1 | - | 40 | 81 |
| | | | | | CAPELIN | - | - | - | - | - | 31 | 17 | - | - | - | - | - | - | 48 |
| | | | | | CHARS(NS) | - | - | - | - | - | - | - | 1 | - | - | - | - | - | 1 |
| | | | | | N PRAWN | 180 | 244 | 72 | 265 | 923 | 1067 | 1224 | 507 | 823 | 536 | 300 | 283 | 645 | 7069 |
| | | | | | TOTAL | 312 | 649 | 451 | 553 | 1204 | 1793 | 2311 | 1388 | 1568 | 787 | 396 | 367 | 685 | 12464 |
| 1A | DEN-M | OTB2 | 3 | PAN | N PRAWN | - | - | - | - | - | - | - | 10 | - | - | - | - | - | 10 |
| | | | | | TOTAL | - | - | - | - | - | - | - | 10 | - | - | - | - | - | 10 |
| 1A | DEN-M | OTB2 | 4 | PAN | N PRAWN | - | - | - | - | - | - | 65 | 12 | - | - | - | - | - | 77 |
| | | | | | TOTAL | - | - | - | - | - | - | 65 | 12 | - | - | - | - | - | 77 |
| 1A | DEN-M | OTB2 | 5 | PAN | N PRAWN | - | - | - | - | - | - | 134 | 24 | - | - | - | - | - | 158 |
| | | | | | TOTAL | - | - | - | - | - | - | 134 | 24 | - | - | - | - | - | 158 |
| 1A | FRA-M | OTB2 | 6 | PAN | N PRAWN | - | - | - | - | - | - | - | - | - | 34 | 33 | - | - | 67 |
| | | | | | TOTAL | - | - | - | - | - | - | - | - | - | 34 | 33 | - | - | 67 |
| | | | | | B. DAYS FISHED | - | - | - | - | - | - | - | - | - | 7 | 8 | - | - | 15 |
| | | | | | C. DAYS GROUNDS | - | - | - | - | - | - | - | - | - | 8 | 8 | - | - | 16 |
| 1B | FAROES | OTB | 4 | PAN | N PRAWN | 569 | 437 | 751 | 718 | 1938 | 821 | 274 | 278 | 183 | 154 | 492 | 366 | - | 6981 |
| | | | | | TOTAL | 569 | 437 | 751 | 718 | 1938 | 821 | 274 | 278 | 183 | 154 | 492 | 366 | - | 6981 |
| | | | | | A. HOURS FISHED | 3246 | 2496 | 1654 | 2436 | 5885 | 4310 | 1154 | 772 | 1051 | 1406 | 3414 | 2811 | - | 30635 |
| 1B | DEN-G | OTB2 | 3 | PAN | N PRAWN | 24 | 37 | 1 | 52 | 45 | 63 | 67 | 57 | 51 | 27 | - | - | - | 424 |
| | | | | | TOTAL | 24 | 37 | 1 | 52 | 45 | 63 | 67 | 57 | 51 | 27 | - | - | - | 424 |
| | | | | | A. HOURS FISHED | 142 | 110 | 6 | 152 | 158 | 337 | 286 | 257 | 207 | 246 | - | - | - | 1901 |
| | | | | | B. DAYS FISHED | 10 | 13 | 1 | 14 | 16 | 21 | 21 | 20 | 17 | 20 | - | - | - | 153 |
| 1B | DEN-G | OTB2 | 4 | PAN | N PRAWN | - | - | - | - | - | - | 49 | 78 | 67 | 53 | 78 | 85 | - | 410 |
| | | | | | TOTAL | - | - | - | - | - | - | 49 | 78 | 67 | 53 | 78 | 85 | - | 410 |
| | | | | | A. HOURS FISHED | - | - | - | - | - | - | 106 | 212 | 128 | 167 | 391 | 244 | - | 1248 |
| | | | | | B. DAYS FISHED | - | - | - | - | - | - | 9 | 15 | 9 | 12 | 25 | 16 | - | 86 |
| 1B | DEN-G | OTB2 | 5 | CAT | COD | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 |
| | | | | | G COD | - | - | - | - | - | - | - | - | - | - | 70 | - | - | 70 |
| | | | | | WOLFFISHES | - | - | - | - | - | - | - | - | - | - | 48 | - | - | 48 |
| | | | | | TOTAL | - | - | - | - | - | - | - | - | - | - | 119 | - | - | 119 |
| | | | | | A. HOURS FISHED | - | - | - | - | - | - | - | - | - | - | 69 | - | - | 69 |
| | | | | | B. DAYS FISHED | - | - | - | - | - | - | - | - | - | - | 5 | - | - | 5 |
| 1B | DEN-G | OTB2 | 5 | PAN | COD | - | - | - | - | - | - | - | - | - | 1 | - | - | - | 1 |
| | | | | | REDFISHES | - | - | - | 1 | - | - | - | - | - | - | 1 | - | - | 2 |
| | | | | | G COD | - | - | - | - | - | - | - | - | - | 1 | 2 | - | - | 3 |
| | | | | | WOLFFISHES | - | - | - | - | 1 | - | - | - | - | 1 | 5 | 1 | - | 8 |
| | | | | | N PRAWN | 78 | - | - | 7 | 645 | 738 | 641 | 630 | 456 | 364 | 360 | 266 | - | 4185 |
| | | | | | TOTAL | 78 | - | - | 8 | 646 | 738 | 641 | 630 | 456 | 367 | 368 | 267 | - | 4199 |
| | | | | | A. HOURS FISHED | 233 | - | - | 13 | 948 | 1209 | 1226 | 1326 | 894 | 1282 | 1199 | 626 | - | 8956 |
| | | | | | B. DAYS FISHED | 15 | - | - | 3 | 67 | 76 | 75 | 82 | 55 | 80 | 67 | 42 | - | 562 |

# ANNEX 2. FUTURE STRUCTURE OF THE CWP[1]

1. Name

The group shall be known as the Coordinating Working Party on Atlantic Fishery Statistics (CWP).

2. Membership

The membership of the CWP shall be the following:

a) Food and Agriculture Organization of the United Nations (FAO)

b) International Commission for the Conservation of Atlantic Tunas (ICCAT)

c) International Council for the Exploration of the Sea (ICES)

d) International Commission for the Southeast Atlantic Fisheries (ICSEAF)

e) Northwest Atlantic Fisheries Organization (NAFO)

f) Commission for the Conservation of Antarctic Living Marine Resources (CCALMR)

g) Statistical Office of the European Communities (EUROSTAT)

h) Organization for Economic Cooperation and Development (OECD)

3. Representation

a) Each of ICCAT, ICES, ICSEAF, NAFO and CCALMR may nominate up to three participants, one of whom must be a member of the secretariat, one should be the chairman (or a designated member) of the appropriate statistics committee of the agency, and one may be a participant of a member state of the agency.

b) EUROSTAT and OECD may each be represented by one person. In the event that no participant of the member states of the European Economic Communities is included in the nominations of ICCAT, ICES, ICSEAF, NAFO and CCALMR, EUROSTAT may nominate a national participant, in addition to the participant from the Statistical Office.

c) FAO may nominate up to five participants to ensure representation of FAO itself and those inter-governmental agencies related to Atlantic fisheries under the aegis of FAO (e.g. GFCM, CARPAS, WECAF and CECAF).

d) The total number of participants in sessions of the CWP shall normally be limited to 25.

e) Each agency shall normally inform the Secretary of the CWP of the names and addresses of its nominees at least six months in advance of each session.

4. Meetings

a) Sessions of the CWP shall normally be held every two years, at times and places to be agreed by the secretariats of the participating agencies.

b) *Ad hoc* inter-agency consultation shall be held approximately one year before each session to draw up a provisional agenda and coordinate plans and participation for the session. This consultation may be by correspondence initiated by the CWP or may be a meeting.

5. CWP Secretariat

The CWP Secretariat should preferably be provided by FIDI of FAO, Rome. Should it become necessary to alter this arrangement, secretariat services for the CWP should alternate among those participating agencies with adequate resources to undertake the task.

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[1] Extract from Report of the Tenth Session of the Coordinating Working Party on Atlantic Fishery Statistics, Madrid, Spain, 22-29 July 1980 (FAO Fish. Rept. No. 242).

6. Officers

At the beginning of the session, the CWP Secretary shall call the meeting to order. In the absence of the CWP Secretary, the host agency will open the session. The participants shall from among their members elect a chairperson and vice-chairperson, who shall hold the offices for the duration of the session.

7. Documentation

Documents for each session should, if possible, be distributed to all nominated participants at least two months before the start of each session. However, documents prepared by one agency that may require the secretariat of another agency to consult with its statistics committee before a decision can be taken should be distributed at least four months before the start of the session. Each agency shall be responsible for the timely distribution of its documentation in accordance with the mailing list of participants supplied by the CWP Secretary.

8. Report

The CWP Secretary, in collaboration with the chairperson, shall, within three months of the end of the session, prepare for publication and distribute the adopted English version of the report with all relevant appendices as follows:

a) One copy to each participant in the session.

b) The number of copies specified by each participating agency before the end of the session.

French and Spanish versions of the report may be prepared by FAO, in consultation with other agencies requiring such versions, and distributed upon request in sufficient copies to meet the needs of the various agencies.

9. Effective Date

These terms of reference will come into force on approval by at least four member agencies.

# ANNEX 3. PROPOSAL FOR COORDINATED SQUID RESEARCH IN 1981

## INTRODUCTION

Based principally on the experience of the Canadian-USSR work on the *R/V Belogorsk* in 1979, it is proposed that more intensive efforts be made to locate spawning *Illex* and determine the distribution of larvae and juveniles as an essential requirement for the future management of the *Illex* resource. Because of the complex nature of the water masses, more intensive sampling is required than in earlier studies. Also, it was suggested that spawning may occur in waters more seaward than have been previously studied.

## OBJECTIVE

The primary objective is to elaborate that portion of the life cycle of *Illex* from maturity and spawning through larval and juvenile stages to recruitment, with emphasis on (a) timing and location of spawning and its possible relationship to physical and biological properties, and (b) larval and juvenile distribution and abundance in relation to these same factors.

## PROPOSED PROJECT

The project will involve two phases, an initial phase concentrated within selected geographical areas traversing the coastal-slope-Gulf Stream-Sargasso Sea water complex, and a second phase involving wide-ranging distribution and abundance studies. During the initial phase, two Canadian vessels are committed to participation and it is highly probable that one USSR vessel will also participate. For the second phase, one Canadian vessel is committed, a USSR vessel is highly probable, and a Japanese vessel may become available. In this proposal emphasis is placed on the initial phase which is timed to find spawning adults as well as the larval and early juvenile stages.

### 1. Phase I

The survey design of phase I involves two operational modes: (i) an initial exploratory mode (low resolution transects) extending through the coastal-slope-Gulf Stream-Sargasso Sea water complex to provide preliminary data on water masses and *Illex* distribution, and (ii) a scientific definition mode (high resolution transects) extending through this water mass complex with finer definition of distributional determinants.

#### a) Vessels

Vessel availability and timing of participation in phase I are as follows:

| Country | Vessel | Time of Participation |
|---|---|---|
| Canada | *A. T. Cameron* | January 16 to February 16 |
| Canada | *Cadus Atlantica* | February 20 to March 1 (approx.) |
| USSR | Argus class | February and March |

Although the USA cannot commit vessels to the project, it is possible that MARMAP transects may be extended to the water masses associated with this research, particularly in the area of Georges Bank. USA scientists also indicated the possible availability of personnel to assist in the research.

#### b) Area of operation (transects)

Sampling will be conducted along transects commencing in coastal waters and extending to Sargasso Sea waters. The Canadian vessels will follow transects within Subareas 3 and 4, and the USSR vessel will, if possible, carry out a parallel study in Subareas 5 and 6 during the same period.

##### i) *A. T. Cameron*

A transect will be run in the vicinity of 63°W longitude with stations at about 30-mile intervals until stations in the Sargasso Sea are sampled (about 15 stations are anticipated). A return transect will be run along approximately the same line with finer resolution to identify details of *Illex* distribution in relation to water masses (about 25 stations).

ii) *Gadus Atlantica*

A transect, similar to that for the *A. T. Cameron*, will be run in the vicinity of 56°W longitude, with low resolution sampling until *Illex* are encountered. At this point, the survey will shift to the second mode and continue with finer resolution until Sargasso Sea waters are sampled. The vessel will continue with transects to the east of the first transect.

iii) USSR vessel

Transects will be run from Georges Bank in the vicinity of 67°W longitude, with the same pattern of stations as that for the *A. T. Cameron*.

After the initial transects are completed, the *A. T. Cameron* and the USSR vessel will continue subsequent transects in the same areas tracking water masses of interest. After the initial detailed cooperative transects are completed, the *Gadus Atlantica* will sample transects to the eastward, investigating distribution and abundance in accordance with phase II.

c) Stations

Sampling at each station, estimated to require six hours, will be conducted as follows:

i) Trawling to capture adults (mature and spawning) and juveniles will be conducted using the Engel Midwater Trawl (EMT). Vessel speed will be standardized to the degree possible after vessel capabilities are known. Trawls will be fitted with time depth recorders (TDR) and, if operationally possible, with small Bongo nets (0.333 mm mesh). Fishing at each depth will be for 15 minutes. Sampling will be made at 50 m, 100 m, 300 m, 500 m, and 750 m. If the vessel is capable of fishing at greater depths, tows at maximum depth may be made at the discretion of the scientific staff. If a spawning population of *Illex* is encountered and a larger trawl than EMT is available, the larger trawl should be used to more effectively sample the population.

ii) Near-surface larval sampling will be conducted to 50 m by oblique Bongo tows (0.333 mm mesh). Operational procedures will be in accordance with standard MARMAP methodology.

iii) Deeper larval sampling will be conducted to 200 m by oblique Bongo tows (0.333 mm). MARMAP procedures will be followed and, where possible, a TDR will be used to determine the actual fishing depth.

d) Hydrography

Hydrographic sampling will be carried out at all stations, involving surface temperature and salinity, XBT, and water sampling at standard depths.

Further hydrographic operations will be conducted, where possible, as follows:

i) Since squid larvae and juveniles appear to be associated with particular water masses (probably slope water), based on present information, the T-S structure of the water masses must be observed at all places sampled for larvae and juveniles, either by standard Nansen cast or STD, with emphasis on more detailed sampling where larvae are found.

ii) Since the variables affecting the spawning stocks are not really known, variables other than temperature and salinity should be measured, particularly chlorophyll, and probably nutrients, dissolved oxygen and particle spectra.

iii) Satellite IR data and sea surface temperature maps (e.g. NESS charts produced three times a week) should be used as a guide in studying particular water masses.

iv) If large concentrations of larvae and juveniles are located in the upper part of the water column (<200 m), buoys such as satellite-tracked buoys should be launched as an aid in tracking and relocating the concentrations.

v) If large concentrations of larvae are located in deep water (>200 m), neutrally-buoyant floats should be launched as an aid in subsequent tracking in relation to water movement.

e) Data collection and formats

Because the data to be collected during phase I will be shared by the participants and must be compatible, protocol and formats will be established under the coordination of Mr T. W. Rowell (Canada).

2. Phase II

Two vessels, one Canadian (*Gadus Atlantica*) and one USSR (unnamed), are planning to conduct more wide-ranging distribution and abundance studies on *Illex*. The Canadian vessel will participate in these studies from late February to 11 March and the USSR vessel will participate from March through April. A Japanese stern trawler may also be available in April. Since the scope of the USSR proposal was very broad and without significant availability of other vessel time, there was little opportunity to coordinate this phase of the program or to specify the details of sampling. However, it is hoped that these studies will take account of the agreed objectives and that the coordinator will be kept advised of plans so as to maximize the possibility of useful cooperation.

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

Chairman: R. G. Halliday

Rapporteur: V. M. Hodder

The Committee met at St. John's, Newfoundland, Canada, in three sessions during 3-8 September 1980, to consider and report on matters referred to it by the Scientific Council (see Part H, this volume). The members in attendance were J. Messtorff (EEC), J. P. Minet (EEC), A. T. Pinhorn (Canada), and V. A. Rikhter (USSR). The Chairman of the Scientific Council (R. H. Letaconnoux) chaired the final session at the request of Dr Halliday who could not preside due to other commitments.

## 1. Scientific Publications and Editorial Policy

The Committee reviewed in detail the needs of the Council in relation to scientific publications and proposed the following policies to the Council regarding the establishment of a primary and a secondary publication:

### a) Primary scientific journal

A primary scientific journal is required of a quality which will reflect favourably on the Council in the view of the international fisheries research community. The journal should be regional in scope, publishing papers on Northwest Atlantic fisheries science but papers of general applicability, methodological papers and review papers from other areas should be considered and included where relevant. Emphasis should be placed on environmental, biological, ecological and fishery aspects of living marine resources and ecosystems.

To develop and maintain author and subscriber support, more frequent issues are required than was the case with the ICNAF Research Bulletin (about one issue per year). It is proposed that Volume 1 be produced in 1980 as a single issue but that, in 1981, Volume 2 be produced in two issues in the spring and autumn of that year. It is foreseen that a desirable number of issues per annual volume could be three or four, but this is dependent on the volume of suitable quality material which can be attracted. In other terms, the long-term objective is to publish 30-35 acceptable papers per year.

It is proposed that the journal be entitled the NAFO "Journal of Northwest Atlantic Fishery Science". The size, production, quality, and format of the journal will be identical to that of the ICNAF Research Bulletin. However, it is proposed that the Secretariat (i) investigate the possibilities for improving the quality of reprints and report its findings to the next meeting of STACPUB, (ii) design several versions of a new cover in a colour and a design distinctly different from the ICNAF Research Bulletin, and (iii) circulate these cover designs to the members of STACPUB by airmail so that a decision can be made through correspondence with STACPUB members on the most appropriate design in sufficient time for its use in the production of Volume 1.

The Committee proposes that an Editorial Board be established, consisting of the Editor and four Associate Editors, none of whom will be remunerated. It is proposed that the Assistant Executive Secretary (Mr V. M. Hodder) be Editor and that the Associate Editors be selected from established scientists in the four fields of biological oceanography, vertebrate fisheries biology, invertebrate fisheries biology, and biomathematics. The Associate Editors need not be members of the Scientific Council. It is further proposed that the members of STACPUB submit lists of candidates in each of these fields to the Chairman of STACPUB, who will amalgamate them for presentation to the next meeting of the Committee for discussion and decision on qualified candidates. At that time, the Committee will also decide on the establishment of the Editorial Board and its terms of reference.

The Committee proposes that papers for the Journal be solicited from potential contributors through NAFO Scientific Council members, ICES, FAO, and other appropriate international bodies and through the present distribution list for the ICNAF Research Bulletin. Authors will be instructed to submit their papers directly to the Editor who will ensure that they are subjected to proper editing and refereeing processes. Provision will be made in the new Journal for the publication of "Letters to the Editor". The Editor will be responsible to STACPUB for implementation of Scientific Council publication policy. The Editor, in collaboration with the Chairman of STACPUB, will prepare an announcement of the new NAFO Journal and a solicitation of papers for distribution.

It is noted that the expenses which these proposals imply for 1980 and 1981 can possibly be accommodated within the budgets approved or proposed for these years. Matters relating to future budgets and any actions to be taken to promote wide distribution of the new Journal must await evaluation of costs in the light of experience.

b) Secondary scientific publication

A secondary scientific publication is required to promote the work of the Council. It is proposed that its scope would be papers of topical interest and importance to the current and future activities of the Council and its Standing Committees, including publication of manuals, contributions to special meetings and symposia, etc., initiated by the Scientific Council. The proposed title of this series is NAFO Scientific Council "Studies", which will be identical in presentation to the ICNAF Selected Papers series. Normally, one issue a year would be produced, but more than one issue might be required occasionally to meet the needs of the Council. The first issue, labelled "No. 1" will be produced in early 1981 and contain the papers selected by STACPUB for publication from the 1980 research document series.

Papers to be published in the "Studies" series will be subject to editing by the Assistant Executive Secretary as Editor but will not be subject to refereeing. Although distribution will be primarily to Scientific Council members, there will be no restrictions on distribution and subscriptions will be available to all interested individuals and organizations.

2. Other Business

a) Proposed ichthyoplankton identification manual

The Committee, in reviewing the list of papers nominated at the June 1980 Meeting for possible publication in the Scientific Council "Studies" series, agreed that the paper entitled "Fish eggs and larvae from the Flemish Cap Bank area", by V. P. Serebryakov (SCR Doc. 80/VI/90), could form the basis for the development of a manual on ichthyoplankton identification and distribution for the Northwest Atlantic as a whole. The Committee proposes that the Scientific Council promote the development of such a manual, preferably in loose-leaf format. The program could be initiated by identifying scientists, expert in the field of ichthyoplankton research, who would be willing to participate in the program by preparing the descriptions. Further consideration of this proposal will be dealt with at the June 1981 Meeting of the Council. The final publication of such identification sheets should have a standard format.

b) Coordination of research information for the NAFO Area

The Committee noted that a large amount of scientific information on Northwest Atlantic species is generated by national organizations and laboratories of the coastal states. Much of this information is not directly available to the Scientific Council. The Council, under its terms of reference and because of interrelationships between species in the whole of the NAFO Area, should encourage these organizations and laboratories to present papers of general biological, ecological and methodological interest for consideration at its various meetings.

c) Proposed new format for Statistical Bulletin Table 5

The Committee noted the recommendation of STACREC regarding a new format for Table 5 to be used in the first issue of the NAFO Statistical Bulletin. Discussion centered on the usefulness of continuing to include Table 6 as in the ICNAF Statistical Bulletin, in view of the general impression that it was seldom used. The Committee therefore

recommends (9)

*that the Scientific Council adopt the new format of Statistical Bulletin Table 5 as proposed by STACREC, and that Table 6 of the ICNAF Statistical Bulletin not be included in the NAFO publication.*

d) Papers nominated for possible publication

The members of STACPUB reviewed the research documents presented to the September 1980 meeting of the Council, requested the Secretariat to invite the authors of the following documents to submit suitably revised manuscripts for possible publication in the Scientific Council Studies series: SCR Doc. 80/IX/123, 127, 135, 145, 150, 153, 155 and 156.

The Committee also considered for possible publication a paper by Carl J. Sindermann entitled "Status of the Northwest Atlantic Herring Stocks". Since time was insufficient to evaluate the suitability of this paper for primary publication, it was agreed that the Editor in consultation with 2 or 3 experts consider the possibility of inviting Dr Sindermann to submit the paper for possible publication in the Journal of Northwest Atlantic Fishery Science.

e) Adjournment

On behalf of the Chairman, Mr Letaconnoux thanked the Committee members for their interest and cooperation in concluding consideration of matters deferred from the June 1980 Meeting.

# PART G

## REPORT OF SCIENTIFIC COUNCIL

Special Meeting, November 1980

CONTENTS

# REPORT OF SCIENTIFIC COUNCIL

## Special Meeting on Shrimp and Seals, November 1980

Chairman: R. H. Letaconnoux Rapporteur: V. M. Hodder

The Scientific Council met at NAFO Headquaters, Dartmouth, Canada, during 18-22 November 1980 to provide advice for 1981 on the conservation of the harp and hooded seal stocks in the Northwest Atlantic as requested by Canada and the shrimp stocks in Subareas 0 and 1 as requested by Canada and the European Economic Community (page 117, this volume). In addition, at the request of ICES (International Council for the Exploration of the Sea) and agreed by the Executive Committee of the Scientific Council, a review of the status of the shrimp stocks and fishery at East Greenland was included in the agenda for this meeting (see Part H, this volume). Representatives attended from Canada, European Economic Community (EEC), Faroe Islands, Iceland and Norway.

The stock assessments were undertaken by the Standing Committee on Fishery Science (STACFIS), whose report as approved by the Council, is given in Appendix I. Brief summaries of the stock assessments, together wtih other matters considered by the Council, are given below.

### I. STOCK ASSESSMENTS (APP. I)

1. Assessment of Seal Stocks

a) Harp seals

Provisional statistics indicate that the 1980 catch of harp seals in the "Gulf" and "Front" areas was 171,929 and that the catch at Greenland could amount to more than 10,000 and possibly as many as 12,000-13,000.

An independent review of the status and management of harp seals in the Northwest Atlantic, by J. R. Beddington and H. A. Williams (1980, US Dept. Commerce, Tech. Info. Serv. Doc. No. PB80-206105, 127 p.), was assessed. These authors used the detailed catch-at-age data derived by P. F. Lett and T. Benjaminsen (1977, J. Fish. Res. Bd. Canada, 34: 1155-1187) and data from a specific population model to form a cumulative $\chi^2$. Parameters of the model are then manipulated until a minimum $\chi^2$ value is obtained which corresponds to the best fit. This results in a high point estimate for natural mortality (M = 0.14) and indicates a substantial decline in the population since 1952 which has only been slowed by recent quotas. In examining their method, it was found that incorrect assumptions about selectivities of landsmen and large vessel hunts, inaccurate age determinations (especially of older animals), and inappropriate weighting of samples biased their results. Their derived vital rates were used to calculate 1952 replacement yields of the order of 10,000 animals, implying that, unless the mortality rate was less, the harp seal population must have been in continuous decline since 1800 from a level of tens of millions of seals. In view of the unlikeliness of this having occurred and for other reasons, the estimates of Beddington and Williams were considered to be unrealistic.

A value of M = 0.10 was adopted for the assessment, although it was recognized that values from 0.08 to 0.12 could not be ruled out by existing analyses. New estimates of pregnancy rates were tabled and adopted for calculation of yields and projections of catch and population size. Mark-recapture experiments in 1978-80 and an aerial survey in 1977 gave a mean estimate of pup production in 1977-80 of 410,000 with a nominal standard error of 46,000. Survival index calculations gave an estimated pup production of 342,000 in 1973 with 95% confidence limits of 267,000-625,000. These two estimates were considered to be equally reliable and were used to provide a best estimate of 375,000 for pup production in 1980. In the absence of a moulting sample of seals in 1980, the 1979 age composition was used to project catch and stock size to 1985 and to calculate replacement yields.

With M = 0.10 and 1980 pup production of 375,000, replacement yield was estimated to be 210,000 animals, with an age 1+ population of 1.57 million animals, and the sustainable yield was estimated to be 234,000 animals. This latter value is lower than would be expected in a population with a stable age distribution, due to the present large proportion of immature animals resulting from the reduced pup catches from 1972 onwards.

The population in 1985, with a continued annual catch of 180,000 (80% pups and 20% age 1+ animals) is projected to consist of 425,000 pups and 1.70 million age 1+ animals, representing an annual growth rate of 1.7%. An annual catch of 210,000 seals, with the same proportions of pups and adults, is projected to result in a stable population for the 5-year period. The projected increase of the harp seal population noted above should not be interpreted as a firm prediction because natural mortality rates from 0.08 to 0.12 and pup productions from 300,000 to

500,000 are possible. Although the available information best corresponds to an expanding population if the annual kill is 180,000 seals, the rate of expansion could be larger or smaller than the 1.7% given above.

b) Hooded seals

No new analyses of age and reproductive data were available, the most recent being those presented at the November 1978 Meeting (ICNAF Redbook 1979, pages 11-14). Consequently, there was no basis for revising the assessment of hooded seals made at that meeting, and the Council reiterates the previous advice that a kill of 15,000 hooded seals at the Front under the present management regime is likely to permit the population to increase. The Council also advises that the upper limit of 5% females in the kill be retained as a conservation measure for 1981.

2. Assessment of Shrimp in Subareas 0 and 1

The 1979 offshore shrimp fishery in Subareas 0 and 1 was regulated by an overall total allowable catch (TAC) of 29,500 tons, of which about 26,000 tons were taken. The same TAC was continued in 1980, and preliminary statistics for January-October indicate an offshore catch of about 30,000 tons. The major fishing areas were the northern parts of Store Hellefiske Bank (Div. 0A and 1B) with an extension of the fishery northward to Div. 1A. Available information on shrimp biology included depth relationships, diurnal variation and age interpretation.

All available information on biomass, trends in catch rates and composition of the stock were considered in advising on a TAC for 1981. It was noted that the decline in abundance, evident during 1976-78 from catch-per-unit-effort indices and biomass estimates, had levelled off with some increase indicated in 1980. However, there was uncertainty as to whether the increase indicated by the catch rates and by the photographic biomass estimates represented a real increase in stock abundance or resulted from changing fishing patterns or environmental conditions. The Council therefore advises that the overall TAC for the offshore grounds in Subarea 1 and adjacent parts of Subarea 0 in 1981 should remain at the same level as in 1980 (29,500 tons). In order to improve the basis for assessing the shrimp stocks, the Council endorsed the recommendations of STACFIS regarding future research requirements (see Appendix I).

3. Assessment of Shrimp off East Greenland

The shrimp fishery off East Greenland began in 1978 and by 1980 vessels from Denmark, Faroe Islands, France, Greenland, Iceland and Norway fished in the area of Strede and Dohrn banks between Iceland and Greenland (around 66°N and 28-30°W). Catch rates were high in the early months of the year and declined sharply in June, indicating a shift in the concentrations due possibly to changes in hydrographic conditions. The available biological data indicate that the fishery in April-May exploits large berried females and that the shrimp are larger than those off West Greenland. Also, there are indications that as many as 25% of the females do not mature. By-catches occasionally consisted of large quantities of capelin, Atlantic cod, and Greenland halibut but generally comprised smaller amounts of redfish, wolffishes and some other species.

A single biomass estimate was presented but it was not considered reliable because of data limitations. Environmental factors and fishing patterns were discussed in relation to the variable catch rates, but no firm conclusions could be reached. Although it was not possible to provide an estimate of potential yield from this stock, a cautious approach to exploitation is suggested. The need for greatly expanded research activity was emphasized.

## II. COLLABORATION WITH OTHER ORGANIZATIONS

1. ICES Request for Assessment of Shrimp at East Greenland

In a telegram to the Executive Secretary of NAFO on 20 October 1980, the General Secretary of ICES on behalf of its Advisory Committee on Fishery Management (ACFM) expressed the desire that assessment of the shrimp stocks at East Greenland be considered at the November 1980 Meeting of the Scientific Council when the shrimp stocks at West Greenland are assessed, because most of the scientists involved would be the same. Telephone contact with the majority of the members of the Executive Committee of the Scientific Council indicated general agreement with the proposal, and this was communicated to Scientific Council members on 23 October 1980 (NAFO Circ. Letter 80/75). Consequently, the report of STACFIS (Appendix I) contains a section entitled "Shrimp at East Greenland".

## III. FUTURE SCIENTIFIC MEETINGS

1. Special Meeting for Assessment of Capelin and Cod

The Council confirmed that its next meeting would be held at NAFO Headquarters, Dartmouth, Canada,

during 17-21 February 1981 to review the status of and provide advice for management in 1981 of the capelin stocks in Div. 2+3K and 3LNO, and the cod stocks in Div. 3M and 3NO.

2. Regular Meeting in June 1981

The Council confirmed that its regular meeting will be held at NAFO Headquarters, Dartmouth, Canada, during 9-20 June 1981, preceded by a special session on "Squid biology and distribution" during 3-6 June and a meeting of the *ad hoc* Working Group on the Flemish Cap Project on 8 June.

## IV. OTHER MATTERS

1. Recommendations for Future Research

The Council noted that the Secretariat has compiled and circulated a list of research requirements recommended at its meetings held in February, June and September 1980, and urged scientists to take particular note of these, since many of them relate to requirements and/or commitments, on which reports are expected to be presented at forthcoming meetings of the Council in 1981.

2. Progress Report on Publication of the New Journal

The Assistant Executive Secretary informed the Council that the Secretariat, in collaboration with members of the Standing Committee on Publications (STACPUB), had completed the new cover design for the Journal of Northwest Atlantic Fishery Science and that Volume 1, containing 10 refereed papers, should be ready for distribution in late December.

## V. APPROVAL OF REPORTS

1. Provisional Report of the September 1980 Meeting

The Council reviewed and formally approved without amendment the report of its meeting at St. John's, Newfoundland, Canada, during 3-8 September 1980.

2. Report of the November 1980 Meeting

The Council noted that its report of the present meeting is scheduled for inclusion in the first issue of "Scientific Council Reports" to be published in December 1980. The Council agreed to formally adopt the report, subject to minor editorial amendment, where necessary, by the rapporteur.

## VI. ADJOURNMENT

The Chairman expressed his thanks to the Bedford Institute Administration for the use of conference rooms, to the NAFO Secretariat for their usual efficiency in preparing for and servicing this meeting, to the Chairman of STACFIS and the conveners and rapporteurs of working groups, and to all participants for their cooperation and contributions. The meeting adjourned at 1300 hours on 22 November 1980.

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

## Special Meeting on Shrimp and Seals, November 1980

Chairman: G. H. Winters

At the request of the Scientific Council, STACFIS met during 18-22 November 1980 to review (a) the status of the harp and hooded seal stocks in the Northwest Atlantic at the request of Canada, and (b) the shrimp stocks in Subareas 0 and 1 at the request of Canada and the European Economic Community. In addition, as requested by ICES on 20 October 1980 and agreed by the Executive Committee of the Scientific Council, the Committee reviewed the status of the shrimp stocks off East Greenland. Scientists attended from Canada, European Economic Community, Faroe Islands, Iceland, and Norway (see Part H, this volume, for agenda and list of participants).

In considering the agenda of the Scientific Council, STACFIS agreed that the assessments of shrimp and seals be carried out in two working groups which would meet concurrently. Consequently, the *ad hoc* Working Group on Seals (convened by Dr A. W. Mansfield with Dr W. G. Doubleday as rapporteur) and the *ad hoc* Working Group on Shrimp (convened by Mr P. Kanneworff with Mr D. G. Parsons and Mr K. Hoydal as rapporteurs) were held during 18-21 November 1980, and their reports as approved by STACFIS are given in Sections I, II and III below.

## I. HARP AND HOODED SEALS

1. Harp Seals (SCS Doc. 80/VI/4, 80/XI/33; SCR Doc. 80/XI/160, 161, 162, 168, 171)

a) Review of fishery

Canadian and Norwegian seal catches in the "Gulf" and "Front" areas in 1979 and 1980 were reported in SCS Doc. 80/VI/4 and 80/XI/33 respectively, the latter indicating a provisional catch of 171,929 harp seals during the 1980 season. The incomplete breakdown of catches by age-group was noted in the provisional 1980 statistics for Canada (Quebec), and the Secretariat was requested to obtain the appropriate figures for inclusion in SCS Doc. 80/XI/33 prior to its post-meeting distribution. No recent information on harp seal catches in the Canadian arctic and at West Greenland were included in the reports, but Denmark provided figures for Greenland catches in 1977-79 which, although incomplete, suggested that the 1980 catch at West Greenland would amount to more than 10,000 and possibly as many as 12,000-13,000 animals.

The age structure of harp seal catches in 1952-80 was retabulated (SCR Doc. 80/XI/168) because errors had been found in the data reported by Lett and Benjaminsen (1977, J. Fish. Res. Bd. Canada, 34: 1155-1187). The original data sources were used for this retabulation which provides the best estimates so far of catches at age. However, data on Canadian arctic catches are poor.

b) Research in 1980

Canada reported on estimates of harp seal production from mark-recapture experiments in the Gulf and Front areas (SCR Doc. 80/XI/162), on inconsistencies in ageing from teeth and a means of reducing the resulting biases in estimates of population parameters (SCR Doc. 80/XI/160), on the utilization of a simulation model to locate the set of possible combinations of population size in 1979 and natural mortality rates (SCR Doc. 80/XI/161), and on the development by the Committee on Seals and Sealing (COSS) of a handgun for killing seal pups. Denmark presented revised catch statistics and age compositions for 1977-79 at West Greenland, and reported on recoveries of tagged harp seals in Greenland during 1979 and 1980 (SCR Doc. 80/XI/171). Norway presented age composition data for harp seals at the Front in 1977-78.

c) Population assessment

i) Natural mortality

The following estimates of the instantaneous natural mortality coefficient (M) for Northwest Atlantic harp seals were considered:

| Estimate | Source |
|---|---|
| 0.106 | Benjaminsen and Øritsland (unpublished data originally presented in 1976) |
| 0.114 | Lett and Benjaminsen (1977, J. Fish. Res. Bd. Canada, 34: 1155-1187) |
| 0.100 | Lett, Gray and Mohn (ICNAF Res. Doc. 77/XI/68) |

0.098 Winters (1978, J. Fish. Res. Bd. Canada, 35: 1249-1261)

0.138 } Beddington and Williams (1980, US Dept. Commerce, Nat. Tech. Inf. Serv., Doc.
0.143 } No. PB80-206105, 127 p.)

0.095 Roff and Bowen (calculated from NAFO SCR Doc. 80/XI/161, using estimates of 400,000 and 370,000 for pup production in 1967 and 1979 respectively)

The report by Beddington and Williams (see above) entitled "The status and management of the harp seal in the Northwest Atlantic: a review and evaluation" was discussed. Their model assumes that selectivities of both the landsmen and large vessel hunts have remained constant over time. This assumption is important because observed and calculated catches are compared. In the case of the large vessel hunt, the progressive shortening of the hunting season during the early 1960's and the cessation of killing whelping females in 1967 produced significant changes in catch compositions, and hence selectivities, with reduced representation of mature (older) seals, particularly females. The expansion of the longliner component of the landsmen hunt during the late 1960's and early 1970's has undoubtedly changed the selectivity pattern of the landsmen hunt, because these vessels catch mainly bedlamers as opposed to the net catches of mainly adults. The test of Beddington and Williams for constant selectivities is not convincing because they were generated by the same model that tested them.

Information presented at this meeting (SCR Doc. 80/XI/160) indicates that age-reading consistency declines with the age of the tooth read. Estimated probabilities of correctly reading the age of a tooth by the methods employed for the age samples used in the paper by Beddington and Williams decline from about 50% at age 10 to about 10% at age 25. Therefore, the estimated age compositions of catches of animals older than age 12 bear little relation to the actual age compositions and are little better than "random numbers". The effective weighting applied by Beddington and Williams in their $\chi^2$ analysis increases with age. The $\chi^2$ estimate chosen is also statistically inefficient because samples of different sizes in different years are weighted in relation to catches and not sample sizes and because older ages have larger relative sampling errors (in addition to the ageing variation noted above) than younger ages. Inappropriate weighting of samples of components of the landsmen catches has also biased the catch-at-age data.

The high and declining pup natural mortality rates of the 1950's and 1960's lead by themselves to high estimates of adult natural mortality. Taken together, the vital rates for the 1952 population estimated from the two sets of catches lead to a paradox. The calculated replacement yields for 1952 are of the order of only 10,000 pups. This means that, unless mortality rates were lower or unless a higher proportion of age 1+ animals bore pups before 1952, the harp seal population must have been in a continuous decline since 1800 from a level of tens of millions of seals. For example, the age 1+ stock in 1946 would consist of at least 1 million more animals than the age 1+ stock in 1952. The high natural mortality rates imply that the 1952 population, even if not hunted, was almost stable. In view of the observed changes in vital rates from 1950 to 1980, the implications of the vital rate estimates of Beddington and Williams for the pre-1950 period (i.e. an unexploited population an order of magnitude greater than the 1952 population, but with the same vital rates) are such that they must be considered unrealistic. For these reasons, the estimates of Beddington and Williams were discarded.

Considering the remaining 5 estimates and their dependence on essentially the same data set, a value of M = 0.10 was adopted for further calculations, recognizing that values of M from 0.08 to 0.12 could not be ruled out by existing analyses, and recognizing the tendency for the methods and data used for some of these estimates to lead to underestimation of M (SCR Doc. 80/XI/60).

ii) Pregnancy

In SCR Doc. 80/XI/161, estimates of maturity and fertility were combined to give the percentage of females at age that reached late-term pregnancy. These estimates were considered more representative than those used at the November 1979 Meeting of the Council, because they incorporated information for ages 7+ females from 1965 onwards and because the maturity rate of age 4 females in the 1979 sample was anomalously high, and they were therefore adopted for calculations of yields and projections of catch and population size. The values used are as follows:

| Age | 1-3 | 4 | 5 | 6 | 7+ |
|---|---|---|---|---|---|
| % late-term pregnancy | 0 | 4.6 | 53.3 | 87 | 87 |

iii) Pup production

Seven estimates of pup production from mark-recapture experiments and one based on an aerial census in 1977 were presented in SCR Doc. 80/XI/162. Taken together, these gave a mean estimate of pup production for the 1977-80 period of 410,000 with a nominal standard error of 46,000. Survival index calculations reviewed at the November 1979 Meeting of the Council indicated an estimated pup production of 342,000 for 1973 with nominal 95% confidence limits of 267,000 and 625,000. Calculations, based on the data in SCR Doc. 80/XI/161, assuming M = 0.10 and 400,000 pups produced in 1967, led to an estimate of 335,000 for 1979 pup production.

The third estimate was considered less reliable than the others because of the 12-year projection with an assumed natural mortality rate. The remaining two estimates were considered about equally reliable. Allowing for calculated trends in pup production in the 1970's and giving these estimates equal weight, 375,000 was considered to be the best available point estimate of pup production in 1980. Although rigorous confidence limits could not be calculated, pup production in 1980 was considered to be between 300,00 and 500,000.

iv) Stock size and relationships

The 1979 stock size was calculated by adjusting proportionally the 1979 age composition (SCR Doc. 79/XI/12), because no moulting sample was taken in 1980. The estimated 1979 age composition was then projected to 1980, giving the following age composition of the population ('000 animals):

| Age | 0 | 1 | 2 | 3 | 4 | 5 | 6+ |
|---|---|---|---|---|---|---|---|
| Number | 375 | 214 | 219[1] | 134 | 107 | 99 | 797 |

[1] This value was considered anomalous due to sampling error in the 1979 sample of moulting seals, and does not affect the projections of stock size and yield.

This age composition was used to project catches and stock size to 1985 and to calculate replacement yields.

Tag recaptures in 1980 qualitatively confirmed earlier observations that immature seals born in the Gulf and at the Front mixed to a considerable degree.

v) Yields

Replacement yields for 1981, calculated from the agreed estimates of natural mortality and 1980 pup productions and from alternative values, are as follows:

| M | 1980 pup production | 1980 age 1+ population | 1981 replacement yield |
|---|---|---|---|
| 0.10 | 375,000 | $1.57 \times 10^6$ | 210,000 |
| 0.10 | 321,000[1] | $1.35 \times 10^6$ | 180,000 |
| 0.12[1] | 375,000 | $1.57 \times 10^6$ | 180,000 |

[1] These values were chosen to give a replacement yield of 180,000 animals in 1981.

The sustainable yield, associated with the 1980 pup production estimate of 375,000 and the vital rates described in the above sections, was estimated, using the formula given in SCR Doc. 79/XI/12, to be 234,000 animals. The vital rates used correspond to a mean age of first maturity of 5.3 years and a fertility rate of 0.87. Age specific hunting mortality rates, estimated in SCR Doc. 79/XI/12, were used in the calculations. Because the 1980 population contains more immature animals than would be present in a population with a stable age distribution, this estimate of sustainable yield is less than the sustainable yield associated with the 1980 population and greater than the replacement yield.

vi) Population projections

Population abundance projected to 1985, assuming an annual harvest of 180,000 seals dis-

tributed over age-groups according to the estimated hunting mortality rates for 1979, indicated a pup production of 425,000 and 1.70 million age 1+ animals. This represents an annual growth rate of 1.7% for the age 1+ population from 1980 to 1985. With an annual catch of 210,000 animals distributed over ages in the same proportions, the population is projected to be approximately stable from 1980 to 1985. Catches less than 180,000 seals lead to projected growth of the age 1+ population at a higher rate then 1.7% per year.

Although point estimates of 0.10 for natural mortality (M) and 375,000 for the 1980 pup production were adopted for yield calculations and projections, available information indicates that natural mortality rates from 0.08 to 0.12 and 1980 pup productions from 300,000 to 500,000 are possible. Therefore, the projected increase of the harp seal population should not be interpreted as a firm prediction. If all other parameters are held constant and the natural mortality is set at 0.12 or the pup production is set at 300,000 no increase in the population is projected from 1980 to 1985. The available information best corresponds to an expanding harp seal population if the annual kill is 180,000 animals, but the rate of expansion could be larger or smaller than the 1.7% annual rate indicated above.

d) Future research

In order to improve the basis for assessment of the harp seal stocks, STACFIS

recommends (1)

*i) that further samples of moulting harp seals be taken at the Front;*

*ii) that further samples of migrating harp seals be taken in the Gulf of St. Lawrence in January and February for studies on age, reproduction, feeding and energetics;*

*iii) that observations on mother-pup interactions and other behavior be carried out in the Strait of Belle Isle;*

*iv) that Norway carry out a series of blind replicate tests on the sample of teeth discussed in SCR Doc. 80/XI/160 and also on a similar-sized or larger sample of teeth from Norwegian collections at the Front; and*

*v) that catch statistics be improved, particularly those for the Arctic and the Gulf of St. Lawrence.*

STACFIS also noted the intention of the Canadian Committee on Seals and Sealing (COSS) to continue development and testing of a suitable handgun for killing seals and to initiate a study of the behavior of seals entrapped in nets.

2. Hooded Seals (SCS Doc. 80/VI/4, 80/XI/33; SCR Doc. 80/XI/158, 170)

a) Review of fishery

Canadian and Norwegian catches at the Front in 1979 and 1980 were reported in SCS Doc. 80/VI/4 and 80/XI/33, with a provisional catch of 15,125 hooded seals indicated for 1980. Denmark provided provisional catch statistics for West Greenland in 1977-79 and Norway provided revised statistics for the North Atlantic in 1945-79.

b) Research in 1980

Denmark reported on age at sexual maturity and reproductive performance of female seals from southern Greenland in 1970-71 (SCR Doc. 80/XI/158) and provided a review of all available information on age composition and feeding of hooded seals at Greenland for 1970-78 (SCR Doc. 80/XI/170). Norway made reference to a study by N. O. Jacobsen on pup production, age at first pupping, and natural mortality of hooded seals in the West Ice (Jan Mayen area of the Greenland Sea).

c) Population assessment

Because no new analyses were available, there was no basis for revising the assessment made at the November 1978 Meeting (ICNAF Redbook 1979, pages 11-14). STACFIS, therefore, reiterates the previous advice that a kill of 15,000 hooded seals at the Front under the present management regime is likely to permit the population to increase. It was noted that, again in 1980, less than 5% of the total kill consisted of adult females. STACFIS advises that the upper limit of 5% adult females in the total kill at the Front should be retained as a conservation measure in 1981.

d) Future research

In order to improve the basis for assessment of the hooded seal stocks, STACFIS

recommends (2)

*i) that all available unworked data on age composition, maturity and fecundity be analyzed and reported as soon as possible; and*

*ii) that detailed catch and effort data continue to be collected from all large vessels operating in the Front area.*

## II. SHRIMP IN SUBAREAS 0 AND 1

1. Fishery Trends

The nominal catch of shrimp in Subareas 0 and 1 (Table 1) increased from less than 10,000 tons prior to 1973 to 50,000 tons in 1976 and declined to 33,000 tons in 1979. The offshore shrimp fishery has been regulated by total allowable catch (TAC) since 1977. In 1977 and 1978, offshore catches in Subareas 0 and 1 were about 34,000 and 27,000 tons against TACs of 36,000 and 40,000 tons respectively. In 1979 the offshore fishery was regulated by a TAC of 29,500 tons of which about 26,000 tons were taken. Preliminary statistics for January to October 1980 indicate a total catch of about 30,000 tons from Subarea 0 and the offshore grounds in Subarea 1, with the TAC being 29,500 tons. The inshore fishery has remained relatively stable around 7,000-8,000 tons except in 1974 when 10,000 tons were taken.

Table 1. Nominal catches and total allowable catchs (metric tons) of shrimp (Pandalus borealis) in Subareas 0 and 1[1].

| Area | Country | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| SA 0 | CAN | - | - | - | - | - | - | - | - | 175[3] |
| | FAROES | - | - | - | - | - | 239 | - | - | - |
| | DEN-G | - | - | - | - | - | - | - | 149 | 1157 |
| | DEN-M | - | - | - | - | - | 68 | 86 | 67 | - |
| | FRA-M | - | - | - | - | - | - | 21 | 7 | 122 |
| | NOR | - | - | - | - | 65 | 150 | 15 | 738 | - |
| | SPA | - | - | - | - | 327 | - | - | - | - |
| | TOTAL | - | - | - | - | 392 | 457 | 122 | 961 | 1454 |
| SA 1 | CAN | - | - | - | - | - | - | - | 245 | 2079[3] |
| | FAROES | 755 | 1371 | 2023 | 5300 | 11179 | 12612 | 8070 | 6982 | 2000 |
| | DEN-G(a)[4] | 7342 | 7950 | 10064 | 8700 | 7300 | 7800 | 7600 | 7500 | 7500 |
| | (b) | 150 | 185 | 180 | 1089 | 2478 | 7081 | 5531 | 12527 | 21313 |
| | DEN-M | - | 196 | 308 | 1142 | 2717 | 5842 | 3382 | 1062 | 871 |
| | FRA-M | - | - | - | - | 803 | 924 | 805 | 352 | 126 |
| | FRG | - | - | - | - | - | 31 | - | - | - |
| | JAP | - | - | - | - | 146 | - | - | - | - |
| | NOR | 1409 | 2940 | 5917 | 8678 | 11658 | 7353 | 8959 | 4251 | 2494 |
| | SPA | - | - | - | 6948 | 6925 | - | - | - | - |
| | USSR | - | - | 3517 | 6033 | 6468 | - | - | - | - |
| | TOTAL | 9656 | 12642 | 22009 | 37890 | 49674 | 41643 | 34347 | 32919 | 36383 |
| | OFFSHORE | 2314 | 4692 | 11945 | 29190 | 42374 | 33843 | 26747 | 25419 | 28883 |
| | TAC (0+1 offshore) | | | | | | 36000 | 40000 | 29500 | 29500 |

[1] Statistics for 1972-1978 pertain to ICNAF Statistical Area 0 and Subarea 1, and for 1979 and 1980 to the new NAFO Subareas 0 and 1.
[2] Preliminary to the end of October.
[3] Canadian data for 1980 include catches from cooperative arrangements with other countries.
[4] a = inshore, b = offshore catches.

2. Distribution (SCR Doc. 80/XI/159, 163, 165, 167, 169, 174, 175)

No research trawl surveys for shrimp were conducted in Subareas 0 and 1 in 1980, but the photographic

survey in Subarea 1 was continued. Information from the fishing fleets of Greenland, Norway, France and Canada indicated a concentration of fishing effort in the northern part of Div. 1B, in the eastern part of Div. 0A and in Div. 1A to 71°N. Fishing effort in Div. 0A and western Div. 1B was limited in the earlier months of the year, presumably due to ice conditions. The data from Greenland trawlers indicated a preference for fishing north of 68°N in 1980, in contrast to 1979 when effort was concentrated just south of this latitude. A relatively small area in Div. 1A northward of Disko Island, previously unexploited, produced catch rates which compare favorably with those for the more traditional fishing areas south of 68°N. Vessels other than those from Greenland were restricted to fishing in areas south of 68°N.

Data from the commercial fishery and the photographic survey confirm observations of previous years that the depths of maximum concentration of shrimp range from 200 to 400 m. No new information was available on hydrographic conditions. Recruitment patterns again remain uncertain but bottom photographs taken in 1980 indicated concentrations of small shrimp (<18-20 mm carapace length) in Div. 1A and the northern part of Div. 1B. Shrimp of these sizes were especially numerous in the area between 68°N and 69°30'N.

The proportion of offshore shrimp grounds within the Greenland 12-mile limit was discussed (SCR Doc. 80/XI/175), and it was roughly estimated that about 19% of the Greenland offshore catch in Div. 1A and 1B in 1980 was taken inside the 12-mile limit.

3. Biology (SCR Doc. 80/XI/159, 167, 169)

New information on the biology of shrimp include depth relationships, diurnal variation and age interpretation. A breakdown of length frequencies by depths greater and less than 300 m indicated that ovigerous females occur more frequently at shallower depths. Data from the photographic surveys indicated that the highest biomass of shrimp in all areas is found around 300 m. Additional information on diel variability from the fishing activity of a French commercial vessel during July-September gave conversion factors at 4-hour intervals which compare favorably with those reported in previous studies (ICNAF Sel. Papers No. 4: 45-46). Analysis of length composition data from French catches by the Cassie method (1954, Austr. J. Mar. Freshw. Res., 5: 513-522) indicated at least 5 age-groups. The modes evident in this analysis were also apparent in the Canadian commercial data.

Although no new information was available on natural mortality of shrimp, there was a general consensus that the estimates for female shrimp used in assessing the stock were perhaps too high. Data from the 1979 surveys indicated that the spawning period extended into October, which is later than previously observed for shrimp in inshore areas. The Canadian data for 1980 showed signs of spawning in September, and the likely extension of spawning into October would tend to support the earlier observation.

4. Catch and Effort (SCR Doc. 80/XI/159, 163, 167, 174)

Mean monthly catches, based on logbook records (haul-by-haul) of French, Greenland and Norwegian vessels and on observers' reports from Canadian vessels, typically declined from a peak in March-April to a level in July-September 1980, which was higher than that observed for 1979. Observations from the French and Canadian data in Div. 0A and 1B indicated the same distribution of effort in 1980 as earlier. However, the Greenland data, based on reports from vessels of the Royal Greenland Trade Department which were not restricted from fishing north of 68°N latitude, indicated a shift in fishing activity farther northward than in previous years. This shift not only relates to areas just north of 68°N but extends as far north as 71°N.

Catch-per-unit-effort data for the months of July to September have been used in recent years to reflect stock abundance. Such catch rates declined from 1976 to 1978 but appeared to level off in 1979. All sources of information for these months in 1980 indicate an increase in catch-per-unit-effort of 20-30%. Some of this increase may be in part due to the utilization of trawls with greater vertical opening than used previously and in part to the northward shift of the Greenland trawler fishery. Although the pattern of fishing by Greenland trawlers gives some indication of a northward displacement of the stock in recent years, this is not reflected in the catch rates listed in Table 2. It was suggested that an in-depth analysis of all available data should be undertaken both in terms of the fishery, including interviews with fishing masters, and environmental factors.

Table 2. Fishing effort and catch rates of Greenland trawlers for the areas north and south of 68°N, 1976-80.

| Area | Parameter | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|
| 68°-68°50'N | Effort (hours) | - | 47 | 1464 | 131 | 1340 |
| | Catch/hr (kg) | - | 549 | 525 | 302 | 457 |
| 67°-68°N | Effort (hours) | 916 | 2908 | 1971 | 3652 | 1962 |

5. Biomass Estimates (SCR Doc. 80/XI/169)

The only biomass estimate for 1980 was that obtained from the photographic survey. The application of a new mathematical model to the photographic survey data gave biomass estimates for 1977 to 1980 which, except for the possibility of a slight overestimate in 1980 due to a concentration of sampling in northern areas around 69°N, compare favorably with the trend in catch rates. The variance associated with the photographic survey data remains quite high. However, the trend in biomass estimates obtained by this method is supported by the results of trawl surveys in previous years. The method produces a 1980 biomass estimate of 177,000 tons, which can be considered the total biomass for the area between 66°N and 69°30'N latitude. Estimates of biomass from trawl surveys represent mean trawlable biomass.

A decrease in the mean size of shrimp was observed from 1977 to 1979 at a check station sampled in all years in the central area south of 68°N, but a small increase in size was noted at this station in 1980. As in previous years, greater proportions of small shrimp were found at some stations in the area northwest of Store Hellefiske Bank than at other stations.

6. Total Allowable Catch

At the November 1976 Meeting of the *ad hoc* Working Group on Shrimp in Subarea 1 (ICNAF Redbook 1977, page 15), in order to estimate the stock size of shrimp and how much of it should be harvested, natural mortality after first spawning (hatching) was assumed to be 1.5 and the time between recruitment to the fishery and first spawning was assumed to be 1.5 years. Under these assumptions, a fishing mortality of 0.40 would lead to a 50% reduction in the spawning stock biomass over several years if the level of fishing remains stable. Catch-per-unit-effort indices, based on weighted catch rates of a comparable group of Greenland trawlers for the July-September period of 1976-80, indicate a reduction of around 50% in the spawning stock biomass from the high (virgin) level of 1975-76:

| Year | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|
| Relative CPUE | 1.00 | 0.73 | 0.67 | 0.50 | 0.64 |

In advising on the total allowable catch for 1981, information from both the photographic survey and catch-per-unit-effort data was considered. It was noted that the decline in abundance, evident from 1976 to 1978, had levelled off and some increase was indicated for 1980. However, there was some uncertainty whether the increase in abundance indices reflected in the catch-per-unit-effort data and the photographic survey in 1980 indicated a real increase in stock abundance. Considering this uncertainty and the rather limited information available, STACFIS advises that the overall TAC for the offshore grounds in Subarea 1 and adjacent parts of Subarea 0 in 1981 could remain at the same level as in 1980 (29,500 tons).

The portion of the shrimp stock in the area between 68°N and 69°30'N has been identified as likely having interrelationships with the inshore stock in the Disko Bay area. Consequently, it was generally agreed that the conservative practice of allowing only a small portion of the overall TAC for the offshore area to be taken in this area (68°-69°30'N) should be continued.

7. Discarding of Shrimp (SCR Doc. 80/XI/159, 163, 165)

The available data indicated variable patterns of discarding in the shrimp fishery of Subareas 0 and 1. Two levels of discarding shrimp were observed in the French fishery, first by the sorting machine and later by hand, both accounting for approximately 8% of the total shrimp catch. Discarding in the Norwegian fishery was estimated at 2.7%, the lowest level following a general decline in recent years. Canadian observers reported that discards exceeded 30% in some instances, the higher rates being mainly associated with the processing of the whole, cooked product. A general lack of information on discards was evident from the commercial logbook data, and it was agreed that the observer program should be intensified to more closely monitor this problem.

8. By-catches in the Shrimp Fishery (SCR Doc. 80/XI/159, 163, 165, 174)

The major by-catch in the shrimp fishery continues to be redfish (*Sebastes mentella*). Lesser quantities of other species occurred as well, including Greenland halibut, Atlantic halibut, wolffishes, Greenland shark and Atlantic cod. France reported no significant by-catches. Norway and Greenland indicated a decrease in by-catches, due mainly to a reduction in redfish catches. Canadian observers reported that redfish occurred as by-catch in varying proportions (2-33%) of the total catch. It was noted that most by-catches are discarded and that records of these are seldom kept.

9. Future Research

A number of essential requirements were identified in relation to improving the assessment of the

shrimp stocks in Subareas 0 and 1. Considering the status of current assessment techniques for shrimp, the results of trawl surveys remain an important part of the data base. It was noted that the discarding of shrimp, if substantial and not reported, could have implications for the stock. Consequently, the importance of recording complete and accurate information on catches and discards in logbooks was emphasized. The need for reliable criteria for ageing shrimp was also stressed. STACFIS therefore

recommends (3)

*i) that stratified-trawl and photographic surveys should be conducted annually to establish a time series of abundance indices independent of those based on commercial catch rates;*

*ii) that the observer program should be continued with emphasis on monitoring the quantities and sizes of shrimp caught and discarded;*

*iii) that the logbooks presently used in the fishery be completed accurately and that appropriate steps be taken to ensure that the data are collected from all participants in the fishery; and*

*iv) that an ageing workshop on shrimp be held, with Mr J. Fréchette as convener (possibly in Quebec, Canada, during early May 1981), to conduct an in-depth analysis of shrimp samples with a view to developing criteria for the ageing of shrimp.*

## III. SHRIMP AT EAST GREENLAND

### 1. Description of Fishing Area (SCR Doc. 80/XI/164, 172, 173)

According to Icelandic data, shrimp were found in 1978 and the first half of 1979 on the part of Dohrn Bank which is inside the Icelandic fisheries management zone. In the second half of 1979 and in 1980, shrimp were found on Strede Bank to the north of Dohrn Bank. Data from the Faroese and French fisheries and the Greenland exploratory fishery in 1980 on the western side of the 200-mile limit indicate the following: in April-June, the fishery took place in an area transected by 66°N latitude and 30°W longitude; in July-August, shrimp had virtually disappeared from this area; in September-October, commercial concentrations were again found but the center of distribution had now shifted northward to an area transected by 66°45'N and 28°30'W; no data were available for the November-March period. The western part of the fishing area is bordered by deeps with soft muddy bottom, no fishable grounds being present, and, to the southeast, the area is bordered by the deep between the East Greenland and the Icelandic plateaux. No definite topographical barrier has been detected towards the north but the actual area of fishing is determined by the extent of ice cover. Hydrographic variation, especially the pulsations of polar water from the north, would be expected to influence the distribution of shrimp.

Exploratory trawling by Greenland and Danish vessels between 63°N and the main fishing area and to the west of this area in April, May, August and October indicated that shrimp were present all over the area but in very low concentrations (catch rates close to zero). Data from Icelandic research trawling during the past 15 years confirmed these observations.

### 2. Fishery

The fishery for shrimp, which was started in 1978 by an Icelandic vessel on the Icelandic side of the fishery limit between Greenland and Iceland, has continued since then. There was some Norwegian trawling in 1979, and a fishery on a large scale began on the Greenland side of the limit in 1980, especially by Norwegian and Faroese trawlers during March-July. Faroese fishing was stopped in July but vessels were allowed to enter the area again in October. Commercial fishing by Danish vessels and exploratory fishing by Greenland vessels occurred during the April-October period. Catches (metric tons) by country for the East Greenland area in 1978-80 were as follows:

| Year | Denmark | Faroes | France | Greenland | Iceland | Norway | Total |
|---|---|---|---|---|---|---|---|
| 1978 | - | - | - | - | 363 | - | 363 |
| 1979 | - | - | - | - | 485 | 800 | 1,285 |
| 1980[1] | 667 | 4,036 | 53 | 186 | 500 | 2,278 | 7,720 |

[1] Preliminary data to end of October.

### 3. Catch-per-unit-effort

Catch rates for the main fishery area on the Greenland side of the 200-mile limit show the same trend in the different fleets, being high in March-April and declining during May and June. In 1980, about 85% of the total catch reported up to October was taken in the early part of the year. Catch rates

(kg/hour) reported by month for 1980 are as follows:

| Month | Denmark & Greenland | Faroe Islands | France | Iceland | Norway |
|---|---|---|---|---|---|
| March | - | 1015 | - | - | 900 |
| April | 734 | 641 | - | - | 691 |
| May | 401 | 373 | - | - | 378 |
| June | 117 | 195 | - | 108 | 101 |
| July | - | - | 69[1] | 84 | - |
| August | 19 | - | - | 109 | 227[1] |
| September | 212 | - | - | 125 | 114 |
| October | 125 | - | - | 99 | - |

[1] Based on low catch figures.

4. Biology

Little is known about the general biology and life history of shrimp on the East Greenland Plateau. Samples have been taken in the Icelandic fishery since 1978 but these do not cover the main area of fishing. Samples taken on the Greenland side of the fishing limit in 1980 were reported by Greenland, Faroe Islands and France. All of these sampling data give a somewhat variable picture.

The Icelandic samples, which cover mainly the autumn season, show a much lower percentage of females than samples taken in April-May, and the same is seen in the French samples taken in July. There are indications from the Icelandic data that as many as 25% of the females do not mature. Nearly all maturing females had spawned by August. The 50% point of sexual reversal is 28.5 mm (carapace lenth) compared to 23 mm in shrimp on the Icelandic Plateau. This clearly indicates a difference in maturity of shrimp on the East Greenland and Icelandic plateaux. The main fishery in April-May clearly exploits berried females of very large size.

The Faroese and Greenland samples show differences in modes of length distributions of females and males + transitionals of about 5 mm between the East Greenland samples and comparable data for West Greenland. Some females (about 7-8%) still carried eggs in June. Very little is known about the horizontal and vertical distributions of shrimp at East Greenland, and no explanation could be offered for the very low catches of shrimp in the main area during July-August. It is possible that the low water temperature found in the area delays the metabolic processes responsible for sexual development, thus resulting in shrimp growing to a large size before changing sex.

5. Biomass Estimates (SCR Doc. 80/XI/172)

One biomass estimate (23,000 tons) for the western side of the fishing limit was presented. This estimate was based on a part of the catch-rate data for the Faroese fleet for only a 4-month period. After considerable discussion, it was agreed that this estimate could not be considered representative of the true stock size at East Greenland.

6. Total Allowable Catch

It was not possible to give any firm assessment of the factors which caused the very low catch rates during the summer, but fishing patterns and environmental factors were mentioned during the discussion. Consequently, it was not possible to provide any indication of what quantity could be removed from this stock. Considering the very limited information available and the uncertainty about the size of this stock, it was agreed that a cautious approach should be taken in allowing exploitation of this resource.

7. By-catches

Information on by-catches was available from the French, Greenland, Danish and Icelandic fisheries, based on logbooks and observer reports. The by-catches included small quantities of redfish, cod, wolffishes, and some other species (e.g. blue whiting). Capelin in large quantities were occasionally caught, and cod and Greenland halibut were sometimes dominant. The length distribution of redfish, which was the dominant by-catch species in the Icelandic fishery, showed a length range of 10-24 cm. Some relative shrimp catches and by-catches (tons) in 1980 were as follows:

| Month | Greenland and Denmark | | | | France | | |
|---|---|---|---|---|---|---|---|
| | Shrimp catch | By-catch | | | Shrimp catch | By-catch | |
| | | redfish | capelin | mixed | | redfish | cod |
| Apr | 24 | 0.8 | - | - | - | - | - |
| May | 498 | 3.3 | 2.7 | 0.6 | - | - | - |
| June | 9 | - | - | - | - | - | - |
| July | - | - | - | - | 2.8 | 0.2 | 0.3 |
| Aug | 1 | 1.1 | 2.0 | - | - | - | - |
| Sep | 54 | 0.2 | - | - | - | - | - |
| Oct | 25 | 0.4 | - | - | - | - | - |

## 8. Future Research

Research requirements for the West Greenland area apply equally well to the East Greenland stock. In addition, biological sampling should cover all fishing areas and all months of the year. It was also noted that the East Greenland stock should, if possible be considered for a tagging study.

## IV. ADJOURNMENT

There being no further business, the Chairman expressed his thanks to all participants, especially the conveners and rapporteurs of the two working groups, for their keen interest and cooperation during the course of the meeting, and to the Secretariat staff for their efficiency in the preparation of documents and reports.

# PART H

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   a) Review of harp and hooded seal stocks (Convener: Dr A. W. Mansfield)
      i) Research in 1979
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1. Opening (Chairman: Mr R. H. Letaconnoux)

   a) Appointment of rapporteur
   b) Adoption of agenda
   c) Plan of work

2. Consideration of Report of STACFIS (Chairman: Dr G. H. Winters)

   a) Stock assessments
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      ii) Capelin (2+3K, 3LNO)
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1. Appointment of rapporteur
2. Adoption of agenda
3. Plan of work
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   a) Stocks lying completely outside the Canadian 200-mile fishery zone in Subarea 3, as required by the Fisheries Commission:
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      ii) Redfish (3M)
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   b) Stocks lying within or partly within the Canadian 200-mile fishery zone in Subareas 2, 3 and 4 for which advice on the scientific basis for management in 1981 has been requested by Canada (Annex 1):
      i) Cod (2J+3KL, 3NO)
      ii) Redfish (3LN)
      iii) Silver hake (4VWX)
      iv) American plaice (3LNO)
      v) Witch flounder (2J+3KL, 3NO)
      vi) Yellowtail flounder (3LNO)
      vii) Greenland halibut (2+3KL)
      viii) Roundnose grenadier (2+3)
      ix) Argentine (4VWX)
      x) Capelin (2+3K, 3LNO)
      xi) Squid-*Illex* (3+4)
   c) Stocks within the EEC fishery zone in Subarea 1 for which advice on the scientific basis for management in 1981 has been requested by the EEC (Annex 2):
      i) Cod (1)
      ii) Redfish (1)
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      iii) Shrimp (0+1)
   e) Other matters relevant to assessments
      i) Uniform mesh size for silver hake and squid fisheries in Subarea 4 (*ICNAF Redbook* 1979, page 51 and 83)
      ii) Commencement date for squid fishery in Subareas 3 and 4 (*ICNAF Redbook* 1979, page 59)

3. Gear and Selectivity

   a) Selection studies on silver hake and squid-*Illex* (*ICNAF Redbook* 1979, page 51)
   b) Selection studies on Greenland halibut (*ICNAF Redbook* 1979, page 57)
   c) Other selectivity studies
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   a) Further progress on ageing silver hake
   b) Guidelines for cod otolith interpretation
   c) Further progress on ageing squid from statoliths
   d) Progress in redfish age validation studies
   e) Ageing and validation studies on other species

5. Fishery Science Items for Consideration at future meetings of the Scientific Council

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   b) Evaluation of the scientific advice provided for management of the Northwest Atlantic fish stocks, with particular reference to cod

c) Review of Flemish Cap research program
d) Review of environmental conditions, 1970-79

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   ii) Development of standard world list of 3-alpha species identifiers
   iii) Compendium of statistical standards for fishing vessels, fishing gear and fishing effort
   iv) Conversion factors
   v) Agenda for 10th session of CWP
b) Fishery statistics
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   ii) Adequacy of national reporting
      - advance statistics for mid-term assessments
      - STATLANT 21A and 21B reports
   iii) Review of statistical requirements
   iv) Review of data processing procedures
   v) Consideration of tabular format for NAFO Statistical Bulletin
c) Sampling program
   i) Implementation of sampling data base
   ii) Status of Sampling Yearbook for 1977
   iii) Efficiency of sampling in 1978
   iv) Acquisition of Greenland halibut sampling data for previous years
   v) Partial length measurement for grenadiers
   vi) Review of reporting requirements for sampling data (Forms CFS-1 and CFS-2)
   vii) Acquisition and processing of detailed 1979 data
d) Reports on national statistical systems
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b) Review of proposed manual on groundfish surveys (revised draft to be prepared by the editor)
c) Review of survey stratification schemes
d) Progress in improving survey methods
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   i) Intensification of surveys for cod stocks in Div. 3M, 3N and 3O
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g) Other matters

3. Environmental Studies

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f) Other matters

4. Review of Tagging Activities

a) Report on tagging activities in 1979
b) Other studies

5. Other Matters

IV. Publications (Chairman: Dr R. G. Halliday)

1. Consideration of Publication Requirements

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b) Sampling Yearbook (Vol. 24 for 1979)
c) Selected Papers
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F. ANNUAL MEETING, SEPTEMBER 1980

1. Opening (Chairman: Mr R. H. Letaconnoux)

a) Adoption of agenda
b) Appointment of rapporteurs
c) Plan of work

2. Fishery Science (Chairman: Dr G. H. Winters)

a) Task Force on Larval Herring Program (Convener: Dr M. D. Grosslein)
b) Analyses related to Flemish Cap Project (Convener: Mr R. Wells)
c) Review of guidelines for cod otolith interpretation
d) Other matters

3. Research Coordination (Chairman: Dr V. A. Rikhter)

a) Consideration of format of Table 5 in first NAFO Statistical Bulletin
b) Review of proposed manual on groundfish surveys (Editor: Dr W. G. Doubleday)
c) Report of *ad hoc* Working Group on Squid Research (Convener: Mr T. Rowell)
d) Review of MEDS progress report for 1979
   i) Summary of environmental conditions during 1979
   ii) Inventory of 1979 oceanographic data
   iii) Data received and processed for 1979

iv) Progress in acquiring historical data
v) Involvement with Flemish Cap Project
vi) National representatives for reporting oceanographic data to MEDS

e) Other matters

4. Publications (Chairman: Dr R. G. Halliday)

a) Editorial policy relating to scientific publications
b) Format of primary and secondary scientific publications
c) Other matters

5. Collaboration with Other Organizations

a) Preliminary report on NAFO participation in the Tenth Session of the CWP
b) Collaboration with ICES regarding redfish research in Subarea 1 and East Greenland

6. Adoption of Reports

a) Provisional report of June 1980 Meeting of Scientific Council
b) Reports of STACFIS, STACREC and STACPUB

7. Future Scientific Meetings (Annex 3 and 4)

8. Other Business

9. Adjournment

## G. SPECIAL MEETING, NOVEMBER 1980

1. Opening (Chairman: Mr R. H. Letaconnoux)

a) Appointment of rapporteur
b) Adoption of agenda
c) Plan of work

2. Fishery Science (Chairman: Dr G. H. Winters)

a) Review of harp and hooded seals (Convener: Dr A. W. Mansfield)
i) Review of fishery
ii) Research in 1980
iii) Stock relationships
iv) Population assessment
- Vital rates
- Pup production
- Stock size
- Sustainable yield
v) Future research needs

b) Review of shrimp stocks in Subareas 0 and 1, and at East Greenland[1] (Convener: Mr P. Kanneworff)
i) Review of fishery trends
ii) Distribution and biology
iii) Catch and effort
iv) By-catches in shrimp fishery
v) Biomass estimates
vi) Total allowable catches
vii) Future research needs

c) Other matters

3. Adoption of Reports

a) Provisional report of September 1980 Meeting of Scientific Council
b) Report of Scientific Council (this meeting), including the report of STACFIS

4. Review of Future Meeting Arrangements

a) Special Meeting (17-21 February 1981)
b) Regular Meeting (3-20 June 1981)
c) Annual Meeting (12-18 September 1981)

5. Other Matters

   a) Scientific Council recommendations and proposals for 1980 and 1981 (NAFO Circular Letter 80/77)
   b) Progress report on publication of Vol. 1 of the Journal of Northwest Atlantic Fishery Science

6. Adjournment

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[1] Assessment of East Greenland shrimp stock included on the Agenda at the request of ICES and with the concurrence of the Executive Committee of the Scientific Council.

## ANNEX 1. CANADIAN REQUEST FOR ADVICE ON THE SCIENTIFIC BASIS FOR MANAGEMENT IN 1981 OF CERTAIN STOCKS IN SUBAREAS 0 TO 4

Canada requests that the Scientific Council, at its meeting in advance of the 1980 NAFO Annual Meeting, provide advice on the scientific basis for management of the following stocks in 1981:

Cod (Div. 2J and 3KL; Div. 3N and 3O)
Redfish (Div. 3N and 3O)
American plaice (Div. 3L, 3N and 3O)
Witch flounder (Div. 2J, 3K and 3L; 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)
Argentine (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 1980 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1981 of the following stocks:

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

Although capelin (2+3K and 3LNO stocks) and squid (Subareas 3-4) were considered at the February 1980 Meeting of the Scientific Council, it is requested that the Standing Committee on Fisheries Science, at its June 1980 Meeting, consider whether the analyses conducted in February are sufficient to provide the basis for advice on management in 1981 and whether reconsideration of the status of these stocks after completion of the 1980 fishery, but in advance of the 1981 fishery, would provide significant improvements in the basis for advice on management.

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:

a) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and management options evaluated in terms of their implications of fishable stock size in both the short and the 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 1981 and subsequent years should be evaluated. The present stock size should be described in relation to those observed historically and to those to be 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 1981 and the long term.

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

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

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

## ANNEX 2. EEC REQUEST FOR ADVICE ON THE SCIENTIFIC BASIS FOR MANAGEMENT IN 1981 OF CERTAIN STOCKS IN SUBAREAS 0 AND 1

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

a) Stocks occurring both in the EEC and Canadian fisheries 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.

For the above-mentioned stocks, the present state of exploitation should be reviewed and options for management in 1981 given. Where possible, these should be expressed graphically in terms of catch in 1981 and the size of the spawning stock biomass on 1 January 1982, for a range of values of F which covers at least -50% to +25% of F in 1979.

For cod in Subarea 1, it is requested that catches for each year up to and including 1983 and spawning stock biomasses for each year up to and including 1984 are calculated for maintaining F at the following levels from 1981 onwards: $F = 0.1$, $F = 0.2$, $F = F_{0.1}$ and $F = 0.6$. For 1980, F will be that value needed to take the TAC. All values of F refer to that on the most heavily exploited age-groups.

Advice is requested on the effects on the stock of redfish in Subarea 1 of by-catches of that species in the shrimp fishery and on the stock of cod in Subarea 1 of by-catches of that species in the fishery for catfish, and on measures which might be adopted to minimize by-catches of both these species.

Mr M. Marcussen, Head of Division
Directorate General for Fisheries
Commission for the European Communities
Brussels, Belgium

## ANNEX 3. CANADIAN REQUEST FOR ADVICE ON THE SCIENTIFIC BASIS FOR MANAGEMENT OF SEAL FISHERIES WITHIN NATIONAL FISHERIES LIMITS

At the request of Canada, the Scientific Council at a special meeting in November 1979 provided advice on the scientific basis for management in 1980 of stocks of harp seals and hooded seals within national fishery limits in NAFO Subareas 0, 1, 2, 3 and 4. Subject to the consent of the other contracting party involved, the Canadian Government considers it desirable that the Scientific Council similarly provide advice on the scientific basis for seal management in 1981.

For the stocks of both species, it is requested that the Council comment on the following aspects:

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

2. 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.

3. 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.

It is suggested that the Council meet and report during the autumn of 1980 with dates to be established through appropriate consultation.

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

## ANNEX 4. EUROPEAN ECONOMIC COMMUNITY REQUEST FOR ADVICE ON THE SCIENTIFIC BASIS FOR MANAGEMENT OF SHRIMP IN SUBAREAS 0 AND 1

On behalf of the EEC, I kindly request the Scientific Council to take measures to make available the advice on shrimps in NAFO Subareas 0 and 1 by early October. I wish to point out that it is of great importance to the Community to dispose of this advice by early October.

If it would facilitate the work of the Scientific Council, the Commission of the European Communities is ready to make meeting room and secretarial assistance available in Brussels for a meeting of the Assessment Committee.

Mr M. Marcussen, Head of Division
Directorate General for Fisheries
Commission for the European Communities
Brussels, Belgium

# II. LIST OF SCIENTIFIC COUNCIL RECOMMENDATIONS, 1979-80

F. ANNUAL MEETING, SEPTEMBER 1980

# III. LIST OF RESEARCH AND SUMMARY DOCUMENTS, 1979

## RESEARCH DOCUMENTS, 1979

| SCR Doc. | Serial | |
|---|---|---|
| 79/XI/1 | N012 | BOWEN, W. D. Changes in harp seal reproductive parameters: another look |
| 79/XI/2 | N013 | ULLTANG, Ø., and S. TORHEIM. Norwegian investigations on shrimp, *Pandalus borealis*, off West Greenland in 1979 |
| 79/XI/3 | N014 | BOWEN, W. D., and D. E. SERGEANT. Research on the population biology of harp seals in 1979 |
| 79/XI/4 | N015 | BOWEN, W. D. A mark-recapture experiment to determine harp seal pup production on the Front, 1979 |
| 79/XI/5 | N016 | MINET, J. P. Data on catches, CPUE and biomass of shrimp (*Pandalus borealis*) from the French fishery off West Greenland in 1979 |
| 79/XI/6 | N017 | DUPOUY, H., J. FRÉCHETTE, and C. LEROY. Biomass estimate of the northern deepwater shrimp, *Pandalus borealis*, in NAFO Divisions 1B and 0B - *R/V Thalassa* survey, September-October 1979 |
| 79/XI/7 | N018 | PARSONS, D. G. Canadian research efforts for shrimp (*Pandalus borealis*) in Division 0A and Subarea 1 in 1979 |
| 79/XI/8 | N019 | FRÉCHETTE, J., and H. DUPOUY. Preliminary biological data on the shrimp stocks of Davis Strait |
| 79/XI/9 | N020 | KANNEWORFF, P. Stock biomass in 1979 of shrimp (*Pandalus borealis*) in NAFO Subarea 1 estimated by means of bottom photography |
| 79/XI/10 | N021 | KAPEL, F. O., and A. GEISLER. Progress report on research on harp and hooded seals in Greenland, 1978-79 |
| 79/XI/11 | N022 | CARLSSON, D. M., and P. KANNEWORFF. Areas of basic strata in West Greenland, ICNAF/NAFO Subarea 1 |
| 79/XI/12 | N023 | BOWEN, W. D., and G. H. WINTERS. On population size and sustainable yield of Northwest Atlantic harp seals |
| 79/XI/13 | N024 | LARSEN, F., and F. O. KAPEL. Seasonal and regional distribution of tagged harp seals recaptured in Greenland, 1949-79 |

## SUMMARY DOCUMENTS, 1979

| SCR Doc. | Serial | |
|---|---|---|
| 79/XI/1 | N025 | NAFO Secretariat. Problems encountered in documenting fishery statistics from cooperative arrangements between coastal states and other countries |
| 79/XI/2 | N026 | NAFO. Report of Scientific Council on Shrimp and Seals, Dartmouth, Canada, 13-16 November 1979 |

# IV. LIST OF RESEARCH AND SUMMARY DOCUMENTS, 1980

## RESEARCH DOCUMENTS, 1980

| SCR Doc. | Serial | |
|---|---|---|
| 80/II/1 | N027 | HURLEY, G. V., and P. BECK. The observation of growth rings in statoliths from the ommastrephid squid, *Illex illecebrosus* |
| 80/II/2 | N028 | MAXIM, C. Population structure of *Illex illecebrosus* on the Scotian Shelf in the summer of 1979 |
| 80/II/3 | N029 | MAXIM, C. Stock assessment of *Illex illecebrosus* in Division 4W based on the area-density method |
| 80/II/4 | N030 | MAXIM, C. Capelin (*Mallotus villosus*) catch, effort, and biological characteristics in the Romanian fishery in Division 2J, September-October 1979 |
| 80/II/5 | N031 | HURLEY, G. V. An examination of criteria for the short-term forecasting of inshore abundance of squid (*Illex illecebrosus*) at Newfoundland |
| 80/II/6 | N032 | HOYDAL, K. The Faroese longline fishery on the Flemish Cap cod stock in 1979 |
| 80/II/7 | N034 | MARI, A., and R. DOMINGUEZ. Biomass estimates of squid (*Illex illecebrosus*) in Divisions 4VW, 1979 |
| 80/II/8 | N040 | HATANAKA, H., and T. SATO. Outline of Japanese squid fishery in Subareas 3 and 4 in 1979 |
| 80/II/9 | N041 | NAGAI, T., and Y. UOZUMI. Estimation of the abundance index for *Illex* based on Japanese fishery operations along the edge of the Scotian Shelf, 1979 |
| 80/II/10 | N042 | VAZQUEZ, A., and M. G. LARRANETA. Assessment of the cod stock in Divisions 3NO |
| 80/II/11 | N043 | DUPOUY, H., and J. C. POULARD. Biomass estimate and biological characteristics of the squid (*Illex illecebrosus*) on St. Pierre and Burgeo Banks (Subdivision 3Ps) in the autumn of 1979 |
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| 80/VI/6 | N106 | NAFO Secretariat. Provisional list of conversion factors for selected Northwest Atlantic species (+ Corrigendum) |
| 80/VI/7 | N107 | NAFO Secretariat. Tagging activities reported for the Northwest Atlantic in 1979 and supplementary data for 1976-78 |
| 80/VI/8 | N108 | NAFO Secretariat. Provisional list of sampling data for 1978 |
| 80/VI/9 | N109 | NAFO. Report of *ad hoc* Working Group on the Flemish Cap Project, January 1980 (R. Wells, Convener) |
| 80/VI/10 | N115 | CWP Secretary. Notes on international classifications and definitions used in fishing gear, fishing effort and fishermen statistics |
| 80/VI/11 | N116 | NAFO Secretariat. Historical catches of selected species by stock area and country for the period 1969-78 |
| 80/VI/12 | N119 | SATO, T., and H. HATANAKA. Japanese research report for 1979 |
| 80/VI/13 | N120 | NAFO Secretariat. Efficiency of sampling the major fisheries of the Northwest Atlantic in 1978 |
| 80/VI/14 | N121 | CWP Secretary. Notes on the inter-agency 3-alpha identifiers for species items in fish catch and landings data |
| 80/VI/15 | N122 | CWP Secretary. Provisional agenda for the Tenth Session of the Coordinating Working Party on Atlantic Fishery Statistics |
| 80/VI/16 | N125 | NAFO. Preliminary report of the Larval Herring Task Force, Woods Hole, USA, 28 April-1 May 1980 (M. D. Grosslein, Convener) |
| 80/VI/17 | N132 | HORSTED, Sv. Aa. Denmark (Greenland) research report for 1979 |
| 80/VI/18 | N144 | KONSTANTINOV, K. G., and A. S. NOSKOV. USSR research report for 1979 |
| 80/VI/19 | N158 | MÖLLER, S., and H. SCHULTZ. German Democratic Republic research report for 1979 |
| 80/VI/20 | N170 | NAFO Secretariat. Revised outline of NAFO sampling program |
| 80/VI/21 | N171 | NAFO Secretariat. Report on statistical activities and publications, 1979/80 |
| 80/VI/22 | N172 | MINET, J. P. French research report, 1979 |
| 80/VI/23 | N173 | VALDES, E., and A. MARI. Cuban research report, 1979 |
| 80/VI/24 | N174 | PACIORKOWSKI, A. J. Polish research report, 1979 |
| 80/VI/25 | N175 | NAFO. Provisional report of the Scientific Council, Dartmouth, Canada, 3-13 June 1980 (see Part E, this volume) |
| 80/IX/26 | N176 | GIBSON, J. A., and E. D. ANDERSON. United States of America report on research in the Northwest Atlantic during 1980 |
| 80/IX/27 | N177 | NAFO Secretariat. Provisional nominal catches in the Northwest Atlantic, 1979 |
| 80/IX/28 | N193 | SANDEMAN, E. J., J. S. SCOTT, and J. BOULVA. Canadian research report, 1979 |
| 80/IX/29 | N195 | NAFO Secretariat. CWP recommendations of direct importance to the NAFO Scientific Council |
| 80/IX/30 | N202 | NAFO. Report of Larval Herring Task Force, April 1980 (M. D. Grosslein, Convener) |
| 80/IX/31 | N229 | DOUBLEDAY, W. G. (Editor). Manual on groundfish surveys in the NAFO area (draft) |

Summary Documents (continued)

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|---|---|---|
| 80/IX/32 | N240 | NAFO. Provisional report of Scientific Council, St. John's, Newfoundland, Canada, 3-8 September 1980 (see Part F, this volume) |
| 80/IX/33 | N245 | NAFO Secretariat. Sealing statistics for the Northwest Atlantic, 1980 |
| 80/IX/34 | N263 | NAFO. Report of Scientific Council, Dartmouth, Canada, 18-22 November 1980 (see Part G, this volume) |

# V. LIST OF PARTICIPANTS IN SCIENTIFIC COUNCIL MEETINGS, 1979-80

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| | | Meetings |
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| P. Kolarov | Research Institute of Fisheries and Oceanography, Boul. Chervenoarmeisky 4, Varna | A B D F |

## CANADA

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| C. A. Bishop | " " " " " | E |
| W. D. Bowen | " " " " " | C G |
| W. R. Bowering | " " " " " | E F |
| J. E. Carscadden | " " " " " | D F |
| E. L. Dalley | " " " " " | F |
| E. G. Dawe | " " " " " | F |
| G. P. Ennis | " " " " " | E |
| T. A. Kendaris | " " " " " | F |
| D. W. Kulka | " " " " " | B E |
| W. H. Lear | " " " " " | F |
| G. R. Lilly | " " " " " | F |
| W. D. McKone | " " " " " | B E F |
| D. S. Miller | " " " " " | D |
| D. G. Parsons | " " " " " | C G |
| A. T. Pinhorn | " " " " " | A B C D E F |
| T. K. Pitt | " " " " " | B E F |
| R. Radtke | " " " " " | F |
| D. A. Roff | " " " " " | G |
| E. J. Sandeman | " " " " " | B E F |
| D. A. Tilley | " " " " " | E |
| R. Wells | " " " " " | B D E F |
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| C. Kohler | " " " " | E |
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