



SCIENTIFIC COUNCIL MEETING - SEPTEMBER 1986

Report of Scientific Council
Annual Meeting, Halifax, Nova Scotia, Canada
3-12 September 1986

CONTENTS

	<u>Page</u>
I. Fishery Science	3
1. Special Session on Recruitment Studies	3
2. Stock Assessments	3
3. Environmental Research	3
4. Topics for Future Special Sessions	4
5. Other Matters	4
II. Research Coordination	4
1. Documentation of National Conversion Factors	4
2. Survey Design Procedures	4
III. Publications	4
1. Editorial Matters	4
2. Promotion of Journal	4
3. Papers for Publication	4
4. Microfiche	5
IV. Rules of Procedure	5
1. Final Results of Vote by Mail	5
2. Implementation of the Amended Rules	5
V. Future Scientific Meetings	5
1. Special Meeting on Shrimp, January 1987	5
2. Scientific Meeting in June 1987	5
3. Special Session and Annual Meeting in September 1987	5
4. Scientific Meeting in June 1988	6
5. Special Session and Annual Meeting in September 1988	6
VI. Other Matters	6
1. Provisional Report of June 1986 Meeting	6
2. Consideration of Reports of Special Mid-term Meetings	6
3. Proposal Regarding the Feasibility of Establishing a Herring Stock	6
VII. Adjournment	6
Appendix I. Report of Standing Committee on Fishery Science (STACFIS)	7
1. Special Session on Recruitment Studies	7
1. Introduction	7
2. Georges Bank	7
3. Flemish Cap	8
4. Other Recruitment-related Studies	10
5. General Discussion	10
6. Publication of Papers	11

II. Stock Assessments	11
1. Cod in Divisions 3N and 3O	11
2. Silver Hake in Divisions 4V, 4W and 4X	12
3. Further Consideration of Fisheries Commission Questions	12
4. Review of Arrangements for Conducting Stock Assessments	16
III. Environmental Research	17
1. Appointment of Environmental Subcommittee Chairman	17
2. Other Matters	17
IV. Topics for Future Special Sessions	17
1. Outline for Special Session in September 1987	17
2. Proposed Theme for Special Session in September 1988	17
V. Review of Scientific Papers	18
1. A Genetic Stock Structure Study of Dogfish in the Northwest Atlantic	18
2. Nature of Spermatogenesis, Type of Spawning and Maturity Scale in Testes of Pearlsides	18
3. Mesopelagic Fishes in the NAFO Subareas 1, 2 and 3	18
4. Newfoundland Fleet Discarding Practices	18
VI. Other Matters	18
1. Trawl Escapement and Selectivity Problems	18
2. Report of <i>ad hoc</i> Working Group on Recruitment and Abundance Indices for Cod	19
3. Acknowledgements	19
Appendix II. Report of Standing Committee on Publications (STACPUB)	21
1. Editorial Matters	21
2. Promotion of Journal	21
3. Review of Papers for Publication	22
4. Other Matters	22
5. Acknowledgements	22
Appendix III. Agenda	23
Appendix IV. List of Participants	25
Appendix V. List of Research and Summary Documents	27

REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, September 1986

Chairman: J. Messtorff

Rapporteur: V. M. Hodder

The Scientific Council and its Standing Committees on Fishery Science (STACFIS) and Publications (STACPUB) met at the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, during 8-12 September 1986, to consider and report on various matters listed in the Agenda (Appendix III). Representatives attended from Canada, Cuba, EEC, Japan, Portugal, Spain, and USSR (Appendix IV).

That meeting was preceded by the Special Session on "Recent Advances in Understanding Recruitment in Marine Fishes of the Northwest Atlantic with Particular Emphasis on Georges Bank Herring and Flemish Cap Cod and Redfish Stocks", which was held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, during 3-5 September 1986, with approximately 50 scientists in attendance.

The reports of the Standing Committees, as adopted by the Council at this meeting, are given in Appendices I and II. Appendix V contains lists of the research and summary documents. Brief summaries of these reports and other matters considered by the Council are given below.

I. FISHERY SCIENCE (APP. I)

1. Special Session on Recruitment Studies

At the Special Session which was convened by M. D. Grosslein (USA), 26 scientific papers and 2 oral reports were presented by authors from various countries. The first day was devoted primarily to papers dealing with herring recruitment on Georges Bank and in adjacent waters, following a review paper which traced the development of the ICNAF larval herring program and subsequent studies relevant to herring recruitment. The second day focused on the Flemish Cap program and was also begun with the presentation of a review paper which summarized the development of this program and the results of recruitment-related research on cod and redfish. On the third day, the presentations dealt with more general recruitment studies not directly related to the two major international projects.

The Council was encouraged by the level of interest and discussion promoted by this Special Session. While the mechanisms behind recruitment of marine fish are still far from being resolved, many areas of research were identified which could enhance future knowledge on this very important subject. In general, the Special Session was considered to be highly successful with good attendance and high quality papers that promoted fruitful discussion.

2. Stock Assessments

A reassessment of the cod stock in Div. 3NO was carried out by STACFIS. While no precise TAC could be advised, the Scientific Council agreed with results of the evaluation performed by STACFIS regarding the biomass levels.

The Scientific Council supported the recommendations of STACFIS regarding questions from the Fisheries Commission on definition of the cod stock in Div. 2J+3KL and the Greenland halibut stock in Subarea 2 and Div. 3KL, which were deferred from the June 1986 Meeting.

The Scientific Council noted that a standard method of calculating abundance estimates from juvenile silver hake surveys has now been adopted by the countries involved and supported this decision. It was further noted that no new research recommendations for silver hake were considered necessary at this time.

A review of arrangements for conducting stock assessments was carried out by STACFIS, and the Scientific Council endorsed the recommendations for further improving the efficient use of time at future June meetings.

3. Environmental Research

The Council noted that the present Chairman of the Environmental Subcommittee (M. Stein, EEC) was re-elected for a second term and supported this decision by STACFIS. The Council also endorsed changes in positions of two standard stations off West Greenland as well as the continuation of the occupation of the Seal Island standard section off Labrador during autumn.

4. Topics for Future Special Sessions

The Council adopted the program which was outlined by STACFIS for the Special Session in September 1987 on "Biology of Demersal Resources of the North Atlantic Continental Slope, with Emphasis on Greenland Halibut and Grenadiers", noting that W. R. Bowering (Canada) had agreed to be convener. The Secretariat was requested to prepare and circulate a suitable announcement as soon as possible after the present meeting.

The Council also adopted the proposal by STACFIS that the theme for the Special Session in 1988 be "The Impact of Changes in Environmental Conditions in the North Atlantic on Distribution, Availability and Abundance of Marine Species, with Particular Emphasis on the Labrador and Grand Bank Regions during the early 1980's".

5. Other Matters

Data were not available for STACFIS to provide advice on trawl escapement and selectivity problems. Therefore, the Council recommends that the national Scientific Council representatives bring this matter to the attention of scientists in their institutes and present any forthcoming information at the June 1987 Meeting.

The Council was encouraged by the results of discussion in the working group on the development of abundance indices and recruitment indices for cod in Div. 2J+3KL, which was held during the first 2 days of the STACFIS Meeting in June 1986. The Council endorsed the use of these standard indices until such time as superior indices are developed and proven.

II. RESEARCH COORDINATION

1. Documentation of National Conversion Factors

With reference to the recommendation of STACREC in June 1986, the Assistant Executive Secretary reported that, although FAO had recently solicited up-to-date information on conversion factors from national statistical offices, the most recent data available was published in FAO Fisheries Circular No. 725 (1980). When the Secretariat was informed that the circular was out-of-print, a condensed version was prepared and issued as SCS Doc. 86/25. It is anticipated that FAO may report some up-to-date information to the CWP (Coordinating Working Party on Atlantic Fishery Statistics) in February 1987.

2. Survey Design Procedures

The Council noted that the Secretariat had received, before the June 1986 Meeting, detailed information on survey procedures from Canada, Federal Republic of Germany, France, and USSR. No additional information has been received.

Regarding establishment of a working group to evaluate the submitted material and to examine past survey results in order to derive more precise abundance indices for assessment purposes, the Council was informed that the nominated candidate for convener, S. Gavaris (Canada), was unable to accept the task due to other commitments. This then led to the nomination of W. Brodie (Canada) who agreed to undertake the work. Final composition of the *ad hoc* working group was deferred to the June 1987 Meeting, but J. Messtorff (EEC), V. A. Rikhter (USSR) and J. C. Poulard (EEC) were named as national contacts by correspondence, so that work can be initiated before the June 1987 Meeting.

III. PUBLICATIONS (APP. II)

1. Editorial Matters

The Council noted the efforts of STACRFIS to find a new Editor for the Journal and approved the interim measures for maintaining publication schedules.

2. Promotion of Journal

The Council stressed the importance of measures to promote a wider distribution of the Journal and agreed that the actions proposed by STACPUB should be quickly implemented.

3. Papers for Publication

The Council was pleased to note that a substantial number of papers which had come before it were potentially suitable for publication, and, in particular, the list included the review papers presented to the Special Session (SCR Doc. 86/101 and 104), as proposed by participants in that session.

4. Microfiche

The Council looked forward to completion of the microfiching of all research-related ICNAF documents and was pleased to note that sets of microfiche would be made available for purchase before the end of 1986.

The Council agreed that having historical documents available at meetings away from Headquarters would be most valuable and recommends that the Executive Secretary provide the Council, at the June 1987 Meeting, with a proposal regarding the purchase of a portable microfiche reader for use of the Scientific Council and its Committees. One set of microfiche must be available for the use of the Council.

The Council is of the view that the microfiche sets will be popular with libraries and wishes their availability to be widely known. The Council recommends that the Executive Secretary ensure that the relevant laboratories of all Contracting Parties and all libraries and organizations, which had expressed some interest in purchase when previously solicited, be informed immediately that sets are available. Furthermore, advertisements for these sets should be placed in forthcoming issues of Scientific Council publications, a flyer should be prepared for inclusion with the proposed brochure advertising the Journal, and all other opportunities should be taken to make the availability of microfiche sets known.

With the ICNAF document project approaching completion, the Council agreed that it was timely to consider microfiching NAFO documents and requests STACPUB to consider to matter at its June 1987 Meeting.

IV. RULES OF PROCEDURE

1. Final Results of Vote by Mail

The Executive Secretary informed the Council that he had contacted the Contracting Parties, who had not responded to the May 1986 request for a vote on the amendment to the Council's Rules of Procedure (NAFO Sci. Coun. Rep., 1985, page 107). Tabulation of the responses indicated that a quorum had indeed existed at the time of the mail vote. The final result is that the amendment to the Council's Rules of Procedure was adopted for future use.

2. Implementation of the Amended Rules

The Council considered it necessary that action be taken under these rules to ensure that proxy votes are available at the June 1987 Meeting from Contracting Parties not in attendance. Accordingly, the Council recommends that the Executive Secretary contact all Contracting Parties well in advance of the June 1987 Meeting and request them, if they do not intend to send a Scientific Council representative to the meeting, to provide him with authority to cast a proxy vote on their behalf under Rule 2.3.

The Council agreed that its Rules of Procedure, including the amendments that are given on pages 107-108 of NAFO Scientific Council Reports for 1985, be distributed as a summary document as soon as possible after this meeting.

V. FUTURE SCIENTIFIC MEETINGS

1. Special Meeting on Shrimp, January 1987

The Council, upon being informed that an official invitation had been received from the Greenland Fisheries and Environmental Research Institute, Copenhagen, Denmark, agreed to meet there during 28 January-3 February 1987, to review the status of the shrimp stocks in Davis Strait and Denmark Strait, as requested by Canada and Denmark (on behalf of Greenland) (SCS Doc. 86/6 and 12).

2. Scientific Meeting in June 1987

The Council reaffirmed its decision in June 1986 to meet, together with its Standing Committees on Fishery Science, Research Coordination and Publications and the Environmental Subcommittee, at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 3-18 June 1987. This meeting will deal with the usual requests for scientific advice on fisheries management and other fisheries-related research and statistical matters.

3. Special Session and Annual Meeting in September 1987

The Scientific Council will meet in conjunction with the Annual Meeting of NAFO at Halifax, Nova Scotia, during 14-18 September 1987. That meeting will be preceded on 9-11 September by the Special Session on "Biology of Demersal Resources of the North Atlantic Continental Slopes, with Emphasis on Greenland Halibut and Grenadiers".

4. Scientific meeting in June 1988

Considering the need for the Secretariat to arrange for meeting facilities at the Bedford Institute of Oceanography well in advance of scientific meetings, the Council tentatively agreed to meet during 1-16 June 1988.

5. Special Session and Annual Meeting in September 1988

Considering that the Annual Meeting is scheduled for 5-9 September 1988, the Council tentatively agreed that the Special Session be held on 12-14 September 1988.

VI. OTHER MATTERS

1. Provisional Report of June 1986 Meeting

The Council formally approved, with minor amendments, the summary report of its meeting on 4-19 June 1986 (SCS Doc. 86/24, and Corrigenda).

2. Consideration of Reports of Special Mid-term Meetings

In the context of the discussion on time and place of the Mid-term Meeting on Shrimp, concern was expressed about the poor representation of Contracting Parties. It was suggested, therefore, that the Scientific Council should, under those circumstances, restrict its activity to the provision of scientific advice on shrimp without considering matters of a more general nature which should be discussed in the presence of Scientific Council representatives from more Contracting Parties. It was also suggested that the Scientific Council, at its forthcoming June meeting, will review the report of the Special Meeting on Shrimp in January 1987 in order to see if there is any potential for improving the advice on shrimp at subsequent mid-term meetings.

3. Proposal Regarding the Feasibility of Establishing a Herring Stock

The Council Chairman introduced a letter from J. J. Graham (USA), which sought the Scientific Council's endorsement of a proposal to hold a conference on the establishment of the Georges Bank herring stock by artificial means (injection of early life stages). The Council representatives showed little interest in supporting the proposal and requested the Chairman to communicate this view to Dr. Graham.

VII. ADJOURNMENT

There being no further business, the Chairman expressed his sincere thanks to the Chairmen of STACFIS and STAC PUB, to the rapporteurs, and to all participants for their cooperation and support in fulfilling the tasks of the Council. Appreciation was also expressed, on behalf of all representatives, to the Secretariat members for their excellent assistance.

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

Chairman: W. R. Bowering

Rapporteurs: Various

The Committee met at the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, during 8-11 September 1986, to consider and report on various fishery science matters that were referred to it by the Scientific Council. Representatives attended from Canada, Cuba, EEC, Japan, Portugal, Spain and USSR.

That meeting was preceded by the Special Session on recruitment studies, which was held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, during 3-5 September 1986. The session attracted scientists from Canada, EEC, Japan, Norway, Portugal, Spain, USSR and USA.

The various matters that were considered at both sessions are outlined below. Various participants contributed to the preparation of initial drafts of different sections of this report.

I. SPECIAL SESSION ON RECRUITMENT STUDIES

1. Introduction

The Special Session on "Recent Advances in Understanding Recruitment in Marine Fisheries of the Northwest Atlantic, with Particular Emphasis on Georges Bank Herring and Flemish Cap Cod and Redfish Stocks", convened by M. D. Grosslein (USA), was held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 3-5 September 1986. Twenty-six scientific papers and two oral reports were presented. The first day was devoted chiefly to papers dealing with herring recruitment on Georges Bank and in adjacent waters. A review paper (SCR Doc. 86/104) traced the development of the ICNAF larval herring program and subsequent studies relevant to herring recruitment and provided a synopsis of knowledge to date on the recruitment process in herring. The second day focused on the Flemish Cap Program and similarly was begun with a review paper (SCR Doc. 86/101) which summarized development of the project and the results of recruitment-related research on the cod and redfish stocks. On the third day, papers were presented on general recruitment studies, which were not directly related to those of the two major international projects. Discussion periods followed the presentation of papers on each of the three days.

The papers represented a wide range of topics covering the entire reproductive life cycles of herring, cod and redfish, with particular emphasis on empirical correlations of recruitment with various physical and biological factors, including spawning stock size and processes affecting abundance, distribution, dispersal, survival and growth of egg and larval stages. Knowledge of these processes was reviewed in relation to the principal historical and current hypotheses about timing and mechanisms which control year-class strength. Also, the effectiveness of research approaches, represented by the Georges Bank and Flemish Cap programs, was considered in relation to their objectives and to the understanding and predictability of recruitment achieved, and ways of improving research strategy were discussed at length.

2. Georges Bank

The ICNAF larval herring project was initiated in 1971 to help clarify the relative sizes and interrelationships of the adult and juvenile herring populations in the Georges Bank-Gulf of Maine region. The objectives were expanded in 1974 to investigate the factors which control variability in year-class success, and this led to a much broader research program which ultimately contributed to a comprehensive description of the ecology of herring larvae and associated ichthyoplankton and zooplankton on Georges Bank and the primary production and hydrography of the region.

During the 8 years of the ICNAF program (1971-78), timing and location of spawning on Georges Bank and Nantucket Shoals were documented, larval growth, feeding and mortality were described, and larval production curves were calculated for each year. Initial larval production was correlated with spawning stock size, but larval abundance (up to 6 months of age) was not correlated with recruitment, indicating that year-class success was not set before the late larval stage. From the ICNAF larval herring survey program, knowledge of the late larval and post-metamorphosis stages was extremely limited. However, other evidence points to the determination of year-class size at least by the end of the first year of life (age 1) but probably earlier near the time of metamorphosis.

Mortality in postlarval and juvenile stages (late larvae to age 2) appears to be roughly comparable in magnitude to that of the first 6 months (eggs to late larvae), which indicates that both periods may be roughly of equal importance in controlling year-class size. In any case, neither the classical "critical period" hypothesis nor the "match-mismatch" hypothesis appears to control recruitment variability in Georges Bank herring. It was noted that overwinter mortality of larvae may exert significant control over recruitment variability, and there was some evidence during several winter seasons that this mortality was inversely correlated with temperature and larval abundance. However, the collapse of the herring stock on Georges Bank in 1978 interrupted the data series, and the significance of overwinter mortality could not be confirmed.

Although the overall objectives of the ICNAF program on Georges Bank herring were successfully met (except for the limitations imposed by the untimely collapse of the stock), there were several constraints on the program which should be avoided in the future. In particular, the rate of processing the zooplankton samples was slow, and timely evaluation and reporting of results was not possible, resulting in prolonged delay in completion of the patch study. In future, for largescale programs, adequate resources should be committed to ensure timely processing of samples. In addition, resources should be allocated to sampling postlarval as well as larval stages of each cohort to provide a basis for comparing mortality profiles of each stage.

Eight papers were presented on a wide range of topics relevant to recruitment of Georges Bank herring. The introductory paper summarized the status of knowledge on recruitment processes in herring, based on available analysis and reports prior to the Special Session. The overview demonstrated that the ICNAF larval herring program had succeeded in estimating spawning biomass, larval dispersal and mortality for a series of years prior to the disappearance of the population. A westerly shift in spawning from Georges Bank to Nantucket Shoals was observed, coincidental with the shift in fishing activity after the disappearance of herring from eastern Georges Bank. A review of the herring stock structure in the entire Gulf of Maine region confirmed that the stocks are discrete at the time of spawning (and for the first several months of larval life) but that juveniles and adults intermix at other times of the year.

A review was presented of the historical literature and the results of MARMAP (Marine Monitoring Assessment and Prediction) surveys which have monitored larval production since 1977. The former indicated that herring, although present, was probably not a dominant species on Georges Bank during the first half of the 20th century. The MARMAP data indicated virtual extinction of spawners on Georges Bank (as shown by the absence of larvae) over the last eight spawning seasons (1978-85), although limited spawning still occurs on Nantucket Shoals.

Three zooplankton faunal zones were described on Georges Bank and these were related to different water masses on the Bank. A seasonal cycle and interannual variability of these zones were documented and the zones were linked to ichthyoplankton faunal zones (described in an earlier paper) which in turn appeared to be linked to retention of shelf larvae on the Bank.

In the last year of the ICNAF program (1978), a multinational larval herring patch study was conducted on Georges Bank. Although no herring larvae were found, a dense patch of chaetognaths was observed in the area normally occupied by early-stage herring larvae and the drift of chaetognaths served as a model for larval herring. The analysis indicated that the mean drift and dispersion of the patch was inconsistent with mean flow, but the observed dispersal was plausible if vertical structure of the water column (both physical and biological) was taken into account.

A model of recruitment to the coastal Maine herring fishery was described. It took account of spawning stock size, overwintering temperature, and exchange rates from east to west and between coastal waters and estuaries. Model development and validation were noted as being in progress.

A study of recruitment to the Gulf of St. Lawrence herring stocks documented predation by mackerel on herring eggs and unusual mortality of herring eggs which were deposited in extremely thick layers. This unusual spawning behavior may have been triggered by oscillations in temperature due to storms.

An exploratory analysis of satellite imagery was undertaken to develop indices of the exchange of shelf water and slope water in the Northwest Atlantic, insofar as they may affect recruitment. Hypotheses developed from the exploratory analysis will be tested on independent data.

Dispersion of larval sea scallops from the Bay of Fundy, Georges Bank and Scotian Shelf was described. There was no evidence of larval exchange between spawning areas, but only two spawning seasons have been sampled.

3. Flemish Cap

Flemish Cap was chosen for the groundfish study because fluctuations in year-class strength of both cod and redfish had been observed, the cod stock was discrete, the area was not too large, the circulation patterns were likely to be amenable to study, and a historical data base existed for both physical oceanography and fish production. Objectives of the project were very broad: to study the effect of water circulation patterns on the retention of larvae and the influence of the abundance and size composition of the food supply on the survival of larvae; to determine the effect of intraspecific and interspecific predation on the survival of juvenile fish; and to improve the assessment of the size of the spawning stock in order to study the relationship between stock size and recruitment. When it became clear that only two countries (USSR and Canada) would participate, the frequency of ichthyoplankton surveys was much reduced (original proposal was one every 2 weeks) and special juvenile surveys were eliminated. Most sampling was conducted from 1978 to 1983, with some surveys continuing to the present.

The program documented several significant events: for example, a strong year-class of cod arose from a small spawning stock; two relatively strong year-classes of redfish were born; annual differences in growth rates of redfish and larvae were described; one year-class of redfish virtually disappeared at the larval stage and another was greatly reduced in abundance at the juvenile stage. Causes of these events have not yet been described. With respect to the hypotheses listed above, it is thought that breakdown of the clockwise gyre on the bank might cause a loss of eggs and larvae, but there has been no documentation of such a breakdown that was followed by a loss of larvae and subsequent poor recruitment. However, mortality from dispersal away from Flemish Cap clearly does occur, and the results of a numerical model of water dispersion on the bank (oral presentation by S. A. Akenhead) indicated that the observed progressive shift of larval redfish from the edge (where spawning occurs) toward the center of Flemish Cap can be attributed to diffusion. Furthermore, from the model, it appears possible to distinguish between the rate of loss from Flemish Cap and the mortality rate occurring on the bank. Spatial and temporal patterns in the life cycle of copepods have been described, but relationships between prey availability and the feeding of fish larvae, and between feeding and survival, have not been described. Cod are known to consume smaller cod and large numbers of small redfish, but the contribution of predation on juveniles to variability in year-class strength has not been assessed. Recruitment in cod appears to be unrelated to size of the spawning stock.

Although the project has not yet greatly advanced an understanding of factors which affect recruitment, it has greatly improved knowledge of the physical oceanography of Flemish Cap and the biology of the species found there. The ichthyoplankton community has been described. For redfish, the time and location of spawning, the change in distribution of larvae over time, and the vertical distribution of larvae are known. Rates of growth and mortality during 2 years have been measured. Very few eggs and larvae of cod were caught, but some information on distribution, growth and mortality was obtained. Techniques were developed for ageing redfish larvae by interpreting rings in otoliths. One important study was conducted on variability in the abundance of redfish larvae at a single station during a 24-hour period. Repeated bottom-trawl hauls within a small area provided a good measure of the distribution of catches within strata.

Several aspects of the Flemish Cap Project reduced the probability of success. First, Flemish Cap is so far from land that it was not convenient to make brief diversions from research trips to other areas, and, hence, observations tended to be greatly restricted in time. Flemish Cap turned out to be a poor choice for other reasons: the poor biological sampling of the commercial catch made it difficult to measure recruitment and spawning stock size, the lack of success in keeping moored current meters in place caused the early curtailment of the special oceanographic program, and the intensive fishery kept the cod stock at a very low level so that the influence of varying stock size on recruitment could not be studied. The hypotheses remained too numerous and too broad, so that the research effort, already very limited, was not sufficiently focused on specific questions. The time required for analyses was seriously underestimated. Results came out so slowly that progress could not be adequately monitored, and the program could not be modified in response to accumulating information. Ichthyoplankton gear in use by the two countries should have been identical, or a calibration study of different gears should have been conducted and reported at a very early stage. The bongo sampler used by Canada was quite useful as a tool for measuring abundance but it was much less useful for examining various aspects of the biology of larvae, such as distribution in the water column. The absence of surveys for juveniles meant that the success of each cohort could not be assessed until juveniles were caught in bottom-trawl surveys in the following winter, and even these catches were unsatisfactory because the juveniles were not highly recruited to the trawling gear. The ageing of juvenile redfish received too little attention, and there was very little work on adult redfish. The redfish spawning stock could not be measured, partly because fecundity was not measured, and cannibalism in redfish could not be measured because there were no quantitative feeding studies. A major problem was that the project went into a monitoring phase without the benefit of a pilot study to describe such things as the annual zooplankton production cycle, spawning times, horizontal and vertical distribution of adults, eggs, larvae and juveniles, and the growth patterns of larvae and juveniles. A very important factor was that the total effort was much too small to address the hypotheses that were proposed. In fact, the total effort was probably equivalent to that which one might want to put into a pilot project, with the lack of a strong seasonal component.

Much data analysis remains to be completed. It may be possible to account for annual variability in mortality of larvae by examining the dynamics of water circulation or by analyzing spatial variation in food availability, feeding and condition. A more accurate estimate of spawning stock of cod may be forthcoming from new information on fecundity and the percentages of females (by size-group) which spawn in a given year. There will also be further analyses of the influence of prey availability on the production of the cod stock, and of the influence of predation by cod on mortality of juvenile redfish and cod. It will also be possible to use the groundfish surveys to describe the groundfish "community" and to look for changes over a period of at least 8 years.

4. Other Recruitment-related Studies

On the third day, the final series of recruitment-related papers included a method for identifying daily growth increments on the shells of larval scallops; temperature-induced effects on survival of Arcto-Norwegian cod larvae; recent surveys of 0-group saithe off the Norwegian coast; effects of temperature and severe advective events on survival of haddock eggs and larvae on Georges Bank; and a conceptual evaluation of the evidence for internal behavioral capabilities of early life stages of fishes, which allow them to "direct" their movements contrary to passive drift. Following the presentation of these papers, there was general discussion on the issues which were raised during the course of the Special Session.

5. General Discussion

The papers stimulated discussion on a number of key topics, including stock structure, density-dependent and density-independent processes, age at which year-class strength is established (i.e. predictable), and adequacy of estimates (i.e. accuracy, precision, and independence of variables). It was apparent that no single dominant physical or biological process determines recruitment and that critical events can occur at almost any stage in the early life history. This implies that year-class strength is not established in a predictive sense until relatively late in the first year of life. Because of the multiplicity of possible factors that can operate over a broad time-scale, it will be difficult to develop useful predictive models to explain interannual variability.

It was concluded that density-dependent processes are most relevant to long-term fishery management strategies, because they involve biological mechanisms that can be influenced by fishing. Although greater research emphasis on density-dependent processes seems desirable, it is clear that these processes cannot be isolated from physical factors which have a density-independent effect, and thus both types of processes must be incorporated into a definitive research strategy on the recruitment problem.

Evidence of density-dependent effects (on growth, maturation and fecundity) was discussed relative to herring, and several hypotheses were considered regarding depensatory processes that might explain the nearly complete extinction of Georges Bank herring and the failure of the stock to recover after almost a decade. If the demise of the stock was due to depensatory processes which began operating after the population was reduced to a very low level by fishing, a slow recovery (if at all) may be expected. Recovery of the herring stock may also be inhibited by increased abundance of several species, most notably sand lance. The replacement may have resulted from the response of opportunistic species which filled the void that was left when the herring stock was overexploited, or from a change in the climatic regime that favored the replacement species, or both.

There was general agreement among participants that the recruitment process is so complex that even large logistic efforts, such as the ICNAF Georges Bank and Flemish Cap projects, may not provide a level of understanding of mortality causes and predictive capability sufficient to justify their overall costs. In order to improve the chances of success in future recruitment studies, it would be extremely important to ensure that sampling design and scope of the research plan provide all essential data which are relevant to the hypotheses being tested. In particular, it is important to conduct appropriate pilot studies in advance of a standard monitoring series in order to document critical biological characteristics (vertical distribution of pelagic life stages) and to develop and/or test the sampling gear for all important life stages. Also, it is important to select species and stocks which are amenable to an extended and definitive research effort, i.e. clearly discrete stocks which are expected to maintain reasonable spawning populations (not overfished) and for which good data on annual recruitment and stock size are available. Also, it was emphasized that, during the initial planning stages, more importance should be given to assuring adequate resources for timely processing and dissemination of data.

Another explanation for the failure of the Georges Bank herring stock to recover relates to the historical occurrence of herring on the bank. One hypothesis is that Georges Bank is a suboptimal habitat which is occupied when the population expands its distribution due to crowding of the optimal habitat (e.g. coastal waters). If this hypothesis is correct, the recovery of the Georges Bank herring stock will not occur until the coastal populations increase substantially. Further evaluation of alternative hypotheses concerning recovery of the Georges Bank stock is desirable because they have important implications for management.

Despite recognition that significant progress had been made in understanding aspects of the recruitment process, there was general consensus that some new approaches are needed. Suggested new approaches include:

- a) Models (genetic) relating diversity of populations to stock size and vulnerability to fishing and environmental perturbations.
- b) Experimental laboratory work on selected behavioral response of fish (including early life stages) to clarify scope for response to environmental cues, stresses, and other adaptive capabilities.

- c) Studies of actual maturation and spawning processes to determine the range of "condition" of adults and possible effects on egg viability.
- d) Comparative studies among different stocks and general patterns of population distributions and production (particularly stock-recruitment relationships) relative to exploitation levels and environmental characteristics of population habitats.
- e) Incorporation of selected fine-scale studies into the framework of larger-scale studies to improve knowledge of basic biology of fishes and to improve measures of the nature and magnitude of sampling errors.
- f) Improved analytical and statistical procedures to reduce incidence of bias and spurious correlations arising from lack of independence among variables in complex and interrelated data sets.

6. Publication of Papers

Twenty-six research documents were presented and discussed at the Special Session, as follows: SCR Doc. 86/91, 92, 93, 94, 96, 97, 98, 99, 100, 101, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117 and 119 (see Appendix V for titles and authors). With respect to the possible publication of these papers by NAFO, the participants agreed that, in view of the wide range of scope and subject matter, publication of all papers in a single volume was not appropriate. However, it was noted that publication of the overview papers (SCR Doc. 86/101 and 896/104) was desirable as a record of the major international recruitment studies that were sponsored by ICAAF and NAFO.

II. STOCK ASSESSMENTS

1. Cod in Divisions 3N and 3O (SCR Doc. 86/124)

a) Introduction

The status of the cod stock in Div. 3NO was recently considered at the Scientific Council Meeting in June 1986. It was not possible at that time, with the data available, to determine the level of fully-recruited F for 1985, and, consequently, advice concerning stock abundance and biomass was deferred to the present meeting. Additional data which became available since the June Meeting included survey data from Canada for 1986 and USSR for 1985 and 1986, and catch-at-age and catch-effort information from the Canadian commercial fishery during January-June 1986.

b) Input data

i) Commercial fishery catch-effort data

Catch and effort data from Canadian otter trawlers during January-June 1986 were added to previously-used 1977-85 data and analysed by using a multiplicative model. Standardized catch rates (tons/hr) generally increased from 1.22 in 1977 to 1.83 in 1982 and declined to 1.24 in 1986.

ii) Research surveys

New information included age compositions from a USSR survey in 1985 and a Canadian survey in 1986, as well as total biomass and abundance estimates for Div. 3NO from USSR and Canadian surveys in 1986. Total biomass estimates from Canadian surveys have been stable in recent years (mean of 195,000 tons in 1984-86) but were considerably higher than in previous years (60,000 tons in 1977-82). Abundance estimates have declined in Div. 3N since 1984, but the presence of higher numbers of older fish has maintained high biomass levels. Abundance in Div. 3O has fluctuated from 11 million to 49 million fish over the survey period, with estimates being relatively high in 1984 and 1986 (49 million and 45 million respectively). Biomass levels in Div. 3O have been high since 1984.

USSR surveys of Div. 3NO indicated that both total biomass and abundance increased from 1984 to 1985 but decreased in 1986. The dominant year-classes in both the 1986 Canadian survey and the 1985 USSR survey were those of 1981 and 1982. Considerable numbers of older fish, most notably the 1975 year-class, were present in the Canadian 1986 survey. Biomass estimates from Canadian and USSR surveys in 1984-86 were considerably different despite the use of similar survey techniques. These estimates (000 tons) are as follows:

Year	USSR			Canada		
	3N	3O	3NO	3N	3O	3NO
1984	-	-	262.5	92.7	125.3	218.0
1985	284.4	174.5	458.9	82.5	97.2	179.7
1986	159.1	226.1	385.2	95.3	92.7	188.0

A recruitment index, based on abundance of age-groups 2 and 3 from the Canadian and USSR surveys, indicated that the 1980 year-class was originally strong, the 1981 and 1982 year-classes were slightly above average, and the 1983 and 1984 year-classes were weak.

iii) Catch-at-age

Canadian sampling data were used to adjust Canadian catches for the first half of 1986. The dominant year-classes were those of 1980 and 1981. Significant numbers of older fish were present (particularly the 1975 year-class), as had been the case in recent years.

c) Estimation of parameters

The following relationships were considered with regard to surveys, CPUE, cohort abundance and biomass to determine F in 1985: (i) age 5+ survey abundance and age 5+ abundance from cohort analysis; (ii) age 5+ survey abundance and age 5+ abundance from cohort analysis (without 1984); (iii) age 6+ survey abundance and age 6+ abundance from cohort analysis; (iv) age 6+ survey abundance and age 6+ abundance from cohort analysis (without 1984); (v) total survey biomass and age 3+ mid-year biomass from cohort analysis; (vi) total survey biomass and age 3+ mid-year biomass from cohort analysis (without 1984); and (vii) CPUE against exploitable biomass from cohort analysis. Of these relationships, only two (iv and v) produced significant results. In both, for the range of fully-recruited F 's under consideration, the correlation coefficient increased as F_t decreased but the sum of the residuals in the most recent years became larger. With the uncertainties associated with these calibrations, STACFIS concluded that neither could appropriately estimate fishing mortality in 1985.

d) Catch projections

The Canada and USSR survey results indicate that the age 3+ annual mean biomass in 1986 is at least 200,000 tons. This is probably a minimum estimates, as both sets of data assumed a catchability equal to 1, which is considered high for research trawls, and the USSR estimates indicated biomass levels well in excess of 200,000 tons.

STACFIS concluded, therefore, that the mean age 3+ biomass would likely exceed 200,000 tons in 1987. However, since the 1985 terminal F could not be precisely determined, no analytical assessment could be conducted and the detailed advice as requested by the Fisheries Commission cannot be provided. STACFIS, however, advised in 1985 that the 1986 mean age 3+ biomass could be 271,000 tons, and it has no basis at present to consider that the 1987 biomass will be significantly different from that level.

Because of discrepancies in survey results, STACFIS

recommends

that possible reasons for discrepancies between biomass estimates for cod in Div. 3NO from Canadian and USSR survey be investigated, including differences in timing of surveys, gear differences and analysis techniques.

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

a) Standard method of calculating survey abundance indices

It was agreed that the Canadian method of calculating abundance indices of prerecruit year-classes from USSR-Canada cooperative juvenile surveys (SCR Doc. 86/54) should be used in the future.

b) Future research requirements

Research requirements for silver hake were identified in detail at the June 1985 Meeting (NAFO Sci. Coun. Rep., 1985, pages 64-65), and no new requirements were identified at this time.

3. Further Consideration of Fisheries Commission Questions

a) Stock discrimination of cod in Div. 2J, 3K and 3L (SCR Doc. 86/118, 122, 123)

What is the evidence for stock separation of cod in Div. 2J, 3K and 3L, i.e. what stock divisions exist, if any?

A review of past and recent studies on discrimination of the various stock components of cod in Div. 2J+3KL (Fig. 1) included discussion of genetic variation, migrations, meristics, infestation by parasites, growth rates, ages and lengths at maturity, and spawning time. The conclusions drawn in each subject area reflect the authors' interpretations. Cod in Div. 2GH are probably a part of the Labrador-East Newfoundland stock complex but they have been considered separately for management purposes since 1974. Analysis of genetic variation of cod

implied that there was a northern component from the deep northern slopes of the Grand Bank (Div. 3L) up to and including Hamilton Bank (Div. 2J) and a southern component from the shallower areas of the northern Grand Bank (Div. 3L), St. Pierre Bank (Subdiv. 3Ps), Burgeo Bank (Subdiv. 3Ps) and the Gulf of St. Lawrence (Div. 4RS) north of the Laurentian Channel. The cod of Flemish Cap (Div. 3M) were significantly different from the population on the northeastern Grand Bank.

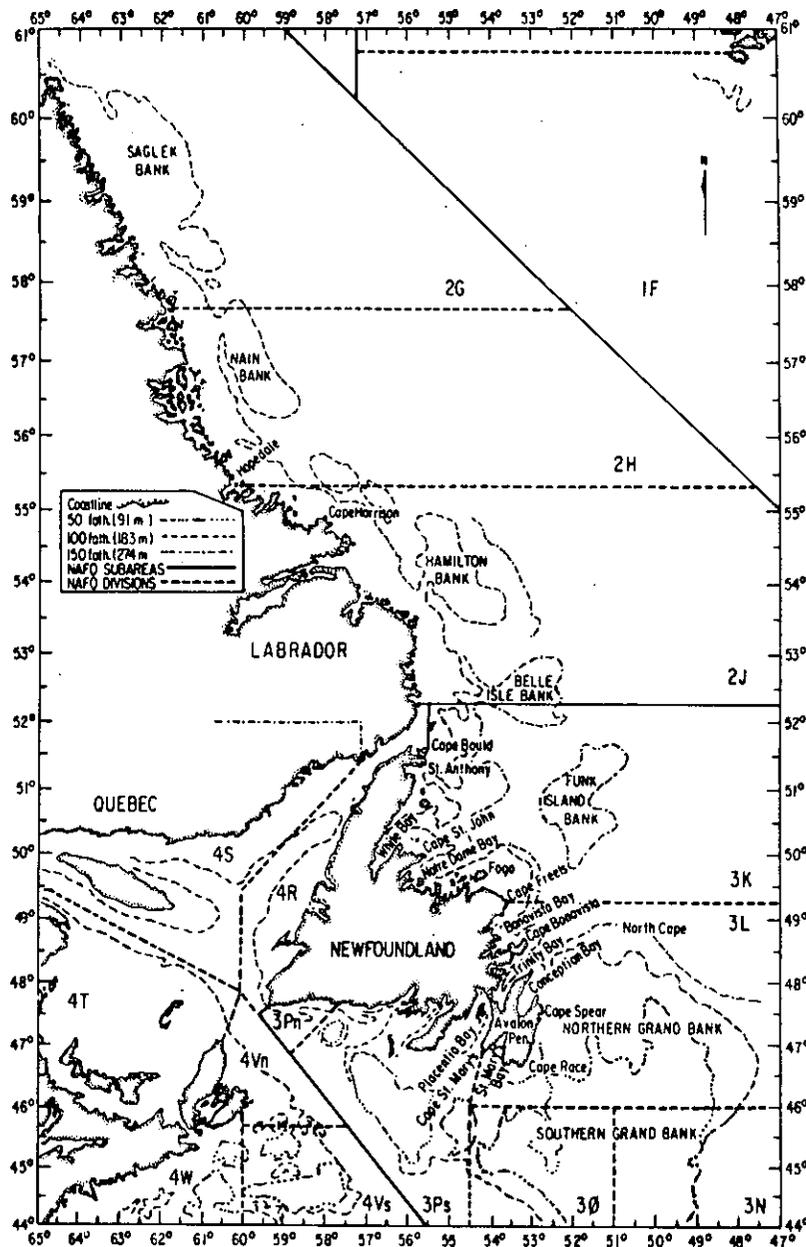


Fig. 1. Area map showing NAFO divisions, offshore banks and some of the place names mentioned in the text.

Studies based upon the parasitic copepod *Lernaeocera branchialis* as a biological tag were considered to be useful in determining relationships between inshore and offshore stock components. In Div. 2J and 3K, the inshore cod and the larger offshore cod were from the same intermingling population, but the smaller offshore cod did not visit the coast in sufficient numbers to obtain high infestation rates. For cod over 30 cm in length, infestation rates near the coast were much higher off Newfoundland and off southern Labrador immediately north of the Strait of Belle Isle than further north along the remainder of the Labrador coast. The cod in Div. 3L had lower infestation rates offshore (east of 50°W) and higher rates inshore. For the nearshore area west of 50°W, infestation rates were as high as in the inshore area for smaller

cod but intermediate for larger sizes. It seems clear that the cod in the offshore area (east of 50°W) have much less contact with the inshore area than cod of the nearshore area (west of 50°W).

From studies on the prevalence of the protozoan parasitic trypanosome (*Trypanosoma murmenensis*) in cod, it was suggested that cod in Div. 2J+3K represented a stock distinct from that in the neighboring Gulf of St. Lawrence (Div. 4RS). There were differences in the prevalence recorded for cod in Div. 2J+3K (southerly limit of 50°N) and Div. 3L, sufficient, in the authors' opinion, to warrant separation of a northern Grand Bank stock from the Labrador-East Newfoundland stock complex.

On the basis of vertebral averages from samples collected in Newfoundland and adjacent areas during 1947-71, an average of 54.8 vertebrae appeared to be appropriate level at which to separate high vertebral averages from low ones. Cod with high vertebral averages extended from Labrador along east Newfoundland to the northern slopes of the Grand Bank. Around the Avalon Peninsula, they usually intermingle with cod of the Avalon stock complex and with migrants from the southern Grand Bank.

On the basis of meristic characters of mature cod from spawning or postspawning concentrations sampled in 1982, it was found that the fin-rays and vertebral counts of cod of southeastern Hamilton Bank were significantly different from those on Funk Island Bank, indicating that they may be distinct spawning components. The homogeneity of the meristic characters from Funk Island Bank and northern Grand Bank did not suggest any differences. The significantly lower vertebral averages of cod on the eastern slope of the Grand Bank indicate that mature cod in this area during the spring are somewhat different from the other groups.

On the basis of taggings during the summer-autumn period in the 1950's and 1960's at many inshore localities from Labrador to the Avalon Peninsula and in offshore areas from Hamilton Bank to the northern Grand Bank, cod were shown to intermingle and overlap from north to south in their winter-spring spawning areas in deep water on the slopes of the Labrador Shelf (Subarea 2) and Northeast Newfoundland Shelf (Div. 3K). In June-September (the main feeding and growing period) in the years after tagging, the most obvious migratory characteristic was the homing of most of the coastally-tagged cod to or near the tagging area.

On the basis of the tagging of about 25,000 cod during February-March, 1978-81, from the prespawning concentrations on Hamilton Bank, Belle Isle Bank, Funk Island Bank and northern Grand Bank, there was evidence, for each group of cod tagged on these offshore banks, of a consistent annual pattern of migration during summer to inshore waters and during winter to or near the offshore areas where they were tagged. The Hamilton Bank component (Div. 2J) evidently contributes to the southern Labrador (Div. 2J) and northeast Newfoundland (Div. 3K) coastal fisheries mainly from Notre Dame Bay northward. The Belle Isle Bank component (located mainly in Div. 2J with a small portion in Div. 3K) migrates during summer mainly to southern Labrador (Div. 2J), the Strait of Belle Isle entrance (Div. 4R) and northeastern Newfoundland as far south as Notre Dame Bay (Div. 3K). The pattern of movement is similar to that of the Hamilton Bank component (Div. 2J) except for the greater proportion in the Strait of Belle Isle from the Belle Isle Bank component. Cod on the northern and northeastern slopes of Funk Island Bank (Div. 3K) migrate during summer to eastern (Div. 3K) and southeastern (Div. 3L) Newfoundland with smaller proportions going to southern Labrador (Div. 2J) and the Strait of Belle Isle (Div. 4R) than from the tagging on Belle Isle Bank. Cod from the southwestern slope of Funk Island Bank (Div. 3K) contribute mainly to the summer inshore fishery of Notre Dame Bay (Div. 3K) and Bonavista Bay (Div. 3L) and, in a smaller degree, to the fishery in Trinity Bay, Conception Bay, and the eastern part of the Avalon Peninsula (Div. 3L). Thus, the components which overwinter and spawn on the northern, eastern and western slopes of Funk Island Bank (Div. 3K) collectively form what might best be described as the "Eastern Newfoundland" stock, and the inshore fishery from the Avalon Peninsula to White Bay, and to Labrador in a small way, would likely be sensitive to changes in the size of this stock. Cod which overwinter on northern Grand Bank (Div. 3L) migrate southwards across the bank to the Virgin Rocks (Div. 3L), to the eastern slope of the bank, and to inshore areas in 3L. This component contributes mainly to the inshore fishery from Trinity Bay southward to St. Mary's Bay, with little effect on the fishery north of Cape Bonavista (i.e. it is limited mainly to Div. 3L).

On the basis of tag recaptures by Newfoundland fishermen in January-April from tagging during 1978-83 of about 33,000 adult cod from offshore concentrations, there was evidence of a significant degree of homing. In years following the tagging, cod returned mainly to the same or adjacent areas where they had originally been tagged. In each of Div. 2J, 3K and 3L, the proportion of recaptures during January-April in the same division was about two-thirds, and most of the remainder were taken in the adjacent division or divisions.

Recaptures in the inshore areas from the same experiments showed that, from cod tagged in Div. 2J in winter, about two-thirds of the inshore recaptures were taken in Div. 2J and 3K and most of the remainder in Div. 3L. From the Div. 3K tagging, in excess of 75% of the recoveries were made in Div. 3K and 3L. Inshore recoveries of cod tagged in Div. 3L were almost entirely (90%) in Div. 3L.

On the basis of an analysis of tag returns from the offshore and inshore areas combined, there was evidence that about half the recaptures of cod which were tagged in Div. 2J were caught in Div. 2J and most of the remainder in Div. 3K. About half of the recaptures of cod which were tagged in Div. 3K were caught in Div. 3K, and those remaining were about equally distributed in Div. 2J and 3L. About two-thirds of the recaptured cod which were tagged in Div. 3L were eventually caught in Div. 3L, and those remaining were about equally distributed in Div. 3K and 3NO. Thus, the results of this analysis indicate a significant intermingling of cod among Div. 2J, 3K and 3L.

The locations of spawning grounds in Subarea 2 and Div. 3KL are poorly documented. However, there is evidence that spawning occurs between April and June in various areas from southern Labrador and Hamilton Bank in the north to the Avalon Channel and the northern and northwestern slopes of the Grand Bank in the south. Tagging of prespawning concentrations of cod on the offshore banks gave results which indicated a clear tendency for fish to return to the vicinity of tagging in following winters, implying an important degree of homing to localized spawning components. In summer, returns were distributed broadly in coastal waters of the division of tagging and those adjacent to it, but, nonetheless, there was also a tendency to home to particular summer feeding grounds. Thus, there is evidence from tagging of a complex of spawning components, the adjacent groups of which overlap broadly in their distributions, particularly in coastal areas in summer. Biochemical, parasitological and meristic studies all indicate close similarities among cod in Subarea 2 and Div. 3K, but these and also the tagging studies indicate that cod in Div. 3L are a more heterogeneous group. Clearly, some of the cod occurring in Div. 3L, particularly those occurring in deep areas of eastern Div. 3L, are similar to those in more northern areas. However, cod on the northern slopes of the Grand Bank, especially in shallower water, show affinities with those of Div. 3NO. From the point of view of assessing the stock in Div. 2J+3KL, in spite of some evidence for genetic subdivisions, the cod of Div. 2J, 3K and 3L are intermingled to a significant degree, especially inshore during the feeding season. The pattern and degree of intermingling may vary, depending on environmental conditions such as ice coverage and water temperature. Therefore, STACFIS concluded that, at present, it is advisable to assess Div. 2J+3KL cod as one stock complex as has been the practice in the past.

From the point of view of management of the resource, STACFIS was not able to precisely assess the effects of exploitation on any one of the spawning components, because biomass estimates of these components were not available. However, from the results to date and the evidence for incomplete mixing of these components, STACFIS advises that the concentration of fishing effort in any one division will generate differential fishing mortality between stock components and that this could result in local overexploitation. If managers wished to guard against this, measures should be considered which provide for a distribution of fishing effort among the three divisions, aimed at a more even distribution of fishing mortality over stock components. Unfortunately, the Committee is not presently able to provide advice on the relative distribution of the resource among divisions but it could provide some general guidance on this matter at a future meeting if requested to do so.

With respect to the stock complex as a whole, the importance of knowing the degree of intermingling of spawning stock components was emphasized, and STACFIS

recommends

that the relative contribution of each spawning component to the offshore and inshore fisheries on that component and on other components be quantified.

With regard to the effects of environmental factors on cod distribution, STACFIS

recommends

that the effects of seasonal ice cover and extreme environmental conditions on cod distribution be examined.

b) Stock discrimination of Greenland halibut in Subareas 2 and 3

What is the evidence for stock separation of Greenland halibut in Subarea 2 and Divisions 3K and 3L, i.e. what stock divisions exist, if any?

To answer this request from the Fisheries Commission, STACFIS reviewed SCR Doc. 82/IX/78 on stock identification studies of Greenland halibut in the Northwest Atlantic. The paper dealt mainly with tagging experiments in the Newfoundland and Labrador areas and also reviewed published stock identification studies based on meristics, biochemical genetics, parasites, and biochemical composition. STACFIS agreed that the weight of the available evidence supports the conclusion that there is a single continuous stock extending from the Davis Strait to the northern Grand Bank, i.e. there is no stock division in Subarea 2 and Div. 3K and 3L.

4. Review of Arrangements for Conducting Stock Assessments

Stock assessments at the June 1986 Meeting were again conducted by using the system of two working groups. Draft reports were considered within each working group as before, but this was done in a more provisional way for some stocks than previously, before consideration by the Committee as a whole.

Two major changes in approach were adopted, the first being to devote 2 days at the beginning of the meeting to development of abundance indices of fishable stock size and recruiting year-classes for cod in Div. 2J+3KL, and the second being the imposition of a strict timetable of work in order to minimize the amount of *ad hoc* reanalysis conducted during the time frame of the meeting. More emphasis was placed on forming research recommendations which, if followed, would result in thorough analyses being conducted and properly documented in time for the assessments at the June 1987 Meeting.

The second innovation resulted in a more timely conduct of business with better distribution of time over consideration of assessments, reanalyses, formulation of advice and drafting of reports, but several problems continue to be identified. In particular, the last 2 days of the meeting devoted to report approval were too cramped for time, resulting in late hours and less effective scrutiny of reports than some members considered desirable. Thus, further improvements in time management are desirable.

One view was that discontinuities in discussions, due to scheduling of non-assessment activities during assessments, resulted in inefficiencies and that this scheduling practice should cease. However, it was also pointed out that time for reanalyses was required, necessitating breaks in the assessment schedule, and that perhaps the creative use of the whole Scientific Council timetable to provide appropriately-timed breaks in the assessment schedule would contribute more to the efficient conduct of business. More weight was given to this latter view, and STACFIS

recommends

that the Council's timetable for the 1987 June Meeting be revised to accommodate suitable breaks in the assessment schedule.

It was recognized that it will be necessary, nonetheless, to continue to schedule the meetings of other committees in advance to facilitate attendance by appropriate experts. It was also pointed out that the proposal of the September 1985 Meeting concerning ways of dealing with reports was only partially implemented. At that time, it was agreed that working groups would carry their work only as far as agreement on report content and that the first draft of the report be discussed and approved by STACFIS (NAFO Sci. Coun. Rep., 1985, pages 114-115). The intention was that the reports should be subjected to only one review and not two, as in the previous year. It was agreed that this approach should be fully implemented at the June 1987 Meeting.

The report-approval process has proved to be a difficult one from the institution of the working group approach, particularly in determining what is open for discussion at each approval stage and in controlling discussion to appropriate aspects. It is this process which largely determines the degree of autonomy of working groups from STACFIS or, put conversely, the extent to which STACFIS as a whole participates in matters which are first considered in working groups. The above proposal should result in most, usually all, technical aspects of particular stock assessments being resolved within working groups. It will then be the responsibility of the working group convener, in conjunction with his rapporteurs, to ensure that a satisfactory first draft of the report is made available to STACFIS. This may involve the main participants in a particular stock assessment in consultations and redrafting but would not involve convening a working group meeting. When the report comes before STACFIS, the primary purposes would be to ensure (i) that it is a clear and unambiguous statement of perceived stock status, and (ii) that the advice provided is consistent with that statement and answers fully any questions asked by the Scientific Council. Clearly, the report must also be open to comment on its technical accuracy both by members of the working group and other STACFIS members. However, to ensure efficient working of the Committee, members should be expected to raise only matters of particular substance, i.e. those for which there is established theory or recorded observation supportive of the member's point and not matters which are supported only by personal opinion. The Chairman of STACFIS must rule at an early stage on whether a technical point is one which is sufficiently new to allow debate or whether it has been adequately dealt with in a working group.

It was generally recognized that the ideal situation would be to conduct all business in the Committee rather than have some aspects dealt with in working groups. This would not only solve difficulties in report approval but give all members an opportunity to bring their expertise to bear fully on all topics. It was agreed that a return to this situation, or even to one where several of the major stocks were assessed in STACFIS while the remainder were done in working groups, was not practical immediately. However, it was agreed that this is a situation which should be worked towards by progressively implementing new procedures which increasingly devote Committee time to advice formulation and to recommendations for technical analyses which are to be conducted between the June meetings.

III. ENVIRONMENTAL RESEARCH

1. Appointment of Environmental Subcommittee Chairman

It was the unanimous decision of STACFIS to re-elect the present Chairman, M. Stein (EEC), for a second term of 2 years until September 1988.

2. Other Matters

- a) On behalf of the Greenland Fisheries and Environmental Research Institute, Copenhagen, Denmark, the Chairman of the Environmental Subcommittee presented a proposal for change in location of two stations in Subarea 1, because the present positions are in areas of unfavorable topography. Accordingly, STACFIS

recommends

that the position of the first station on the Lille Hellefiskebanke Section be changed from 65°06'N 53°00'W (150 m) to 65°06'N 52°55'W (490 m), and the first station on Fyllas Banke be changed from 64°01'N 52°19'W (108 m) to 63°57'N 52°22'W (287 m).

- b) The Chairman of the Environmental Subcommittee informed STACFIS that occupation of the Seal Island Section off Labrador will not be continued by the Federal Republic of Germany beyond 1985. STACFIS proposed that the hydrographic survey of this section be undertaken during the Canadian autumn survey in Div. 2J, and this was endorsed by Canadian scientists. The Environmental Subcommittee Chairman pointed out that it would not be necessary to run the section in a quasi-synoptic way. Standard methods of sampling were recommended.

IV. TOPICS FOR FUTURE SPECIAL SESSIONS

1. Outline for Special Session in September 1987

At the September 1985 Meeting, "Biology of Demersal Resources of the North Atlantic Continental Slope, with Emphasis on Greenland Halibut and Grenadiers" was chosen as the theme for the Special Session in advance of the Annual Meeting in September 1987. At the June 1986 Meeting, W. R. Bowering (Canada) was unanimously nominated to be Convener for the Special Session. The following outline was adopted:

a) General theme

The primary intent is to elicit research papers on Greenland halibut and grenadiers which have established commercial potential but about which relatively little is known. While the principal area of interest is the North Atlantic Ocean, papers related to Greenland halibut in the North Pacific Ocean are welcomed since it is the same species as in the North Atlantic. The scope of the Special Session will be broadened to include other unexploited deepwater species which share the same or greater depths on the continental slope. These may include benthic invertebrates of the slope but excludes well-studied species such as cod and redfish even though these species are distributed along the upper parts of the slope. Papers which deal with oceanographic and topographic features of the slope area, especially in relation to the biology of deepwater species, are also invited.

b) Specific topics

- i) Oceanographic features of North Atlantic continental slopes.
- ii) Spatial and temporal distribution and abundance of deepwater species.
- iii) Biological characteristics (age and growth, sexual maturity, food and feeding, other biological features).
- iv) Species interactions (e.g. predator-prey relationships among deepwater species).
- v) Biological implications to management.

2. Proposed Theme for Special Session in September 1988

STACFIS, at its June 1986 Meeting, considered that the "early eighties anomaly" in the environment and its possible impact on distribution and availability of marine species would be a topic of interest for a Special Session of the Council, possibly in September 1988. It has since been suggested that the environmental conditions of the early 1980's may prove to be of long-term duration and, hence, may prove not to be suitably characterized as "anomalous"; that a definitive description of the impacts of conditions in the early 1980's are unlikely to be possible until the early 1990's, and, hence, 1988 is too early to deal with this question; and that effects on recruitment should also be considered, but this likewise could not be described until the early 1990's).

While STACFIS considered that these views were valid in the context of providing a definitive statement on impacts of observed environmental changes, the motivation for the original proposal lay in the stock assessment difficulties being faced at June meetings, which appeared to stem from these changes. In the stock assessment context, greater understanding of the influences of environmental changes on distribution and abundance, and their impact on survey and commercial abundance indices, is required immediately. STACFIS considered that these practical aspects should be the focus of the September 1988 Special Session. The effects on recruitment, as distinct from survey recruitment indices, would of necessity have to be considered at a later date.

STACFIS confirms its view that a Special Session on the general topic proposed at the June 1986 Meeting would be worthwhile, and proposes the following title:

"The impact of changes in environmental conditions in the North Atlantic on the distribution, availability and abundance of marine species, with particular emphasis on the Labrador and Grand Bank regions in the early 1980's".

It was suggested that the session synopsis, while emphasising the practical stock assessment implications for stocks in these latter areas, encourage case histories of effects of environmental changes on resources in other areas (particularly the Northeast Atlantic).

V. REVIEW OF SCIENTIFIC PAPERS

1. A Genetic Stock Structure Study of Dogfish in the Northwest Atlantic (SCR Doc. 86/102)

Previous studies of the stock structure of spiny dogfish (*Squalus acanthias*), using tagging methods, indicated that they are composed of one stock in the Northwest Atlantic with an extensive seasonal migration. In this study, the amount of genetic differentiation between dogfish from the Gulf of Maine and on the Scotian Shelf was estimated from electrophoretically detectable protein loci expressed in skeletal muscle and liver. Both samples were in Hardy-Weinberg equilibrium and showed no genetic differentiation in allelic frequencies. These results support the previous conclusions that there is one stock of spiny dogfish which undergoes large seasonal migrations.

2. Nature of Spermatogenesis, Type of Spawning and Maturity Scale in Testes of Pearlsides (SCR Doc. 86/120)

Histophysiological analysis of changes in the gonads of male pearlsides (*Maurolicus muelleri*) was carried out on specimens that were collected in the central North Atlantic (48°N to 58°N). Some special features in the development of the reproductive system were investigated, including stages of maturation and the duration and nature of spawning.

3. Mesopelagic Fishes in the NAFO Subareas 1, 2 and 3 (SCR Doc. 86/121)

A total of 586 samples of mesopelagic fish of the Suborder Stomiatoidei, belonging to 27 species, were collected in Subareas 1, 2 and 3 during 1979-85. The distributions of all species are shown and their biology briefly described.

4. Newfoundland Fleet Discarding Practices (SCR Doc. 86/95)

The discarding practices of the offshore fleet of Newfoundland trawlers in 1985 were examined and compared with other years. An increase in discard rate of all species combined (10%) was observed in 1985 to almost twice the 1981 level, and of cod, haddock, redfish and flatfish (8%) to almost three times the 1981 level. It was noted, however, that these levels of discard are moderate compared to levels in some fisheries in the Northeast Atlantic. Sizes of discarded cod in the Div. 2J+3KL fishery ranged from 22 cm to 55 cm with an average of 42.5 cm. The extent to which increasing discarding of small cod reflected improved recruitment was not quantified.

VI. OTHER MATTERS

1. Trawl Escapement and Selectivity Problems

The Scientific Council was requested by the Fisheries Commission to consider escapement and selectivity problems that are associated with the use of strengthening ropes, splitting straps and codend floats (FC Doc. 84/6, revised, para. 21). This topic initially appeared on the agenda for the September 1985 Meeting of the Scientific Council and was repeated on the agenda for the June 1986 Meeting and the present meeting. No scientific information on this matter has been submitted, and STACFIS is not aware of any research being undertaken to address these issues.

2. Report of Ad Hoc Working Group on Recruitment and Abundance Indices for Cod

STACFIS reviewed the progress made at its June 1986 Meeting toward deriving indices of abundance which could be used as standards in future assessments of the Div. 2J+3KL cod stock. The working group met during the first two days of the STACFIS meeting and considered all available data relating to abundance indices for this stock based on commercial and research data and recruitment indices based on research data.

At the present meeting, STACFIS concluded that the index based on the abundance estimates for ages 3-6 from Canadian autumn surveys during 1977-85 in Div. 2J and 1978-85 in Div. 3K and spring surveys during 1976-85 in Div. 3L, as constructed and used at the June 1986 Meeting (SCS Doc. 86/24, page 27), be adopted as the standard index of recruitment for estimating year-class size at the June 1987 Meeting.

With regard to a standard index of abundance for Div. 2J+3KL cod from survey data, it was agreed that the index based on the Canadian autumn surveys in Div. 2J, 3K and 3L, as constructed and used at the June 1986 Meeting (SCS Doc. 86/24, page 26), be adopted as one standard index for estimating abundance and calibrating the cohort analysis at the June 1987 Meeting.

With regard to a standard index of abundance for Div. 2J+3KL cod from commercial data, it was agreed that the index based on the standardized catch rate from the multiplicative model using 1979-85 data only, as constructed and used at the June 1986 Meeting (SCS Doc. 86/24, page 27), be adopted as another standard index for estimating abundance and calibrating the cohort analysis at the June 1987 Meeting.

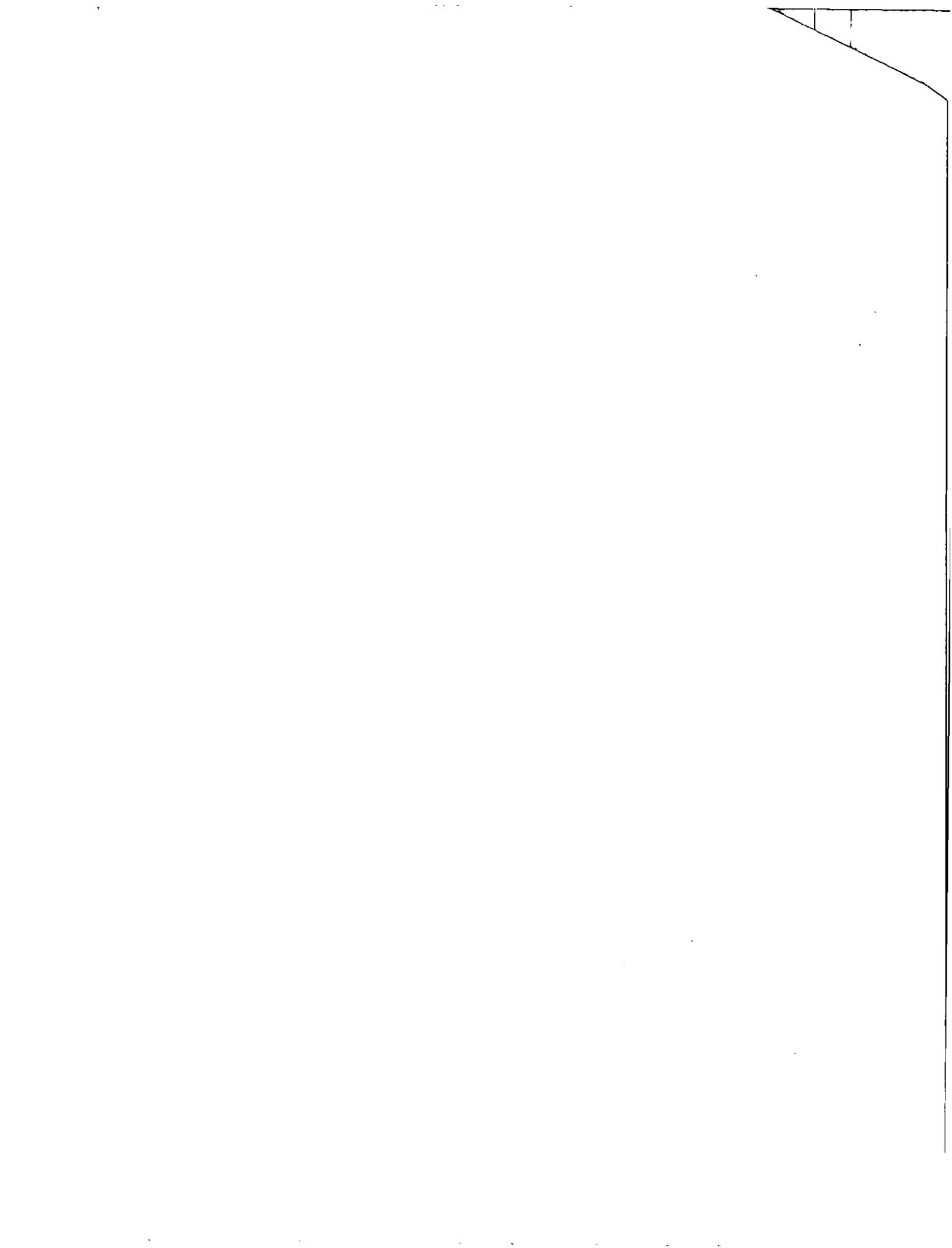
The Chairman of STACFIS was requested to instruct the designated experts for assessment of the Div. 2J+3KL cod stock to utilize only these adopted standards for estimating abundance, calibrating the cohort analysis and estimating year-class size during preparation of the preliminary assessment for the June 1987 Meeting. The indices, as constructed at the June 1986 Meeting, will obviously have to be updated with the 1986 research vessel and commercial fishery data, but any major reanalysis of these standard indices have to be included in a report separate from the standard assessment document. In other words, any reanalyses of data in an attempt to support indices of abundance or recruitment which are different from the adopted standard have to be presented in research documents separate from the assessment document, and the onus is clearly on the proponents of such revised indices to prove to STACFIS that such indices are superior to those which have been adopted for use.

Regarding the standard index of abundance from commercial data, substantial further work is necessary as follows:

- a) Alternative means of linking the abundance indices for the two time periods, 1962-78 and 1979-85, should be investigated, and, in particular, the results of the Federal Republic of Germany survey series by age should be used to re-evaluate the relationships between standardized CPUE and offshore exploitable biomass for the two periods. To this end, Federal Republic of Germany scientists are requested to supply the designated experts with the age compositions of their entire survey series by the end of 1986 for analysis prior to the June 1987 Meeting.
- b) The standardized catch rates for the multiplicative model should be related to the Canadian survey results by division to investigate the possibility of a better relationship between the two indices.
- c) The reliability of biomass estimates from surveys as weighting factors for divisional trends in the multiplicative model should be investigated.
- d) Catch and effort information from the Canadian fleet on a smaller unit than NAFO division should be investigated, as well as appropriate temporal units.
- e) Data from the Canadian observer program should be examined to determine patterns of fishing on a finer scale than NAFO division and on a time scale appropriate to describe the evolution of fishing patterns over the season.
- f) Biomass estimates for the various spawning components in Div. 2J+3KL should be obtained.

3. Acknowledgement

There being no further business, the Chairman thanked the participants for their help and cooperation and the NAFO Secretariat for their usual efficient service throughout the course of the meeting.



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

Chairman: J. S. Beckett

Rapporteur: R. G. Halliday

The Committee met at the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, on 11 September 1986. In attendance were J. S. Beckett (Chairman), S. Kawahara (Japan), R. G. Halliday and A. T. Pinhorn (Canada), the Chairman of the Scientific Council (J. Messtorff), the Assistant Executive Secretary (V. M. Hodder) and the Administrative Assistant (W. H. Champion).

1. Editorial Matters

a) Editorial Board activities

The Council was pleased to note that 7 papers have been accepted for publication in Vol. 7 of the *Journal of Northwest Atlantic Fishery Science* and 13 others are under review.

b) Editorial Board appointments

No candidates for the position of Editor had been identified by the time of the meeting. It was agreed that the Chairman would contact the directors of relevant laboratories for suggestions on nominees, as this had not yet been done.

The possibility of contracting professional editorial services was investigated by the Chairman, and it was clear that costs would be significant (in excess of \$5,000 annually).

c) Tentative editorial arrangements

It was decided that Associate Editors, who had all agreed to undertake complete editing until a new Editor was found, could reasonably be expected to continue doing this until June 1987 when the matter would be reconsidered. Since this is a fairly extensive period, clear guidelines on the relationship between Associate Editors and the Secretariat are required. Papers are to be submitted by authors to the Assistant Executive Secretary who will be responsible for an equitable distribution of these among Associate Editors. Associate Editors will submit completely edited and accepted papers to the Assistant Executive Secretary for technical preparation, typesetting and publication. Technical preparation of papers for publication will include formatting and correction of grammatical errors (e.g. spelling, tense and concordance) only, as responsibility for grammatical style and text clarity lies with the Associate Editor. If for any reason the Secretariat finds that a paper is not in a form considered to be ready for publication, it is to be referred back to the Associate Editor. It is the Secretariat's responsibility to provide authors with proofs of their papers which have been subject to the usual standards of quality control regarding accuracy, but it is, of course, the authors' responsibilities to ensure that their papers are error-free. If, for any reason, the Secretariat considers that any change in a paper is required after proofs have received an author's approval, the paper must be referred back to the author for consideration of such a proposed change.

2. Promotion of Journal

a) Presentation of a draft brochure

It was regretted that a design proposal for an advertising brochure for the Journal was not available for consideration. The Committee requests that the Executive Secretary have a draft brochure circulated to STACPUB members by mail for consideration as soon as possible after the present meeting.

b) Development of a mailing list

It was agreed that extracts of the International Directory of Marine Scientists should be sent to National Representatives on the Scientific Council, as decided in June 1986, for them to identify people or organizations which are likely to be interested in the Journal. The results will be used as a mailing list for the brochure. It was noted that costs of production and mailing of a brochure would be insignificant.

c) Other suggestions

The Chairman indicated that he had the opportunity to discuss with the former Editor both the items on cooperation with ICES in publication matters and on invitational papers but that no new information resulted from the suggestions.

3. Review of Papers for Publication

The Committee reviewed SCR documents that were submitted since June 1986 and proposed that the Assistant Executive Secretary contact authors of the following documents expressing the Council's interest in having them submitted in suitable form for publication in either the *Journal of Northwest Atlantic Fishery Science* or *NAFO Scientific Council Studies*: SCR Doc. 86/93, 96, 98, 99, 100, 101, 104, 105, 106, 108 (with figures), 109, 110, 111, 115, 116 and 119. The authors of SCR Doc. 86/90, 107, 112, 113 and 114 are requested to consider combining these into one paper for publication. The author of SCR Doc. 86/118 and 123 is invited to combine these and add a suitable discussion and interpretation section in a paper for consideration.

4. Other Matters

It was noted that the microfiche project was nearly complete at a total cost of about \$16,000. Sets of these will be made available for purchase (\$750 Can) before the end of the year.

It was proposed that the Council consider asking the Secretariat to purchase a portable microfiche reader and reserve one set of fiche for use at Scientific Council Meetings. This should be of particular value at meetings held outside of NAFO Headquarters.

5. Acknowledgements

The Chairman thanked the Secretariat for its support of the work of the Committee.

APPENDIX III. AGENDA FOR THE SEPTEMBER 1986 MEETINGS OF THE SCIENTIFIC COUNCIL

- I. Opening (Chairman: J. Messtorff)
 1. Appointment of rapporteurs
 2. Adoption of agenda
 3. Plan of work

- II. Fishery Science (STACFIS Chairman: W. R. Bowering)
 1. Report of Special Session on "Recent Advances in Understanding Recruitment of Marine Fishes with Particular Emphasis on Georges Bank Herring and Flemish Cap Cod and Redfish Stocks" (see footnote * below) which involved the following topics:
 - a) Brief synopsis of research to date and current knowledge of recruitment process for selected stocks
 - b) Evaluation of sampling methods with major emphasis on first year life stages
 - i) Sampling designs, gear and its efficiency relative to behavior
 - ii) Methods of collecting and processing samples, measurement conventions
 - iii) Ageing methods and their accuracy
 - c) Estimation of key biological aspects of the recruitment process
 - i) Fecundity and spawning
 - ii) Distribution and dispersal (eggs, larvae, juveniles)
 - iii) Abundance at age/size (accuracy of growth and mortality rates)
 - iv) Recruitment and spawning stock estimates and their accuracy
 - d) Estimation of recruitment variability and potential controlling factors
 - i) Patterns of physical environment relative to spawning
 - ii) Possible biological factors (recruitment *versus* food, predators, spawning stock, disease, parasites)
 - e) Critique of hypotheses on factors controlling recruitment variability and implications for future research
 2. Stock Assessments
 - a) Further assessment of cod stock in Div. 3NO
 - b) Silver hake in Div. 4VWX
 - i) Standard method of calculating survey abundance indices
 - ii) Future research requirements
 - c) Further consideration of Fisheries Commission questions
 - i) Stock discrimination of cod in Div. 2J, 3K and 3L
 - ii) Stock discrimination of Greenland halibut in the Northwest Atlantic
 3. Environmental Research
 - a) Appointment of chairman (present chairman was appointed in September 1984)
 - b) Other matters
 4. Gear and Selectivity
 - a) Escapement and selectivity problems associated with the use of strengthening ropes, splitting straps and codend floats

* The Special Session will be held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, on 3-5 September 1986, with Dr. M. D. Grosslein (USA) as Convener (see NAFO Circular Letter 86/53, dated 10 July 1986)

5. Future Special Sessions
 - a) Special session in September 1987 (outline to be provided by convener)
 - b) Proposed theme for special session in September 1988
6. Review of Arrangements for Conducting Stock Assessments
7. Other Matters

III. Research Coordination

1. Documentation of National Conversion Factors
2. Survey Design Procedures
 - a) Review of additional reported material
 - b) Establishment of working group for evaluation of reported material

IV. Publications (STACPUB Chairman: J. S. Beckett)

1. Editorial matters
2. Promotion of Journal
 - a) Presentation of a draft brochure
 - b) Development of a mailing list
3. Review of papers for possible publication
 - a) Research documents deferred from June 1986 Meeting
 - b) Contributions to the present meeting
4. Other Matters

V. Amendment to Rules of Procedure

1. Progress report by Executive Secretary
2. Further consideration, if necessary

VI. Adoption of Reports

1. Provisional Report of Scientific Council, June 1986
2. Committee Reports of Present Meeting

VII. Review of Future Meeting Arrangements

1. Mid-term Meeting on Shrimp (final decision on time and place)
2. June 1987 Meeting (confirmed dates are 3-18 June 1987)
3. Special Session on Greenland Halibut and Grenadiers (9-11 September 1987)
4. Annual Meeting (14-18 September 1987)
5. Tentative dates for June 1988 Meeting

VIII. Other Business

IX. Adjournment

APPENDIX IV. LIST OF PARTICIPANTS

CANADA

Akenhead, S. A. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Baird, J. W. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Bishop, C. A. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Brodie, W. B. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Bowering, W. R. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Dalley, E. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Evans, G. T. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Lear, W. H. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Lilly, G. R. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Myers, R. A. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Nakashima, B. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Pepin, P. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Pinhorn, A. T. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Pippy, J. H. C. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Power, D. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Rice, J. C. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Wells, R. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Wheeler, J. Northwest Atlantic Fisheries Centre, P. O. Box 5667, St. John's, Nfld.
Bowen, W. D. Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.
Campana, S. Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.
Halliday, R. G. Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.
Hurley, P. C. F. Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.
Koeller, P. Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.
McGlade, J. Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.
Waldron, D. E. Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.
Frank, K. Marine Ecology Lab., Bedford Institute of Oceanography, Dartmouth, N.S.
Trites, R. W. Marine Ecology Lab., Bedford Institute of Oceanography, Dartmouth, N.S.
Loder, J. W. Atlantic Oceanographic Lab., Bedford Institute of Oceanography, Dartmouth, N.S.
Misra, R. K. Invertebrates and Marine Plants Div., DFO, P. O. Box 550, Halifax, N.S.
Sinclair, M. Invertebrates and Marine Plants Div., DFO, P. O. Box 550, Halifax, N.S.
Tremblay, M. J. Invertebrates and Marine Plants Div., DFO, P. O. Box 550, Halifax, N.S.
Iles, T. D. Marine Fish Division, Biological Station, St. Andrews, N.B.
Perry, R. I. Marine Fish Division, Biological Station, St. Andrews, N.B.
Stephenson, R. L. Marine Fish Division, Biological Station, St. Andrews, N.B.
Waiwood, K. C. Marine Fish Division, Biological Station, St. Andrews, N.B.
Messiah, S. Fisheries Research Branch, Gulf Region, P. O. Box 5030, Moncton, N.B.
McQuinn, I. H. Dept. of Fisheries and Oceans, P. O. Box 15500, Quebec City, Que.
Ouellet, P. Dept. of Fisheries and Oceans, P. O. Box 15500, Quebec City, Que.
Gagne, J. Dept. of Fisheries and Oceans, 310 Avenue des Ursulines, Rimouski, Que.
Beckett, J. S. Dept. of Fisheries and Oceans, 200 Kent Street, 12th Floor, Ottawa, Ont.
Gagnon, J. Dept. of Fisheries and Oceans, 200 Kent Street, 12th Floor, Ottawa, Ont.

CUBA

Dominguez, R. Flota Cubana de Pesca, Ave. Pesquera esq. Desamparados, Havana

EUROPEAN ECONOMIC COMMUNITY (EEC)

Noé, R. Commission of the European Communities, 120 Rue de Loi, 1047 Brussels, Belgium
Messtorff, J. Sea Fisheries Institute, Bremerhaven, Federal Republic of Germany
Schumacher, A. Sea Fisheries Institute, Hamburg, Federal Republic of Germany
Stein, M. Sea Fisheries Institute, Hamburg, Federal Republic of Germany

JAPAN

Kawahara, S. Far Seas Fisheries Research Laboratory, 7-1 Orido 5-Chome, Shimizu 424

NORWAY

Fossum, P. Institute of Marine Research, P. O. Box 1870-72, N-5011 Bergen-Nordnes
Nedreaas, K. H. Institute of Marine Research, P. O. Box 1870-72, N-5011 Bergen-Nordnes

PORTUGAL

Godinho, Maria L.M. Instituto Nacional de Investigacao Das Pescas, Alges-Praia, 1400 Lisbon

SPAIN

Vazquez, A. Instituto Investigaciones Pesqueras, Muelle de Bouzas, Vigo Pontevedra

UNION OF SOVIET SOCIALIST REPUBLICS (USSR)

Rikhter, V. A. AtlantNIRO, 5 Dmitry Donskoy Street, Kaliningrad, 236000
Fedorenko, V. G. VNIRO, 17 V. Krasnoselskaya, Moscow B-140
Riazantsev, Y. B. VNIRO, 17 V. Krasnoselskaya, Moscow B-140

OBSERVERS

Grosslein, M. D. Northeast Fisheries Center, Woods Hole Lab., Woods Hole, MA. 02543, USA
Lough, R. G. Northeast Fisheries Center, Woods Hole Lab., Woods Hole, MA. 02543, USA
Sissenwine, M. P. Northeast Fisheries Center, Woods Hole Lab., Woods Hole, MA. 02543, USA
Campbell, D. E. Maine Dept. of Marine Resources, West Boothbay Harbor, ME, 04575, USA
Graham, J. J. Maine Dept. of Marine Resources, West Boothbay Harbor, ME. 04575, USA

APPENDIX V. LIST OF RESEARCH AND SUMMARY DOCUMENTS

A. RESEARCH DOCUMENTS (SCR)

SCR Doc. 86/1 to 86/90 were considered at the January and June 1986 Meetings of the Scientific Council.

<u>SCR #</u>	<u>Ser. #</u>	
86/91	N1217	<u>A. VAZQUEZ and M. G. LARRANETA.</u> Recruitment of cod in Div. 2J+3KL and the physical environment. (4 pages)
86/92	N1218	<u>R. A. MYERS and K. DRINKWATER.</u> The effects of entrainment of shelf water by warm core rings on Northwest Atlantic fish recruitment. (10 pages)
86/93	N1219	<u>W. G. SMITH and E. JOHNSON.</u> Contrasts in distribution patterns of larval Atlantic herring in the Georges Bank area, early 1970's vs early 1980's. (13 pages)
86/94	N1220	<u>V. M. GOMEZ-MUNOZ.</u> Equilibrium yield of Flemish Cap cod from a general stock and recruitment curve. (11 pages)
86/95	N1221	<u>D. W. KULKA.</u> Estimates of discarding by the Newfoundland offshore fleet in 1985 with reference to trends over the past 5 years. (20 pages)
86/96	N1222	<u>J. T. ANDERSON.</u> Review of recruitment variability in exploited marine fish stocks and survival during the larval stage. (12 pages)
86/97	N1223	<u>J. T. ANDERSON and I. WEBSTER.</u> Variability in abundance and mean length of a marine fish larva (<i>Sebastes</i> sp.) sampling during 24-h at a single station on Flemish Cap. (16 pages)
86/98	N1224	<u>M. J. TREMBLAY and M. M. SINCLAIR.</u> The horizontal distribution of larval sea scallops (<i>Placopecten magellanicus</i>) in the Bay of Fundy, on the Scotian Shelf and on Georges Bank. (15 pages)
86/99	N1225	<u>G. V. HURLEY, M. J. TREMBLAY, and C. COUTURIER.</u> Daily growth increments in the shells of larval sea scallops (<i>Placopecten magellanicus</i>). (11 pages)
86/100	N1227	<u>R. G. LOUGH and R. W. TRITES.</u> Chaetognaths and oceanography on Georges Bank. (30 pages)
86/101	N1228	<u>G. R. LILLY.</u> A synopsis of research related to recruitment of cod and redfish on Flemish Cap. (18 pages)
86/102	N1229	<u>C. ANNAND and D. BEANLANDS.</u> A genetic stock structure study of dogfish in the Northwest Atlantic. (5 pages)
86/103	N1230	<u>S. N. MESSISH.</u> The enigma of Gulf herring recruitment. (22 pages)
86/104	N1231	<u>M. D. GROSSLEIN.</u> Synopsis of knowledge of the recruitment process for Atlantic herring with special references to Georges Bank.
86/105	N1232	<u>G. R. BOLZ and R. G. LOUGH.</u> Zooplankton faunal zones and their relationship to hydrography and ichthyoplankton production in the Georges Bank region. (24 pages)
86/106	N1233	<u>J. C. RICE and G. T. EVANS.</u> Non-parametric predication of recruitment from stock and the relationship of the residuals to water temperature for cod in NAFO Divisions 2J+3KL and 3M. (13 pages)
86/107	N1234	<u>R. WELLS and D. POWER.</u> An estimate of redfish availability to cod on the Flemish Cap in the period 1978-85. (13 pages)
86/108	N1235	<u>G. R. LILLY.</u> Abundance and growth rate of juvenile redfish (<i>Sebastes</i> sp.) on Flemish Cap during the period 1978-1985. (5 pages)
86/109	N1236	<u>G. R. LILLY and G. T. EVANS.</u> Inferences from juvenile redfish found in cod stomachs from Flemish Cap. (13 pages)
86/110	N1237	<u>E. B. COHEN, D. G. MOUNTAIN and R. G. LOUGH.</u> Possible factors responsible for the variable recruitment of the 1981, 1982 and 1983 year-classes of haddock (<i>Melanogrammus aeglefinus</i> L.) on Georges Bank. (27 pages)
86/111	N1238	<u>S. J. WALSH, R. WELLS and S. BRENNAN.</u> Histological and visual observations on oogenesis and sexual maturity of Flemish Cap female cod. (11 pages)

<u>SCR #</u>	<u>Ser. #</u>	
86/112	N1239	<u>R. WELLS.</u> Fecundity of cod on the Flemish Cap. (2 pages)
86/113	N1240	<u>R. WELLS.</u> Condition factors of cod on the Flemish Cap in 1978-85. (11 pages)
86/114	N1241	<u>R. WELLS.</u> Variations in the gonad weight and the percentage occurrence at length of maturing female cod on the Flemish Cap. (4 pages)
85/115	N1242	<u>D. E. CAMPBELL and J. J. GRAHAM.</u> An evaluated model of larval herring recruitment in coastal Maine. (20 pages)
86/116	N1243	<u>B. ELLERTSEN, P. FOSSUM, P. SOLEMDAL, S. SUNDBY and S. TILSETH.</u> Effects of biological and physical factors on survival of Arcto-Norwegian cod and influence on recruitment variability.
86/117	N1244	<u>K. NEDREAAS.</u> Abundance and distribution of post larvae in the 0-group saithe survey in the North-East Arctic in 1985. (25 pages)
86/118	N1245	<u>W. H. LEAR.</u> A further discussion of the stock complex of Atlantic cod (<i>Gadus morhua</i>) in NAFO Div. 2J, 3K and 3L. (18 pages)
86/119	N1246	<u>T. D. ILES.</u> Interaction of external and internal factors in relation to recruitment. (24 pages)
86/120	N1248	<u>G. V. GRIGORYEV and S. A. OGANESYAN.</u> Nature of spermatogenesis, type of spawning and maturity scale for testes of <i>Maurolicus muelleri</i> (14 pages)
86/121	N1249	<u>V. M. KISELEVA and V. A. POLETAEV.</u> Mesopelagic fishes (Suborder Stomiatoidei) in the Northwest Atlantic. (20 pages)
86/122	N1251	<u>J. W. BAIRD, C. A. BISHOP and R. WELLS.</u> Estimates of age and length at maturity for cod in NAFO Divisions 2J+3KLNO. (3 pages)
86/123	N1252	<u>W. H. LEAR.</u> Results of tagging on winter concentrations of cod in NAFO Divisions 2J, 3K and 3L during 1978-83. (8 pages)
86/124	N1253	<u>C. A. BISHOP and J. W. BAIRD.</u> An assessment update of the cod stock in NAFO Divisions 3NO. (14 pages)

B. SUMMARY DOCUMENTS (SCS)

SCS Doc. 86/1 to 86/23 were considered at the January and June 1986 meetings of the Scientific Council.

<u>SCS #</u>	<u>Ser. #</u>	
86/24	N1216	<u>NAFO.</u> Provisional Report of Scientific Council, Dartmouth, Canada, 4-19 June 1986. (99 pages)
86/25	N1226	<u>FAO.</u> Quantity conversion factors: Atlantic fish species - landed or product weight to live weight. (45 pages)
86/26	N1264	<u>P. ERNST.</u> German Democratic Republic research report for 1985. (20 pages)
86/27	N1265	<u>NAFO.</u> Report of Scientific Council Meeting, Annual Meeting, Halifax, Nova Scotia, Canada, 3-12 September 1986. (28 pages)
86/28	N1266	<u>NAFO.</u> Rules of procedure for the Scientific Council. (6 pages)