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SCIENTIFIC COUNCIL MEETING - JUNE 1984

Provisional Report of Scientific Council

Dartmouth, Canada, 6-21 June 1984

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PROVISIONAL REPORT OF SCIENTIFIC COUNCIL

6-21 June 1984

Chairman: V. A. Rikhter Rapporteur: V. M. Hodder

The Council and its Standing Committees met at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 6-21 June 1984 to consider and report on the various matters listed in its agenda (Appendix IV). In addition to dealing with matters of general scientific interest, the Council considered the requests of the Fisheries Commission and the coastal Contracting Parties (Canada and European Economic Community) for scientific advice on management in 1985 of a number of stocks in Subareas 0 to 4. The provisional agenda was adopted after considering the EEC request, at the opening session on 6 June 1984, to be identified with the assessment of the cod stock in Subdiv. 3Ps by the addition of a footnote to the specific agenda, as follows: "Also requested by the EEC as a stock overlapping EEC and Canadian waters". The Executive Committee met briefly prior to the opening session and recommended a plan of work for the three Standing Committees and the Environmental Subcommittee, which was adopted by the Council.

Representatives attended the Council and Committee sessions from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France, and the Commission of the European Communities), Japan, Portugal, Spain, and Union of Soviet Socialist Republics (USSR), and observers were present from the United States of America (Appendix V).

The reports of the Standing Committees, as adopted by the Council on 20-21 June 1984, are given in Appendix I (STACFIS), Appendix II (STACREC), and Appendix III (STACPUB). Lists of research and summary documents are given in Appendix VI. Brief summaries of the Committee reports and other matters considered by the Council are given in Sections I to VI below.

I. FISHERY SCIENCE (see App. 1)

1. General Fishery Trends

The provisional nominal catch of all fish and invertebrate species in the Northwest Atlantic (Subareas 0 to 6) was about 2.70 million (metric) tons, a very slight increase from the 1982 catch of 2.69 million tons in 1982 (see Appendix I, Table 1). The total catch of "groundfish" species decreased (5%) from 1.30 million tons in 1982 to 1.24 million tons in 1983, due mainly to decreased catches of silver hake, haddock, pollock, redfish and some flounders. The total catch of "pelagic fish" increased slightly (3%) from 541,000 tons in 1982 to 556,000 tons in 1983, due mainly to a larger catch of Atlantic menhaden. For the "other finfish" group of species, the 1983 catch of 87,000 tons was 7% higher than the 1982 catch of 81,000 tons. The total catch of "invertebrate" species increased (7%) from 766,000 tons in 1982 to 816,000 tons in 1983, due mainly to increased catches of some molluscs (86%) and crabs (32%), although declines were noted for squids (14%), clams (8%) and scallops (8%).

With respect to the total nominal catches of finfish and invertebrates by subarea, increases were recorded for Subarea 0 (3,000 to 5,000 tons), Subarea 1 (124,000 to 129,000 tons), Subarea 3 (469,000 to 482,000 tons), and Subarea 6 (738,000 tons to 847,000 tons), and decreases were noted for Subarea 2 (134,000 to 77,000 tons), Subarea 4 (735,000 to 689,000 tons), and Subarea 5 (490,000 to 467,000 tons).

2. Assessment of Finfish and Invertebrate Stocks

The Council noted that STACFIS reviewed the status of certain stocks in Subareas 0 to 4, as requested by Canada and the EEC (see Appendix IV, Annexes 1 and 2), and the three stocks in Div. 3M, as required by the Fisheries Commission, and advised on catch levels corresponding to the reference fishing mortality $F_{0.1}$ or to two-thirds of the fishing effort associated with the maximum sustainable yield, except the capelin and squid stocks which required different management criteria. In cases where specific total allowable catches (TACs) were advised, these are listed in the last column of Table 1. Details of the stock assessments are given in Appendix I. Some general observations are as follows:

a) For the cod stock in Subarea 1, managment options at various levels of fishing mortality are presented (see relevant section of Appendix I).

b) For the cod stock in Div. 3M, no exploitation is advised for 1985. Although there is evidence of good recruitment, the fishable stock biomass remains in a depleted state. Too early exploitation of the 1980 and 1981 year-classes will reduce considerably their expected contribution to the fishable biomass and subsequently to the spawning stock. The estimated stock size in 1983 was approximately one-half of the reference level, which is "one-half of the mean age 3+ equilibrium biomass associated with fishing at F_{max}, and assuming long-term average recruitment levels".

c) For cod in Div. 3NO, the current assessment indicates that the age 3+ annual mean biomass in 1985 will be above the reference level of 200,000 tons. The catch in 1985, calculated to correspond to fishing at $F_{0.1}$, is 33,000 tons, which represents an increase of 7,000 tons over the 1984 TAC.

d) For the cod stock in Subdiv. 3Ps, the catch in 1985 which will result from fishing at $F_{0.1}$ (0.20) is 41,000 tons.

e) For Greenland halibut in Subarea 2 and Div. 3KL, the TAC advised for 1985 is 75,000 tons. Previous TAC advice related only to Div. 2J+3K.

f) Reductions in TAC were advised for American plaice in Div. 3LNO from 55,000 tons in 1984 to 49,000 tons in 1985, and for yellowtail flounder in Div. 3LNO from 17,000 tons in 1984 to 15,000 tons in 1985, which corresponds to the level of average catch in 1978-82.

g) No changes in TAC are advised for cod in Div. 2J+3KL, redfish in Div. 3M and Div. 3LN, silver

Table 1. Summary of recent catches (1978-83) and TACs (1978-84) for stocks reviewed at the June 1984 Meeting of STACFIS, together with the advised TACs for 1985.

Species	Stock area	Nominal catches (000 tons)						TACs (000 tons)							
		1978	1979	1980	1981	1982[1]	1983[1]	1978	1979	1980	1981	1982	1983	1984	1985
Cod	1	39	48	47	53	55	63	...	...	...	50	62	62	...	( )[2]
	2J+3KL	139	167	176	171	230	227	135	180	180	200	237	260	266	(266)
	3M	33	30	10	14	13	10	40	40	13	12.7	12.4[3]	12.4[3]	13	(0)[4]
	3NO	15	28	20	24	32	29	15	25	26	26	17[3]	17[3]	26	(33)
	3Ps	27	33	38	39	34	38	25	25	28	30	33	33	25[9]	( )[10]
Redfish	1	8	9	8	6	8	8	-	13	...	...	...	...	...	( )[5]
	3M	17	20	16	14	15	20	16	20	20	20	20	20	20	(20)
	3LN	12	14	16	24	22	20	16	18	25	25	25	25	25	(25)
Silver hake	4VWX	48	52	45	41	60	34	80	70	90	80	80	80	100	(100)
A. plaice	3M	1	1	1	1	1	2	4	2	2	2	2	2	2	(2)
	3LNO	50	49	49	50	51	38	47	47	47	55	55	55	55	(49)
Witch flo.	3NO	3	3	3	2	4	4	10	7	7	5	5	5	5	(5)
Yellowtail	3LNO	16	18	12	15	12	9	15	18	18	21	23	19	17	(15)
G. halibut	0+1	12	19	8	6	7	6	20	25	25	25	25	25	25	(25)
	2+3KL	39	34	33	31	26	22	30	30	35	55[6]	55[6]	55[6]	55[6]	(75)[6]
R. grenadier	0+1	6	7	2	+	+	+	8	8	8	8	8	8	8	(8)
	2+3	21	8	2	7	4	4	35	35	30	27	27	11	11	(11)
Wolffishes	1	6	17	5	4	4	3	-	-	...	...	...	...	(5-6)	(5-6)
Capelin	3LNO	30	12	14	24	27	25	200	10	16	30	30	30	...	( )[8]
Shrimp	0+1	34	35	44	45	43	46	40	29.5	29.5	35	35	34.6	29.5	( )[7]
Squid-*Illex*	2-4	94	162	70	32	13	0.4	100	120	150	150	150	150	150	(150)

[1] Provisional statistics
[2] See Section II(1) of STACFIS Report
[3] Excludes expected catches by Spain
[4] See Section II(3) of STACFIS Report
[5] See Section II(6) of STACFIS Report
[6] TAC for Divisions 2J, 3K and 3L only
[7] Deferred to later mid-term meeting
[8] See Section II(19) of STACFIS Report
[9] Established by Canada
[10] See Section II(5) of STACFIS Report

hake in Div. 4VWX, American plaice in Div. 3M, witch flounder in Div. 3NO, Greenland halibut in Subareas 0+1, and roundnose grenadier in Subareas 0+1 and 2+3.

h) For capelin in Div. 3L, the catch level advised for 1985 corresponds to 10% of the projected biomass in 1984. No catch is advised for capelin in Div. 3NO due to uncertainity about year-class strength and the low level of biomass.

i) No firm assessments of the stocks of redfish and wolffishes in Subarea 1 were possible due to lack of adequate biological data. However, it was noted that the redfish yield corresponding to two-thirds of fishing effort associated with the maximum sustainable yield is about 9,000 tons, and that a combined catch in 1985 of 5,000-6,000 tons of spotted and Atlantic wolffishes seems to be reasonable.

j) The squid-*Illex* in Subareas 3 and 4, the advised TAC of 150,000 tons for 1985 is intended to avoid excessive fishing mortality if the population in that year is of moderate abundance. If the population in 1985 is quite low, it is expected that fishing effort would be directed from the fishery because of low catch rates. This management regime implies a loss in yield in years of high abundance.

k) Advice on management in 1985 of the shrimp stock in Subareas 0 and 1 and in Denmark Strait could not be provided at this meeting. In view of the substantial contribution of shrimp recruitment to annual yields and the lack of adequate biological and fishery data before the end of 1984, it was agreed that a mid-term meeting in January 1985 would be appropriate.

3. Environmental Research

The Council noted that the Environmental Subcommittee had met during 11-12 June 1984, with R. W. Trites as Chairman, and was encouraged by the greatly increased participation of scientists in the work of the Subcommittee at this meeting. The full report of the Subcommittee is at Annex 1 to the Report of STACFIS (Appendix I).

The Council welcomed the establishment of a working group to identify ways of developing knowledge on the topic dealing with influences of environmental factors on distribution, movements and migrations of marine species in the Northwest Atlantic, noting that such guidelines would be useful in determining the future work of the Subcommittee.

The Council noted the resignation of Dr. R. W. Trites as Chairman of the Subcommittee and extended its appreciation for his efforts during the past 3 years in bringing together the work of oceanographers and fishery biologists. The Council endorsed the decision of STACFIS to appoint a chairman as soon as possible.

4. Other Matters

a) Special Session on Biology and Ecology of Squid

The Council noted that the Special Session in September 1984 should be a successful and interesting one, with the anticipated presentation of about 34 contributions covering a wide range of topics on the subject.

b) Documentation of STACFIS assessments

The Council noted that time was insufficient for the Committee to fully evaluate the adequacy of the guidelines for provision of assessment advice. In fact, the workload of STACFIS at this meeting was such that much more time (including many night sessions) had to be allocated to STACFIS than was provided for in the initial timetable. Consequently, the Council appointed Dr. W. G. Doubleday to convene a small working group of scientists at the Septmeber 1984 Meeting, for the purpose of considering better means of handling the workload of STACFIS at future June meetings.

c) Consideration of the EEC request for advice on the Subdivision 3Ps cod stock

The Council noted that the request for advice on the cod stock in Subdiv. 3Ps, which was presented by the EEC representative at the opening session on 6 June 1984, contained a wider range of options than the Canadian request which was received in advance of the deadline for such requests. Scientific advice on this stock was formulated, at this meeting, on the basis of the Canadian request, and it was agreed that additional information requested by the EEC be provided at the time of the September 1984 Meeting.

d) Topics deferred for consideration in September 1984

i) Ageing techniques and validation studies, including proposal for second workshop on ageing shrimp.

ii) Gear and selectivity studies.

iii) Flemish Cap research project.

iv) Review of research documents, for which time was insufficent at this meeting.

II. RESEARCH COORDINATION (see App. II)

1. Statistics and Sampling

a) Fishery statistics

The Council noted that late submission of STATLANT 21B catch and effort data has significantly delayed publication of Statistical Bulletin Vol. 31 and 32 containing data for 1981 and 1982. However, there was improvement in the submission of STATLANT 21A data for 1983, allowing, for the first time in 3 years, the production of the "Fishery Trends" section of the STACFIS Report (Appendix I). If the apparent improvement continues with the submission of STATLANT 21B data for 1983, it should be possible to issue Statistical Bulletin Vol. 33 well in advance of the June 1985 Meeting. The Council was informed that the historical series of catch and effort data in computerized format has been extended back to 1965 and that this work will continue.

The Council noted that fishing effort data provided by Canada (M) for 1977-80 and by USA for 1981 have been revised, and endorsed the recommendation of STACREC, which requested the Secretariat to provide advance notice of these revisions (and the data, if requested) to all current recipients of Statistical Bulletin, pending the issue of revised editions of the relevant bulletins.

b) CWP activities relevant to NAFO

The Council noted the report of the *ad hoc* Inter-Agency Consultation on Atlantic Fishery Statistics, which was held at Gothenburg, Sweden, in October 1983 and which contained the provisional agenda for the 12th Session of the CWP to be held in Copenhagen during 25 July-1 August 1984.

c) Sampling data

The Council noted that the Secretariat has continued to process the historical ICNAF series and that up-to-date lists of the data for 1966-78 have been compiled and will be published in a single volume. The Council agreed that the matter of reporting requirements for 1979 and subsequent sampling data be deferred for consideration at the September 1984 Meeting.

d) Scientific observer program

Canada reported that the program is being actively pursued and that bilateral agreements will soon be in effect for all countries fishing in the Regulatory Area.

e) Listing of fishing vessels for 1983

The Council noted that late submission of the national data to the Secretariat could delay the timely publication of the 1983 lists.

f) Tagging activities in 1983

The Council endorsed the Secretariat's effort to acquire and distribute through its Circular Letter series information on tagging activities in the Northwest Atlantic.

2. Biological Surveys

a) Survey activities

The Council endorsed the efforts of STACREC to compile inventories of research vessel surveys in 1983 and planned surveys for 1984 and early 1985, the details of which are given in Tables 1 and 2 of Appendix II.

b) Stratification schemes

The Council noted that the stratification scheme for Subarea 1 was currently under revision and that accurate stratification of Div. 2G and 2H could not be achieved until new navigational charts become available.

c) Coordination of squid surveys

There were no proposals for coordination of squid surveys in 1984 and early 1985.

III. PUBLICATIONS (see App. III)

1. STACPUB Membership

In the absence of two regular members of the Committee, the Council requested Dr. Hatanaka to substitute for Dr. Kawahara, who could not be present at this meeting, and appointed Dr. Larraneta to replace Mr. Minet, who earlier had informed the Secretariat of his resignation.

2. Review of Publications

The Council, in accepting STACPUB's review of the status of publications in the preceding 12 months, agreed with the procedures proposed for publishing 5-year indexes of scientific meeting documents and publications and the 1966-78 updated lists of sampling data currently available in computerized format.

3. Editorial Policy Concerning Publications

The Council was pleased to note that the steady supply of papers submitted for publication in the *Journal of Northwest Atlantic Fishery Science* was adequate to support the present schedule of semi-annual publication, and that subscriptions for the Journal were slowly increasing. The Council concurred with STACPUB's view about the usefulness of the information on costs and revenues provided by the Secretariat for the Journal, and requested that future annual reports to STACPUB should include similar analyses for other scientific publications.

The Council shared STACPUB's regret that Mr. E. J. Sandeman could not continue as Associate Editor of the Journal for Invertebrate Fisheries Biology, and requested the Editor to contact one or more of the potential candidates proposed by STACPUB with the hope that an appointment could be made in September 1984.

4. Production of Microfiche Copies of Meeting Documents

The Council agreed with STACPUB's proposal that a first run of 30 microfiche sets of ICNAF scientific documents be produced, based on the current estimate of potential purchasers, and that these sets be offered for purchase at $750 per set. The Council, in anticipation of full cost recovery for this project,

recommends

that the Executive Secretary include, in budget estimates to be submitted to the General Council for the 1985 fiscal year, a sum appropriate to allow the production of 30 microfiche sets of the ICNAF scientific documents.

Since some countries have no interest in acquiring the microfiche copies, the Executive Secretary is requested to elaborate clearly to the General Council on how he expects to recover fully any allocated funds for this project.

IV. COLLABORATION WITH OTHER ORGANIZATIONS

1. Joint NAFO/ICES Study Group on Biological Relationships of the West Greenland and Irminger Sea Redfish Stocks (SCS Doc. 84/VI/2)

The Council considered the report of the Study Group which met for the second time at ICES Headquarters, Copenhagen, Denmark, on 21 February 1984, with the following terms of reference: (i) to review and evaluate additional information relevant to stock identification from historical data series, (ii) to report on the feasibility of tagging *Sebastes marinus* in the Godthåb Fjord, and (iii) to report on the availability of research vessels for a multiship program for direct observations of drift of redfish larvae from the Irminger Sea to West Greenland. Discussion by the Study Group resulted in the following observations on these points:

i) Most of the available data on redfish are of no relevance to the objectives of the Study Group, and no further progress could be made in solving the problems.

ii) Since the main population of redfish in Godthåb Fjord available to the gear which could catch redfish in good condition for tagging consists of *Sebastes mentella*, it seems unlikely that sufficient quantitites of *S. marinus* could be obtained for a successful tagging experiment. Information should be obtained on whether other locations along the West Greenland coast could provide better opportunities for a tagging experiment on *S. marinus*.

iii) Most members of the Study Group were not in a position to make commitments regarding research vessel time. However, the USSR participant in the Study Group expressed willingness to participate with one or two vessels, if an agreed program is in progress. It was consequently agreed that a program should be developed in some detail by correspondence during 1984 and be finalized at a meeting in 1985. This would enable interested institutes to better evaluate the need for allocation of research vessel time on more realistic basis.

The Council endorsed the proposals of the Study Group and urged that its activities be continued.

2. Twelfth Session of the CWP

The Council was pleased to note that the USSR had designated two participants (Ms. N. V. Janovskaya and Mr. R. K. Zviriako) to represent NAFO at the 12th Session of CWP at ICES Headquarters, Copenhagen, Denmark, during 25 July-1 August 1984, and that the other NAFO representatives are Mr. J. Møller Jensen (Chairman of STACREC) and Mr. V. M. Hodder (Assistant Executive Secretary).

V. FUTURE SCIENTIFIC MEETINGS

1. Annual Meeting, September 1984

The Council and its Standing Committees will meet during the Sixth Annual Meeting of NAFO (5-14 September 1984) at Dartmouth and Halifax, Nova Scotia, Canada, to deal with the following items:

a) Special Session on "Biology and Ecology of the Squids, *Illex illecebrosus* and *Loligo pealei*, in the Northwest Atlantic". The conveners are T. W. Rowell and Ch. M. Nigmatullin, and more than 30 papers are expected to be presented.

b) Consideration for futher options for the cod stock in Subdiv. 3Ps, as requested by the EEC.

c) Evaluation of the guidelines for documenting STACFIS assessments, including discussion of means for handling the excessive workload of STACFIS at future June meetings.

d) Matters relevant to environmental research, including the Flemish Cap Project, guidelines for the work on the influence of environmental factors on distribution and movements of marine fishes, and appointment of Environmental Subcommittee Chairman.

e) Feasibility of holding another workshop on ageing shrimp.

f) Development of plans for the 1985 Special Session on "Design and Evaluation of Biological Surveys in Relation to Stock Assessments".

g) Further consideration of requirements for reporting sampling data for 1979 and subsequent years.

h) Matters relevant to publication of papers presented to the Special Session on Squids, and

appointments to the Editorial Board for the Journal.

i) Feasibility of providing advice at short mid-term meetings of STACFIS.

j) Plans for future meetings.

2. Mid-term Meeting for Assessment of Shrimp Stocks

The Council concurred with the proposal of STACFIS that the best time for a meeting to assess the shrimp stocks would be in early 1985. Noting the previous invitation of the Danish (Greenland) laboratory through the EEC, the Council accepted this invitation and agreed to meet in Copenhagen, Denmark, during 16-22 January 1985.

3. Scientific Council Meeting, June 1985

The Council and its Standing Committees will meet at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 5-20 June 1985.

4. Annual Meeting, September 1985

The Council will meet in conjunction with the Seventh Annual Meeting of NAFO during 4-13 September 1985. The Special Session on "Design and Evaluation of Biological Surveys in Relation to Stock Assessments" will take place during 4-6 September, and Dr. J. Messtorff (EEC) was unanimously nominated as Convener for that session.

VI. OTHER MATTERS

1. Provisional Report of January 1984 Meeting of the Scientific Council

The Council reviewed and formally approved with minor amendments the report of its meeting which was held during 18-23 January 1984 to assess the status of the shrimp stocks in Subareas 0 and 1 and Denmark Strait (SCS Doc. 84/VI/1 + Corrigenda)

2. Theme for Annual Meeting in September 1986

The Council unanimously agreed that the theme for the Special Session in September 1986 will be "Recent Advances in Understanding Recruitment in Marine Fishes of the Northwest Atlantic, with Particular Emphasis on Georges Bank and Flemish Cap".

3. Death of Former ICNAF Scientist

The Council was saddened to hear of the recent passing of Alister M. Fleming, who was Assistant Director of the St. John's Biological Station during 1955-75 and served as Director for 2 years prior to his retirement in 1977. His contributions to and participation in ICNAF Meetings extended over 20 years from 1952 to 1972.

VII. ADJOURNMENT

The Chairman expressed his gratitude to the chairmen and rapporteurs of the various committees and to all participants for their patience, cooperation and contributions to the success of the meeting, noting that the results could not be achieved without the agreement of participants to hold several night sessions. He also thanked the Secretariat staff for arranging the meeting facilities and for their efficiency in servicing the meeting. The final session was adjourned at 1700 hours on 21 June 1984.

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

Chairman: J. E. Carscadden Rapporteurs: Various

The Committee met at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 6-21 June 1984 to consider and report on various matters referred to it by the Scientific Council, particularly with regard to the provision of advice on management measures for certain finfish and invertebrate stocks in Subareas 0 to 4. Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France and the Commission of the European Communities), Japan, Portugal, Spain, USSR and USA.

Various scientists, designated by the Chairman, assisted in the initial preparation of the draft reports on the various assessment topics considered by the Committee (Section II). The report of the Subcommittee on Environmental Research (Chairman: R. W. Trites) is introduced in Section III of this report and given in detail in Annex 1. The remaining sections deal with other matters considered by the Committee.

I. FISHERY TRENDS

1. General Trends for the Northwest Atlantic

The fishery statistics in Table 1 are based on provisional data for 1982 and data in SCS Doc. 84/VI/22 for 1983. The provisional data for 1983 do not include catches by Italy, Poland, and United Kingdom, which were not available at the time of preparing this report. The overall nominal catch of all finfish and invertebrates at 2.70 million tons in 1983 was only very slightly higher than the 1982 catch of 2.69 million tons. The total groundfish catch, which represented 46% of the overall nominal catch in 1983, decreased (5%) from 1.30 million tons in 1982 to 1.24 million tons in 1983, due mainly to decreases for silver hake (32%), American plaice (17%), haddock (15%), Greenland halibut (17%), pollock (10%) and redfish (8%), which were partly offset by increases for yellowtail and other flounders (10%). The total pelagic fish catch, which represented 21% of the overall nominal catch in 1983, increased slightly (3%) from 541,000 tons in 1982 to 556,000 tons in 1983, due mainly to an increase for Atlantic menhaden (13%) which constituted about 63% of the total for this group. The total "other finfish" catch increased slightly (7%) from 81,000 tons in 1982 to 87,000 tons in 1983 due to increased catches of skates and some other species in Subareas 5 and 6. The capelin catch in 1983 (41,000 tons) was essentially the same as in 1982. The total catch of invertebrates, which represented 30% of the overall nominal catch in 1983, increased significantly (7%) from 766,000 tons in 1982 to 816,000 tons in 1983, due mainly to increased catches of some molluscs (oysters and blue mussels, 86%) and crabs (32%), although decreases were noted for squids (14%), clams (8%) and scallops (8%).

2. Fishery Trends by Subarea

a) Subarea 0

The usual low catch of 5,000 tons in 1983 was nearly twice the 1982 catch of 2,800 tons, with northern prawn (3,300 tons) and Greenland halibut (1,600 tons) being the dominant species taken.

Table 1. Provisional nominal catches (000 tons) for 1982 and 1983[1]. (The symbol + indicates less than 500 tons.)

	SA 0		SA 1		SA 2		SA 3		SA 4		SA 5		SA 6		Total	
	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983
Atlantic cod	+	-	55	62	95	54	238	272	232	242	72	65	+	+	693	696
Haddock	-	-	-	+	+	-	1	1	40	35	25	20	+	+	66	56
Atlantic redfishes	+	+	8	8	8	1	61	65	42	37	7	5	-	+	126	116
Silver hake	-	-	-	-	-	-	+	-	60	36	11	11	6	6	78	53
Red hake	-	-	-	-	-	+	+	+	+	1	2	1	1	1	2	3
Pollock	-	-	-	-	-	+	1	1	33	30	20	18	+	+	54	49
American plaice	-	-	1	+	+	+	56	43	14	14	15	13	+	+	86	71
Witch flounder	-	-	-	-	+	+	7	6	3	3	5	6	+	+	15	15
Yellowtail flounder	-	-	-	-	+	-	13	9	3	2	26	31	1	2	42	45
Greenland halibut	1	2	5	4	15	9	11	13	2	1	-	-	-	-	35	29
Other flounders	-	-	1	1	+	+	2	3	8	8	18	19	7	10	36	41
Roundnose grenadier	+	+	+	+	2	2	3	2	-	-	-	-	-	-	4	4
White hake	-	-	-	-	+	+	2	3	15	11	7	7	+	+	24	22
Wolffishes	-	+	4	3	+	+	3	3	3	3	1	1	-	-	11	11
Other groundfish	-	-	5	6	+	+	+	+	9	6	11	10	6	6	31	28
Atlantic herring	-	-	+	+	+	+	3	1	145	142	35	23	+	+	182	166
Atlantic mackerel	-	-	-	-	-	-	+	8	16	12	1	2	9	4	26	25
Atlantic butterfish	-	-	-	-	-	-	-	-	-	-	8	4	1	1	9	5
Atlantic menhaden	-	-	-	-	-	-	-	-	-	-	35	40	274	308	309	348
Other pelagics	-	-	+	-	-	-	+	1	1	1	6	3	7	6	15	12
Capelin	-	-	+	+	10	10	31	30	+	1	-	-	-	-	42	41
Other finfish	-	+	3	1	1	1	3	3	9	7	11	11	11	22	39	46
Squids	-	-	-	-	-	-	11	-	2	+	4	11	20	21	37	32
Clams	-	-	-	-	-	-	-	-	6	5	46	45	297	271	349	321
Scallops	-	-	-	-	+	+	6	5	23	22	97	79	19	28	145	133
Other molluscs	-	-	-	-	-	-	-	-	2	2	8	18	55	102	65	121
Shrimp	1	3	42	43	3	1	+	-	9	10	2	2	-	-	57	58
Other crustaceans	-	-	-	-	+	-	15	12	57	57	17	22	24	57	112	148
Other invertebrates	-	-	-	-	-	-	-	-	-	-	1	1	+	2	1	3
Total	3	5	124	129	134	77	469	482	735	689	490	467	738	847	2692	2696

[1] Data for 1983 from SCS Doc. 84/VI/22.

b) Subarea 1

The total nominal catch of all species increased slightly (4%) from 124,000 tons in 1982 to 129,000 tons in 1983, due almost entirely to the increased catch of cod (13%) which represented 48% of the overall catch in the subarea.

c) Subarea 2

The total nominal catch of all species declined sharply (57%) from 134,000 tons in 1982 to 77,000 tons in 1983, due to significant decreases in the catch of cod (57%), Greenland halibut (60%) and redfish (87%). The capelin catch remained the same in both years (10,000 tons).

d) Subarea 3

The total nominal catch of all species increased slightly (3%) from 469,000 tons in 1982 to 482,000 tons in 1983, due mainly to increased catches of cod (14%), redfish (7%) and Greenland halibut (18%), although decreased catches were noted for American plaice (13%), yellowtail flounders (31%) and squid (11,000 tons in 1982 to zero catch in 1983).

e) Subarea 4

The total nominal catch of all species declined (6%) from 735,000 tons in 1982 to 689,000 tons in 1983. Decreased catches of haddock (12%), redfish (12%), silver hake (40%), pollock (9%), white hake (27%), and mackerel (25%) were partly offset by increased catches of cod (4%) and shrimp (10%).

f) Subarea 5

The total nominal catch of all species declined (5%) from 490,000 tons in 1982 to 467,000 tons in 1983. Decreased catches of cod (10%), haddock (20%), pollock (10%), American plaice (13%), Atlantic herring (34%) and scallops (19%) were partly offset by increased catches of yellowtail flounder (19%), Atlantic menhaden (14%), squids (175%), blue mussels (125%) and crustaceans (29%).

g) Subarea 6

The total nominal catch of all species increased substantially (15%) from 738,000 tons in 1982 to 847,000 tons in 1983, due mainly to increased catches of Atlantic menhaden (12%), scallops (85%), blue mussel (85%) and crabs (138%), although the catch of clams, which constituted 32% of the invertebrate catch in 1983, declined by 9%.

II. STOCK ASSESSMENTS

1. Cod in Subarea 1 (SCR Doc. 84/VI/59, 78, 92, 93; SCS Doc. 84/VI/3, 16)

a) Introduction

The fishery for cod in Subarea 1 is partly an offshore fishery, mainly by large trawlers using bottom otter trawl, and partly a coastal and fjord fishery in which the major part of the catch is taken by pound-net. The pound-net season is generally from May-June to September. In 1983 about 80% of the catch by gears other than otter trawl was taken in the pound-net season. As a rough guideline for a breakdown of the catch by gears, it is estimated that about 3/4 of the non-trawled catch in May-September came from the fishery by pound-nets. The remainder of the non-trawled catch was taken by handlines, longlines and set gillnets (bottom). No breakdown of the catch by this miscellaneous-gear group is available.

Trawlers accounted for 2/3 of the total nominal catch of cod in Subarea 1 in 1983 and just above 1/2 the total catch in 1982, whereas in 1981 only 1/4 of the catch was made by trawlers (Table 2). The increase in catch from 1981 to 1983 is partly due to the fact that, while during the period of 1977-81 only Greenland vessels were allowed directed cod fishing in 1977-81, fishing in 1982 and 1983 was also allowed for some other EEC member countries, primarily the Federal Republic of Germany. Fishing over the last 10 years has been regulated by setting TACs and minimum mesh size for trawls. Trawling for cod in inshore waters is generally not allowed. Local rules prescribe a minimum landing size of 40 cm total length for cod.

During the 1955-68 period, catches fluctuated between 234,000 and 451,000 tons with the highest catch in 1962. Catches declined gradually after 1968 to a low of 33,000 tons in 1976, after a number of years with recruitment failure, and then increased somewhat when the relatively good 1973 year-class recruited in 1977 (Table 2). The high catch by non-trawlers in 1979 was based largely on the 1973 year-class and the fishery was especially good in Div. 1E and 1F.

Table 2. Catches (000 tons) of cod in Subarea 1, 1974-83.

	1976	1977	1978	1979	1980	1981	1982	1983
Trawlers	19	46	53	57	16	14	29	42
Other vessels	14	27	20	42	38	39	26	21
Total	33	73[4]	73[4]	99[4]	54[4]	53	55[5]	63[5]
TAC	45[2]	31[2]	-[1]	-[1]	20[1+2]	50[1+3]	62	62

[1] Catches limited to Greenlander's fishery and to by-catches in 1978-81.
[2] Quota for offshore fishery only.
[3] Quota for offshore plus inshore Greenland fishery.
[4] Estimates used for stock assessments.
[5] Provisional data.

The nominal catch in 1983 (about 63,000 tons) was about 15% higher than that in 1982. The increase was entirely due to the increase in the catch by trawlers. Data for Greenland trawlers indicate that the increase was due to an increase in fishing activity (effort) rather than to an increase in catch rate. On the contrary, the catch rate apparently decreased considerably from 1982 to 1983, as noted in the next section.

The winter of 1983/84 was one of the coldest observed in West Greenland over the last 100 years, and drift ice and locally-formed sea ice was a great hinderance to the fishery. There was only a negligible inshore fishery in the first 4 months of 1984.

b) Input data

i) Commercial fishery data

During 1977-81, Greenland vessels were the only ones allowed a directed fishery for cod. Therefore, data for the Greenland trawlers are used to illustrate trends in catch rates. The basic material is a haul-by-haul logbook record adjusted to actual weight of landings, as recorded in the factories where the catches are landed. Effort figures for Greenland vessels are available only for the nine trawlers operated by the Royal Greenland Trade Department. Six of these are in the 500-999 GRT tonnnage class. Their nominal catches, effort and catch per unit effort for 1980-83 are listed in Table 3.

The annual overall CPUE decreased sharply from 3,259 kg/hour in 1981 to 2,212 kg/hour in 1982 and to 1,364 kg/hour in 1983, a level slightly above that for 1980. As in 1982, the best catch rate in 1983 was in Div. 1E, and 70% of the recorded fishing time for cod by the trawlers took place in this division, whereas for the years 1980-81 no single division had

Table 3. Cod in Subarea 1: catch, effort and catch-per-unit-effort for the directed fishery by Greenland trawlers (500-999 GRT), 1980-83.

NAFO Div.	1980 Catch (tons)	1980 Effort (hr)	1980 CPUE (kg/hr)	1981 Catch (tons)	1981 Effort (hr)	1981 CPUE (kg/hr)	1982 Catch (tons)	1982 Effort (hr)	1982 CPUE (kg/hr	1983 Catch (tons)	1983 Effort (hr)	1983 CPUE (kg/hr)
1B	1,789	727	2,461	-	-	-	133	100	1,330	292	927	315
1C	1,646	1,513	1,088	4,254	1,279	3,326	4,023	1,937	2,077	562	593	948
1D	1,768	1,983	892	4,701	1,856	2,533	7,189	4,084	1,760	3,974	4,039	984
1E	1,395	1,093	1,277	4,381	952	4,602	9,350	3,221	2,903	11,382	6,295	1,808
1F	19	31	613	-	5	-	11	17	647	112	114	982
Total	6,617	5,346	1,238	13,336	4,092	3,259	20,706	9,359	2,212	16,322	11,968	1,364

more than 45% of the total cod fishing effort by these trawlers in 1980 and 1981. The decrease in CPUE was observed for all divisions and quarters of the year except for Div. 1C, 1E and 1F in the third quarter. However, fishing effort in that period accounted for only 10% of the effort in 1983 by these vessels.

ii) Weight-at-age data

Based upon samples of the commercial fisheries by Greenland vessels, mean weights at age by quarters were calculated for the offshore trawl fishery and for the inshore fisheries. Using quarterly catches as weighting factors, weighted annual means for these two components were calculated. For the purpose of catch projections, assuming that 2/3 of the catch will be taken by trawlers and that the fishing pattern remains as in 1983, the overall mean weights at age were calculated, and a smoothed curve was used to give the weight-at-age values (Table 4). For the important age groups (4-8), the figures are about 12% below those used in the 1983 assessments, which were based on the mean weights observed in 1982.

Table 4. Cod in Subarea 1: weighted mean annual weight (kg) by age from samples of landings by Greenland vessels, 1981-83, after conversion from landed to catch weight by conversion factor of 1.22.

Age (yr)	Offshore 1981	Offshore 1982	Offshore 1983	Inshore 1981	Inshore 1982	Inshore 1983	Weight used for projection
3	-	0.90	0.76	-	0.86	0.64	0.78
4	1.23	1.22	1.07	1.20	1.14	1.07	0.98
5	1.94	1.84	1.29	1.75	1.78	1.36	1.38
6	2.72	2.63	2.08	2.61	2.36	2.07	2.08
7	3.75	3.59	3.21	2.83	3.97	2.96	2.95
8	4.68	4.75	3.83	4.05	4.40	3.58	3.85
9	-	5.69	4.94	4.21	5.65	4.47	4.78
10	-	9.60	5.82	-	-	5.10	5.58
11+	-	-	-	-	-	-	6.00

iii) Age compositions

The nominal catches in terms of numbers at age are given in detail in SCR Doc. 84/VI/78 (table 15) and catch-at-age figures for 1965-82 are found in revised SCR Doc. 83/VI/60 (table 15B). The 1983 catches were heavily dominated by the 1977 year-class (6-year-old fish). This

year-class occurred mainly in the offshore catches and mainly in Div. 1E and 1F, whereas inshore catches were dominated by the 1979 year-class, mainly in Div. 1B-1D, followed by the 1977 year-class. The 1979 year-class will presumably increase its relative importance in 1984-85.

iv) Research data

The assessment in June 1983 was based upon minimum trawlable biomass and abundance estimates, from a stratified-random trawl survey carried out in November-December 1982 by the Federal Republic of Germany. An identically designed survey was carried out in November-December 1983 but the numbers of valid sets was increased by 45% to 142. Cod biomass and abundance estimates for 1982 and 1983 for the total survey area (19,864 nm²), which should include most or nearly all of the cod population off West Greenland, were as follows:

	1982	1983
Biomass (tons)	179,934 ± 37.0%	98,843 ± 25.5%
Population no. (000)	109,039 ± 36.1%	59,375 ± 26.5%

The confidence intervals are given at the 95% significance level. The survey results indicate a drastic decline in cod biomass and abundance during 1983. This decline was observed in all divisions (SCR Doc. 84/VI/93, table 2). The age compositions for both surveys show the 1977 and 1979 year-classes clearly dominating in both years. The decline in abundance, however, is particularly pronounced for 1977 and older year-classes.

v) Environmental data

The last two winters (1982/83 and 1983/84) have shown extremely low temperatures at West Greenland and over Davis Strait. Temperatures in the surface water were below normal during 1983, and also lower than normal temperatures were observed to the west of the banks in the fall of 1983. Although the absolute bottom temperatures throughout the area covered by the above-mentioned trawl survey do not by themselves seem restrictive to cod distribution, 1983 seems to have been an unusual year in terms of hydrographic conditions and ice, and it can not be excluded that the distribution of cod in Greenland waters has changed compared to the previous year.

c) Assessment results and basis for projections

As in the June 1983 assessment, the Committee has based its advice on results from the trawl surveys. The decrease between the 1982 and 1983 estimates of minimum trawlable biomass was supported by trends in catch-per-unit-effort figures. The Committee found that the stock size observed in the November-December 1983 survey could serve as a conservative lower estimate of stock size at the beginning of 1984. In previous assessments, it was indicated that migration of cod from West Greenland to East Greenland-Iceland may vary between years and year-classes. A

quantification of the emigration during 1983 was made on the basis of the face-value results from the two surveys, and on the analyses carried out by the ICES Working Group on cod stocks at East Greenland, January 1984 (ICES C.M. 1984/Assess: 5). That working group estimated that, during 1983, the immigration from West Greenland of 6.4 million cod of age 6 and older must have taken place. The difference at West Greenland between two survey stock estimates is not fully explained by the numbers caught during 1983, the numbers lost due to natural mortality with M = 0.20, and the emigration of 6.4 million fish. If the difference were to be fully explained by catch, natural mortality and emigration, the latter would amount to 19.6 million fish, the figures being:

Stock size in numbers at the beginning of 1983	71.3 million
Catch in numbers during 1983	22.5 "
Losses due to natural mortality	8.1 "
Losses due to emigration	19.6 "
Stock size at the end of 1983	21.1 "

The details of this calculation are found in SCR Doc. 84/VI/92 (table 1). Such an emigration would correspond to an instantaneous coefficient E = 0.50 for age 6+ fish, while the emigration of 6.4 million fish corresponds to an E-value of 0.14. Therefore, there is good evidence, in the present situation, that a higher value than E = 0.05 for Subarea 1 cod as a whole has to be adopted. Consequently, E = 0.15 (same value as previously estiamted for Div. 1E-1F separately) was chosen as the lower limit and a value of 0.30 was used as the upper limit (same level as found by the ICES/ICNAF Working Group on cod stocks in the North Atlantic for Div. 1E-1F and East Greenland combined, *ICES Coop. Res. Rep.*, No. 33, 1973).

If only 6.4 million fish are considered to have migrated during 1983, one could agree that the remainder (19.6-6.4 = 13.20 million) could be explained by assuming either higher natural mortality or that the survey stock biomass was overestimated in 1982 or underestimated in 1983 (or a combination of these possibilities). As an upper limit for the projections, the Committee took the November-December 1983 survey biomass estimates of the stock (age 5+) with the addition of the 13.2 million fish. For ages 3 and 4, the recuitment of 20 million and 75 million respectively were used, the latter reduced to 54.4 million for mortality in 1983.

Thus, projections are given for a range of stock sizes at the beginning of 1984 of about 129 million and 142 million fish and for emigration rates of E = 0.15 and 0.30. The above mentioned calculations were performed in order to cover possible ranges for stock sizes and emigation rates. The Committee, recalling that stock estimates from surveys have a wide confidence interval, considers that the results can not be interpreted as precise estimates. The Committee also points out that survey biomass estimates of stocks by themselves are believed to be underestimates of the true stock sizes if, as in this case, a catchability factor of 1.0 is applied.

d) Request for advice (SCS Doc. 84/VI/3)

The EEC has requested projections of catches up to and including 1987 (1988 for the spawning

stock) for a number of specified management options and has informed that the agreed TAC for 1984 is 68,500 tons. The projections are, therefore, generally given on the assumption that the catch in 1984 amounts to the TAC. The analyses show that such a catch can be obtained only if F-values are well above $F_{0.1}$ on the yield-per-recruit curve (Fig. 1). With an emmigration rate of E = 0.15, the F-values to achieve the TAC also exceeds F_{max}. One of the options requested is a constant catch from 1983 onwards equal to that in 1984 if the stock were fished at $F_{0.1}$ in 1984. The analyses indicate $F_{0.1}$ = 0.27 with E = 0.15 and $F_{0.1}$ = 0.39 with E = 0.30. In addition to the options requested, projections for a steady $F_{0.1}$ level from 1984 onwards are also given.

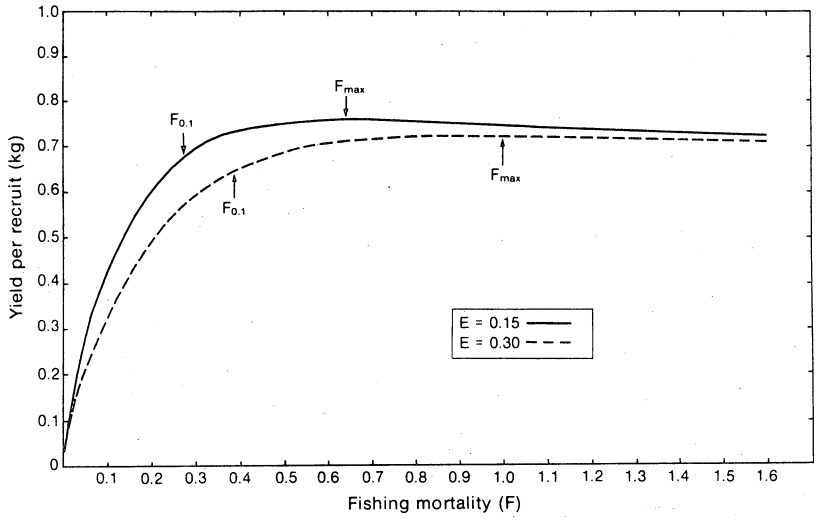

Fig. 1. Subarea 1 cod: yield-per-recruit for a range of fishing mortality (F) and two levels of emigration from West Greenland.

e) Catch projections

Parameters used for projections are given in Table 5. Partial recruitment values were taken from the analysis in June 1983. A natural mortality rate of M = 0.20 was used, as previously estimated, except for age-group 3 where M = 0.30 was used in order to account for possible discarding of small fish. The emigration rates in recent years seem to be higher than the instantaneous coefficient of 0.05 previously used for Subarea 1 cod as a whole. Consequently, yield-per-recruit curves were constructed for E = 0.15 and E = 0.30 (Fig. 1). As a result of the increased E-values, the $F_{0.1}$ and F_{max} estimates became higher than those obtained last year. The $F_{0.1}$ levels were estimated at 0.27 and 0.39. The F_{max} values are not very meaningful, because they lie in the upper flat part of the yield-per-recruit curves, but, for the purpose of projections as requested by the EEC, values of 0.64 and 1.0 with E-values of 0.15 and 0.30 respectively were used.

The projections of catch and spawning stock biomass, according to the EEC request and the assumptions and estimates made for stock size and biological parameters, are set up in Table 6 and

Table 5. Subarea 1 cod: parameters used in catch projections, with M = 0.2 and recruitment at age 3 as listed below[1].

Age (yr)	Stock size 1 Jan 1984 direct[2] (000)	Stock size 1 Jan 1984 adjusted[3] (000)	Relative natural mortality (M) for E=0.15	Relative natural mortality (M) for E=0.30	Mean weight at age (kg)	Percent maturity	Relative fishing mortality (F)
3	20,000	20,000	1.50	1.50	0.78	1	0.039
4	54,407	54,407	1.00	1.00	0.98	3	0.520
5	33,245	33,245	1.00	1.00	1.38	15	1.000
6	4,895	7,954	1.75	2.50	2.08	48	1.000
7	12,412	20,170	1.75	2.50	2.95	83	1.000
8	1,996	3,243	1.75	2.50	3.85	96	1.000
9	1,121	1,821	1.75	2.50	4.78	99	1.000
10	359	583	1.75	2.50	5.58	100	1.000
11	226	367	1.75	2.50	6.00	100	1.000
12	1	2	1.75	2.50	6.70	100	1.000
13	6	10	1.75	2.50	7.30	100	1.000
14	16	26	1.75	2.50	7.70	100	1.000
15+	5	7	1.75	2.50	8.00	100	1.000

[1] Recruitment at age 3: 150 million fish in 1985, and 20 million fish in both 1986 and 1987.
[2] Direct estimates from 1983 survey.
[3] Adjusted estimates from 1983 survey.

7 for the lower and upper stock estimates respectively, and are illustrated in Fig. 2. Clearly the new data suggest very low stock and catch levels. A spawning stock in the order of 175,000 tons, used as reference stock in one of the requested options, is not likely to be achieved within the next 4 years, even with no catch taken.

This rather drastic change in the situation is not fully understood and explained. However, since all evidence from research and commercial fishing points to the drastic decline, the Committee considers that projections have to be made on a prudent and conservative basis. The projections are, of course, subject to revision if the assumed catch of 68,500 tons in 1984 is not taken. Likewise, the projections are subject to revision if recuitment estimates for the 1980-84 year-classes are revised. In fact, the Committee feels that, under the present circumstances, projections of catch beyond 1985 and stock size beyond 1986 are very uncertain. By 1986, the major part of the catch is likely to consist of the 1980-82 year-classes, especially if the 1979 year-class is fished heavily during 1984 as projected for a catch equal to the TAC.

After the good 1973 year-class recruited in 1976-77, exploitation of this stock was characterized by concentration of fishing on relatively good but newly recruited year-classes. The 1977 year-class seems already to have been heavily fished and the 1979 year-class will be so in 1984. The chances of rebuilding stock size, especially spawning stock, have not really been used. The next chance may, hopefully, occur with recruitment of the 1982 year-class, but much more prudent management is called for if the stock is to be rebuilt.

Table 6. Subarea 1 cod: projections of spawning stock biomass (SSB) at the beginning of each year and catch during the year for various management strategies. Population numbers at the beginning of 1984 are based on direct results of 1983 survey.

Management options		F(1985-87) = $F_{0.1}$		F(1985-87) = Fmax		F(1985-87) = F(1982)		SSB> 175,000 t		Catch(85-87) = Catch (83)		Catch(85-87) = 68,500 t		Catch(85-87) at $F_{0.1}$(84)[1]		F(84-87) = $F_{0.1}$(84-87)	
E		0.15	0.30	0.15	0.30	0.15	0.30	0.15	0.30	0.15	0.30	0.15	0.30	0.15	0.30	0.15	0.30
1984	SSB[2]	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	F	0.772	0.800	0.772	0.800	0.772	0.800	0.772	0.800	0.772	0.800	0.772	0.800	0.772	0.800	0.273	0.392
	Catch[2]	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	29.4	39.2
1985	SSB	46	41	46	41	46	41	46	41	46	41	46	41	46	41	72	59
	F	0.273	0.392	0.642	1.000	0.340	0.340	0	0	1.010	1.145	1.172	1.335	0.373	0.587	0.273	0.392
	Catch	22.4	28.2	45.5	57.4	27.2	25.0	0	0	62.5	62.5	68.5	68.5	29.4	39.2	32.1	37.4
1986	SSB	58	45	41	26	54	47	75	64	30	23	26	20	53	38	85	61
	F	0.273	0.392	0.642	1.000	0.340	0.340	0	0	0.950	1.087	1.179	1.353	0.268	0.458	0.273	0.392
	Catch	31.6	37.6	54.3	61.8	37.0	34.1	0	0	62.5	62.5	68.5	68.5	29.4	39.2	38.9	43.1
1987	SSB	72	50	41	22	64	54	113	93	26	19	20	15	67	42	95	61
	F	0.273	0.392	0.642	1.000	0.340	0.340	0	0	1.124	1.418	1.180	2.650	0.206	0.380	0.273	0.392
	Catch	39.0	43.8	55.7	54.8	44.2	40.7	0	0	62.5	62.5	68.5	68.5	29.4	39.2	44.1	46.8
1988	SSB	95	65	45	21	82	72	174	145	21	14	10	4	98	59	111	70

[1] Catch in 1985-87 = hypothetical catch at $F_{0.1}$ in 1984.
[2] SSB and catch values in thousands of tons.

Table 7. Subarea 1 cod: projections of spawning stock biomass (SSB) at the beginning of each year and catch during the year for various management strategies. Population numbers at the beginning of 1984 are based on adjusted results of 1983 survey.

Management options		F(1985-87) = $F_{0.1}$		F(1985-87) = Fmax		F(1985-87) = F(1982)		SSB> 175,000 t		Catch(85-87) = Catch (83)		Catch(85-87) = 68,500 t		Catch(85-87) at $F_{0.1}$(84)[1]		F(84-87) = $F_{0.1}$(84-87)	
E		0.15	0.30	0.15	0.30	0 15	0.30	0.15	0.30	0.15	0.30	0.15	0.30	0.15	0.30	0.15	0.30
1984	SSB[2]	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92
	F	0.561	0.586	0.561	0.586	0.561	0.586	0.561	0.586	0.561	0.586	0.561	0.586	0.561	0.586	0.273	0.392
	Catch[2]	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	37.5	49.4
1985	SSB	75	66	75	66	75	66	75	66	75	66	75	66	75	66	98	79
	F	0.273	0.392	0.642	1.000	0.340	0.340	0	0	0.665	0.763	0.752	0.870	0.350	0.555	0.273	0.392
	Catch	30.2	37.1	61.0	75.1	36.6	32.9	0	0	62.5	62.5	68.5	68.5	37.5	49.4	37.7	42.8
1986	SSB	81	61	57	35	76	64	105	88	56	43	52	39	76	52	103	71
	F	0.273	0.392	0.642	1.000	0.340	0.340	0	0	0.660	0.790	0.790	0.955	0.291	0.516	0.273	0.392
	Catch	37.1	42.5	61.8	67.2	43.2	38.7	0	0	62.5	62.5	68.5	68.5	37.5	49.4	42.6	45.9
1987	SSB	89	59	49	25	79	64	142	113	47	33	40	28	82	48	106	66
	F	0.273	0.392	0.642	1.000	0.340	0.340	0.1	0	0.710	0.914	0.950	1.290	0.248	0.491	0.273	.392
	Catch	42.6	46.3	59.2	56.3	48.0	43.2	23.2	0	62.5	62.5	68.5	68.5	37.5	49.4	46.4	48.1
1988	SSB	106	69	48	22	91	77	180	160	44	29	31	18	103	56	118	73

[1] Catch in 1985-87 = hypothetical catch at $F_{0.1}$ in 1984.
[2] SSB and catch values in thousands of tons.

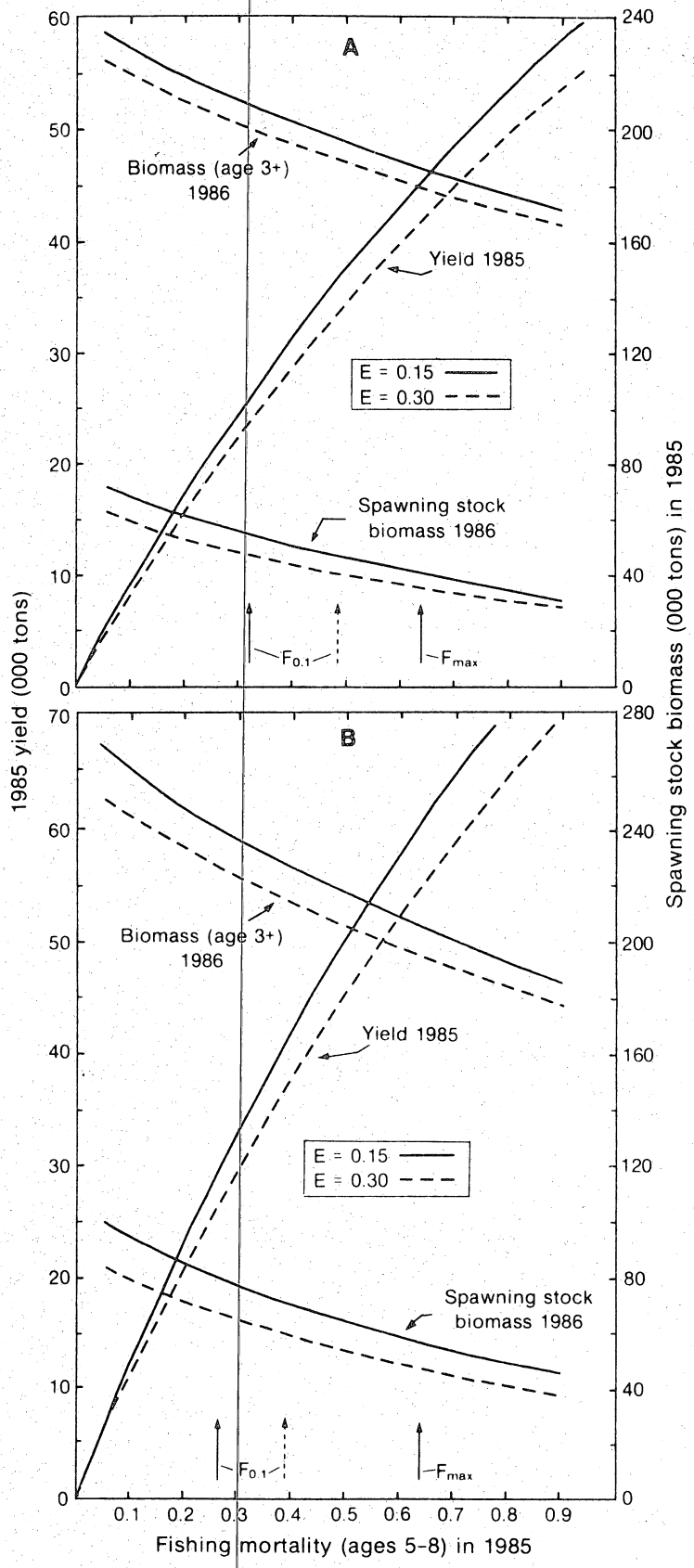

Fig. 2. Subarea 1 cod: trends in estimated yield in 1985, biomass (age 3+) and spawning stock biomass by January 1986 for various levels of fishing mortality in 1985, assuming a catch of 68,500 tons in 1984.

f) Mesh assessments

The Committee noted the EEC request for an assessment of increasing the mesh size from the present minimum (130 mm) to 140, 150 and 160 mm as alternatives. No new analysis was presented at this meeting, but the Committee refers to the conclusion reached at the June 1980 Meeting (based on the analysis in SCR Doc. 80/VI/76), that an increase in mesh size to 140-160 mm would lead to a moderate (1-8%) increase in yield-per-recruit and a larger increase (5-40%) in spawning biomass per recruit. In these calculations, discards of small cod from gears other than trawl have been taken into account, by applying a natural mortality of 0.30 to the age 3 cod. The actual gain in yield and spawning biomass per recruit will vary from year to year due to the variations in growth rate and in emigration rate, but there is a gain to be achieved from cod, especially insofar as the spawning stock is concerned.

2. Cod in Divisions 2J, 3K and 3L (SCR Doc. 84/VI/23, 24, 26, 29, 33, 51, 73, 79, 88, 91)

a) Introduction

Since the mid-1960's, nominal catches have ranged from a high of 800,000 tons in 1968 to a low of 139,000 tons in 1978. The catch in 1983 was the second highest since 1975 with only the nominal catch in 1982 being higher. In 1982 and 1983 the catch by inshore gears was approximately 50% of the total catch. In recent years, the catches by inshore gears have reached the levels attained in the mid-1960's. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	300	160	135	180	180	200	237	260	266
Catch (000) tons	214	173	139	167	176	171	230[1]	227[1]	

[1] Provisional data.

b) Input data

i) Commercial fishery

Approximately 45% of the commercial catch in 1983 came from Div. 3L, 35% from Div. 3K and 20% from Div. 2J. The dominant year-class in the catch was that of 1978 with the year-classes of 1973, 1974 and 1975 also being well represented. Mean weights at age were similar to those of 1981 and 1982, being just slightly lower in 1983 for some of the older ages.

Catch rates for 1959-83, standardized with respect to gear type by country, division and month, were derived from available catch and effort data using the multiplicative model. In general the catch rate index shows a decline through the late 1960's to the mid 1970's, with an increase in subsequent years. The 1983 value was about the same as that for 1969.

ii) Research data

Stratified-random surveys have been carried out by Canada since 1977 in Div. 2J, 1978 in Div. 3K and 1971 (except 1983) in Div. 3L. Surveys were also conducted by the Federal Republic of

Germany in Div. 2J since 1972, and by the USSR in Div. 3K and 3L since 1972. The Canadian and Federal Republic of Germany surveys both showed a substantial increase in abundance and biomass in Div. 2J from 1982 to 1983. A slight increase in abundance and biomass was evident in the Canadian and USSR surveys for the same period in Div. 3K. The 1978 year-class, which was dominant in the commercial catches, was strong in the surveys conducted by all three countries in 1983. In both the Canadian and Federal Republic of Germany surveys in 1983 in Div. 2J, the 1979 year-class appeared to be relatively strong.

Recoveries of adult cod tagged in inshore areas of eastern Newfoundland during autumn in 1979 and 1980 confirmed earlier studies that cod returned in subsequent years to the same general area in which they had been tagged. Cod tagged during winter in Conception Bay tended to remain mainly within the bay with only occasional individuals recovered in areas outside the bay. Adult cod tagged inshore at Orton Island, northern Labrador, during August 1981 were recaptured offshore during winter-spring, mainly along the slopes of Hamilton Bank and occasionally as far south as Belle Isle Bank and Funk Island Bank.

A stratified-random trawl survey during February 1978 in Div. 2J indicated that cod were most abundant on the eastern slope of Hamilton Bank in depths of 300-500 m at bottom temepratures of 3-5°C. On the basis of catches during tagging cruises in 1979-83, the highest catch rates for Div. 2J+3KL occurred on the northern slope of Funk Island Bank, followed by southeast Hamilton Bank, Belle Isle Bank, southwest Funk Island Bank, northern Hamilton Bank and northern Grand Bank. The largest concentrations were found in depths of about 230-420 m (average about 300 m) where bottom temperatures ranged from 1.5 to 5.5°C (average about 3°C).

It was demonstrated previously that several major offshore components of the cod stock complex in Div. 2J+3KL contribute to the coastal inshore fishery in specific, though wide, geographic areas from Labrador to southeastern Newfoundland (SCR Doc. 82/IX/89). It was suggested that the effects of a sustained high exploitation rate on a major offshore component of the overwintering concentration may have an adverse effect on the coastal inshore fishery. Catches in recent years (1978-83) have been distributed over most of the coastal areas with some fluctuation among areas in different years. There is no evidence at present to indicate that any one component is being fished more intensively than others, even though there may be a real potential in some years for this to occur. In fact, this may have occurred in the past, as evidenced by differences in rates of decline of inshore catch-per-man in Div. 2J, 3K and 3L (ICNAF Res. Doc. 74/103).

Examination of the stomachs of cod caught in 1983 by various inshore gears at Bonavista, Newfoundland, showed that cod in shallow water fed intensively and almost exlusively on capelin in late June and July, but that, after the capelin spawning season, they fed much less intensively, primarily on benthic invertebrates. Cod caught by gillnet in deep water had

a moderately low feeding rate and a broad prey spectrum, except in late June and early July when they fed intensively on sand lance.

The major prey of cod collected off southern Labrador and northeast Newfoundland during autumn in 1977-82 were capelin, shrimp, crabs, hyperiid amphipods and Arctic cod. Predation on capelin was most intensive on Hamilton Bank and southward along the adjacent coastal shelf. During the period of low capelin abundance in the late 1970's, cod did not compensate for reduced predation on capelin by preying more intensively on shrimp, crabs or other benthic invertebrates, but there was increased predation on Arctic cod and hyperiids. This increased predation on alternate prey only partly compensated for the reduction in predation on capelin.

The feeding intensity of cod collected from southern Labrador and eastern Newfoundland in winter during 1978-83 was low, especially near the outer part of the continental shelf and on the upper slope. The major fish prey was capelin, which occurred frequently in cod stomachs from off Cape Bonavista and occasionally in those from the central and western parts of Belle Isle Bank and Funk Island Bank. The major invertebrate prey was shrimp (*Pandalus borealis*), which was widely distributed south of Hamilton Bank but particularly important on Belle Isle Bank.

c) Estimation of assessment parameters

i) Catch composition, weight-at-age and partial recruitment

Catch and average weight-at-age data from the commercial fishery during the 1962-83 period were used in cohort analyses. These analyses with M = 0.20 were performed for a range of fishing mortality values in 1983. Partial recruitment values of ages 4-7 were obtained by taking the averages of the selectivity coefficients for 1975-81 after replacing values greater than 1.0 by 1.0. It was assumed that the partial recruitment of ages 8-13 in 1983 was 1.0. The fishing mortality for age 13 in the 1962-82 period was assumed to be equal to the total fishing mortality for ages 8-11.

ii) Fishing mortality in 1983

Two relationships were derived using unweighted least squares regression to estimate fishing mortality in 1983. Mid-year exploitable biomass versus commercial catch rate gave the highest r^2 and minimum residuals for 1981-83 with a fully recruited fishing mortality estimate of 0.20. Exploitable biomass was calculated by multiplying each mid-year biomass at age with its respective partial recruitment value.

A survey biomass index was obtained by combining results from Canada and the Federal Republic of Germany autumn surveys. The data for Div. 3L was omitted because of lack of a Canadian survey in 1983. The 1977 biomass estimate for Div. 3K from the Canadian survey was calculated by taking the proportion of the Div. 3K to Div. 2J average biomass for the 1978-82 period.

The Canadian series in the two divisions were then added and the combined series scaled to its mean. The mean weight per tow from the Federal Republic of Germany survey in Div. 2J was scaled to its 1977-83 mean and then averaged with the Canadian series to produce the index of biomass. Age 4+ biomass from cohort analysis versus this survey biomass index lagged 1 year gave the highest r^2 with a fully recruited fishing mortality estimate of 0.25.

The fully recruited F that was accepted for use in the cohort analysis was 0.225, because it was the midpoint of the range of fishing mortalities derived from the above relationships.

d) Catch projections

A regression, using unweighted least squares between age 3 survey abundance from the combined Canada and Federal Republic of Germany survey abundance index and beginning of year age 4 abundance in the succeeding year from cohort analysis, was not significant and did not allow estimation of recruiting year-classes. A regression using strengths of the year-classes derived from age 3 abundance from the USSR survey and age 4 abundance from cohort analysis was significant and showed the 1979 year-class at a level of 312 million fish and the 1980 year-class to be equal to long-term (1962-82) geometric mean of 400 million fish (Table 8). Both 1979 and 1980 year-classes were set at 400 million at age 4 in the projections. The recruitment at age 4 for 1985 was taken as the short-term geometric mean of 1973-82 values (250 million fish). The mean weights-at-age used in the projections are averages of values derived for 1982 and 1983. The basic parameters used to project stock size and catches are given in Table 9. The TAC value for 1984 of 266,000 tons was used as the expected catch in 1984 for projection purposes, and the projection results are shown in Table 10. STACFIS advises that the estimated catch which will result from fishing at $F_{0.1}$= 0.2 in 1985 is not different from 266,000 tons, the level of TAC for 1984. The estimate of average population biomass (age 4+) for 1983 from this assessment is 1.58 million tons

Table 8. Cod in Div. 2J, 3K and 3L: relationships between year-class abundance estimates from surveys at age 3 and from cohort analysis at age 4, 1959-80.

Year-class	Survey no./tow age 3	Cohort no. at age 4 (millions)	Year-class	Survey no./tow age 3	Cohort no. at age 4 (millions)
1959[1]	51	578	1970	16	124
1960	27	506	1971	16	125
1961	71	685	1972	15	242
1962	78	817	1973	65	373
1963	95	925	1974	68	328
1964	79	670	1975	8	314
1965	44	578	1976	5	190
1966	99	536	1977	3	243
1967	84	588	1978	25	591
1968	164	475	1979	6	(312)[2]
1969	79	208	1980	32	(388)[2]

[1] For the 1959-78 year-classes, r^2 = 0.28, slope = 2.94, intercept = 294.
[2] Predicted values.

Table 9. Cod in Div. 2J, 3K and 3L: parameters used in the projections of stock biomass and catch.

Age (yr)	Population (millions)	1983 catch (millions)	Mean wt. (kg)	Partial recruitment
4	400.0	13.4	0.85	0.17
5	454.4	41.4	1.26	0.47
6	141.2	18.7	1.76	0.70
7	75.4	11.8	2.19	0.84
8	79.1	14.5	2.63	1.00
9	48.0	8.8	3.13	1.00
10	34.9	6.4	3.84	1.00
11	5.5	1.0	5.51	1.00
12	1.1	0.2	7.47	1.00
13	0.6	0.1	8.55	1.00

Table 10. Cod in Div. 2J, 3K and 3L: projections of spawning stock biomass (age 7+) and catch.

	1983	1984	1985	1986
Spawning biomass (000 tons)	640	722	1,056	1,207
Fishing mortality (F)	0.255	0.225	0.20	
Catch (000 tons)	227	266	268	

and is projected to increase to 1.84 million tons by 1985. These levels are comparable to those of the late 1960's and well above the minimum of 300,000 tons in 1976. The estimate of spawning biomass (age 7+) at the beginning of 1984 is 722,000 tons and is projected to be 1.2 million tons by the beginning of 1986 (Table 10). The 1984 level is similar to that of the late 1960's, the spawning biomass having declined to a low of 125,000 tons in 1977-78. The projected 1986 level is within the range of the target spawning biomass established by STACRES of ICNAF (1.2-1.8 million tons), although it is somewhat less than that projected in the 1983 assessment, partly because of declining average weight-at-age in recent years.

3. Cod in Division 3M (SCR Doc. 84/VI/29, 33, 41, 47, 94; SCS 84/VI/14, 17)

a) Introduction

The Flemish Cap includes depths from about 150 m at its center to 750 m within a radius of about 60 nautical miles. Cod are, however, uncommon in depths greater than 550 m. The bottom is fairly smooth except in the south in depths greater than about 350 m. The cod fishery is prosecuted by otter trawl, pair trawl, longline and gillnet. Catches have been taken mostly from May or June to October or November, and also in March. In the 1963-72 period, the average annual catch was about 41,000 tons, about 80% of which was taken by USSR, Portugal, France and Faroe Islands. In the succeeding ten years (1973-82), the average annual catch dropped to about 23,000 tons, about 85% of which was taken by Portugal, Faroe Islands, USSR and Spain. The provisional catches in 1983 were by Spain (4,407 tons), Portugal (2,930 tons), Faroe Islands (1,489 tons), USSR (1,264 tons),

Norway (111 tons) and others (4 tons), for a total of 10,205 tons. Catch quotas have been in effect since 1974. Recent catches and TACs have been as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	40	25	40	40	13	12.7	12.4[1]	12.4[1]	13.0
Catch (000 tons)	22	27	33	30	10	14	13[2]	10[2]	

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

b) Input data

i) Commercial fishery data

The catch rate series presented in SCR Doc. 81/II/12 for the 1960-80 period showed a decline from a level of about 2 tons per hour in 1963-64 to about 0.5 tons per hour in 1978-79 and 0.1 tons per hour in 1980. This catch rate series has not been extended because of scarcity of effort information. The longline catch rates for Faroe Islands and Norway have declined since the mid-1970's.

Length and age composition data were available from Portugal, Spain and Canada (observers) for the otter-trawl, pair-trawl and longline fisheries in 1983. Sampling data were available for 1981 and 1982 and, although these data were rather scanty, age composition estimates for the total catch were derived for 1981 and 1982 as well as for 1983. In 1981, the dominant age-groups were ages 3 and 4, and the same year-classes were dominant at ages 4 and 5 in 1982. STACFIS noted with concern that the dominant age-group in the commercial catch in 1983 was age 3, the 1980 year-class. The relatively abundant 1981 year-class at age 2 was reported taken only in small quantities.

ii) Research data

Research vessel surveys have been conducted in the area by the USSR since 1971 and by Canada since 1977. Abundance estimates from the Canadian surveys were consistent with F values in the order of 1.0 since the late 1970's. Both USSR and Canadian survey results indicated a strong increase in population numbers in 1983 as compared to 1982, with a much smaller increase in biomass. This is because the 1981 year-class at age 2 in 1983 appears to be stronger than that of 1980. The 1981 year-class accounted for 75% of the age composition in the 1984 Canadian survey. There is a potential, therefore, for population growth, depending on the fishing strategy applied in the next few years.

c) Estimation of parameters

The age compositions for 1981-83 and those for 1972-80 from SCR Doc. 81/II/12 were used in a cohort analysis. The partial recruitment vector, derived from a comparison of numbers-at-age for 1981-83 in the commercial catches and in the Canadian research vessel surveys, was as follows:

Age	3	4	5	6	7	8	9	10	11	12
	0.55	0.75	0.90	1.0	0.95	0.75	0.55	0.40	0.40	0.40

For the terminal F in the years prior to 1983, the F was derived by iteration such that the terminal F at age 12 in any year was equal to the total F weighted to population numbers of ages 10-12 in that same year.

d) Assessment results

From the correlation coefficients derived from a comparison of population numbers (age 3+) in the Canadian surveys with the population numbers (3+) from the cohort analysis, the terminal F in 1983 might be in the range 0.4 to 1.0 or even higher. From a comparison of catch rates (kg/hour) from the USSR surveys and mid-year biomass (3+) from the cohort analysis, a terminal F of about 0.4 was implied.

Because of the inadequacy of sampling in 1981-82, (e.g., only 74 otoliths from the entire otter trawl and pair trawl fishery in 1981), STACFIS had little confidence in the estimates, derived from the cohort analysis, of biomass and population numbers in the last few years. More confidence was put in the estimates for 1978-80 where the accumulated catches for each year-class had reached a high proportion of the total catch expected from it. In 1978-80, the average mid-year biomass was about 30,000-35,000 tons. Catch rates for 1978-80 and for 1983 from the USSR and Canadian surveys were as follows:

Year	Survey catch rate (kg)	
	USSR	Canadian
1978	79	105
1979	108	39
1980	35	45
1983	69	37

The USSR survey results imply that the biomass has not changed since the late 1970's. The Canadian survey results imply that there may have been a decline since then. On this basis, STACFIS concluded that the population biomass of cod on the Flemish Cap in 1983 was about 30,000-35,000 tons and has been at about that level since the late 1970's. In the 1960-65 period, the average biomass was about 200,000 tons.

e) Catch projections

Although there is evidence of good recruitment, STACFIS noted that the fishable stock remains in a depleted state and reiterates, for 1985, the advice given in 1982 and 1983 that there be no exploitation of the stock. Too early exploitation of the 1980 and 1981 year-classes will reduce considerably their expected contribution to the fishable biomass and subsequently to the spawning stock, and the fishery on these year-classes should therefore be delayed.

STACFIS noted the management strategy of the Fisheries Commission for this stock (NAFO FC Doc.

83/IX/4, revised), namely "The TAC will not be increased beyond 12,965 metric tons until the Scientific Council advises that the age 3+ mean biomass has reached a level approximately equal to one-half the mean age 3+ equilibrium biomass associated with fishing at F_{max}, and assuming long-term average recruitment levels". A previous yield-per-recruit analysis (ICNAF Res. Doc. 79/VI/79) indicated F_{max} = 0.27. Recruitment estimates from SCR Doc. 80/II/28 and SCR Doc. 81/II/12 indicated that, for the years 1959-78, the geometric mean of 3 year-olds recruiting to the fishery was 32 million fish. With selection pattern and average weights-at-age as in ICNAF Res. Doc. 79/VI/79 and with fishing at F_{max} = 0.27, one-half the mean age 3+ equilibrium biomass is about 85 thousand tons.

4. Cod in Divisions 3N and 3O (SCR Doc. 84/VI/29, 33, 52; SCS Doc. 84/VI/14)

a) Introduction

Nominal catches have declined from a high of 227,000 tons in 1967 to a low of 15,000 tons in 1978. The Spanish pair-trawl fishery, which has traditionally accounted for the highest proportion of the catch in this area, has been fishing in a restricted area in the southernmost part of the zone since 1981. Other countries involved have been Canada, Portugal and the USSR. Catches from the Canadian otter-trawl fishery are currently at their highest level (11,000 tons) since 1954, although cod have been caught mainly as by-catch in the flounder fisheries. Catches by Portugal have been mainly from a gillnet fishery. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	43	30	15	25	26	26	17[1]	17[1]	26
Catch (000 tons)	24	18	15	28	20	24	32[2]	29[2]	

[1] Excludes expected catch by Spain.
[2] Provisional data including Spanish catch of 12,300 tons in 1983.

b) Input data

i) Commercial fishery catch-effort data

In recent assessments, available catch and effort data for the commercial fishery have been analyzed to produce a single catch-rate index using a multiplicative model, which standardized the catch rates with respect to gear type by country, division and month. The major gear types in the cod fishery of this area are otter trawl and pair trawl, the catch-rate series of which exhibited different seasonal patterns. Because the model assumes that the different catch-rate series have similar seasonal patterns, it was considered inappropriate to combine data from the two series in a multiplicative model. In an attempt to obtain a catch-rate index reflective of the total fishery, the two separate series were combined and averaged over the 1959-75 period, after scaling each to its respective mean catch-rate index for the period. The catch-rate index for 1976-83 which was also scaled to the otter-trawl catch-rate for 1959-75, was derived from the Canadian otter-trawl fleet.

However, the previously-stated uncertainties about the catch-rate data for this stock continue to be a problem. These uncertainties include (i) large fluctuations in the catch rates of Spanish pair trawlers in recent years, together with fishing being limited to a much smaller area in 1981-83 than in previous years; (ii) use of catch-rate data for otter trawlers, which take a small proportion of the total catch; and (iii) use in recent years of catch-rate data for Canadian otter trawlers, which take cod mainly as by-catch in the fishery for flounders. Directed cod catch from the Canadian otter-trawl fishery in recent years has come mainly from Div. 3O, but the general area within Div. 3O from which the highest proportion of the directed catch was obtained has varied. Catch rates for some tonnage classes show considerable variation, but there appears to have been a general increase in recent years.

ii) Research surveys

Stratified-random surveys were conducted in the area by Canada from 1971 to 1982 and in 1984. Div. 3O was not surveyed in 1971, 1972 and 1984. Strata coverage was incomplete and inconsistent in the early years. There was no evident trend in biomass and abundance estimates from 1971 to 1982 but the 1984 survey indicated a substantial increase in both estimates. However, the 1984 survey was conducted by a different research vessel than that used previously, and suitable conversion factors for fishing power are not well established. Surveys conducted by the USSR over the same period showed considerable fluctuation and no consistent trend in abundance (mean number per tow of age 4+ fish). Estimates for 1982 and 1983 indicated an increase over the previous period.

The Canadian survey in 1982 indicated that the 1978 year-class was strong and that the 1980 year-class might be above average. Ages 3-6 (1980-77 year-classes) were predominant in the USSR survey in 1983. The 1982 year-class was considered above average for the survey period (1972-83) but that for 1981 did not exceed the mean level.

iii) Catch-at-age

Biological sampling data from the Canadian otter-trawl, Portuguese gillnet and Spanish pair-trawl fisheries were used to estimate the age composition and mean weights-at-age of the commercial catches in 1983. Nominal catch-at-age data for the Spanish pair-trawl fishery in 1982 were available and replaced the estimates that were used previously. The 1983 sampling data, obtained by Spanish observers, indicated that the 1980 year-class was dominant in the catch. There was also an unusual abundance of small cod, as evidenced by the high proportion of fish of ages 2 and 3 years. Among older fish, the 1974, 1975 and 1978 year-classes were most abundant. The Canadian otter-trawl catches were composed mostly of the 1974, 1975, 1977 and 1978 year-classes, whereas the Portuguese gillnet catches were composed mainly of the 1978 year-class.

c) Estimation of parameters

i) Cohort analysis

Catch compositions from the commercial fishery for each year over the 1959-83 period were used in cohort analyses. Average weights-at-age included estimated averages for each of the 1959-65 and 1966-76 periods, and those for each year from 1977 to 1983 were obtained from the commercial sampling data. The partial recruitment-at-age vector was estimated by iteration, using cohort selectivity coefficients obtained by dividing fishing mortality by fully recruited fishing mortality for ages 6-10. The arithmetic means of the coefficients for the period 1974-82 (excluding 1976) obtained from a cohort analysis were used as the partial recruitment multipliers for the 1983 catch-at-age. These partial recruitment values and the average weights-at-age in 1983 are as follows:

Age	3	4	5	6	7	8	9	10	11	12
Partial recruitment	0.09	0.51	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average weight (kg)	0.85	1.17	1.87	2.63	3.80	5.20	6.27	8.08	8.99	11.01

A natural mortality rate of 0.20 was used and the fishing mortality on the oldest age (12) was set at the fully recruited mortality for ages 6-10.

ii) Fishing mortality in 1983

An estimate of fully recruited fishing mortality in 1983 was obtained using unweighted least squares regression analysis to determine the relationship between average exploitable biomass from cohort analysis and catch-rate indices. The relationship between the combined (otter trawl and pair trawl) catch-rate indices and exploitable biomass (mid-year biomass × partial selection matrix) indicated that fishing mortality in 1983 was between 0.10 and 0.15. A similar relationship with the Spanish pair-trawl catch-rate indices indicated that F in 1983 was in the vicinity of 0.40. (It was also determined that F = 0.15 in 1983 produced a fishing mortality in 1982 similar to that estimated in the previous assessment). In spite of problems with both catch-rate series, it was decided that the combined catch-rate series was more representative of the stock in recent years and that F = 0.15 for full recruited age-groups in 1983 would be appropriate to the fishery in 1983.

iii) Recruitment

From catch-at-age estimates, it appeared that the 1980 year-class was at least average. Available survey data did not permit the estimation of reliable values for the 1980, 1981 and 1982 year-classes. The USSR survey data could only be used as an indicator of trends in abundance rather than for absolute abundance estimates. The sizes of the 1980-82 year-classes were therefore set equal to the geometric mean (35 million fish) of cohort abundance at age 3 over the 1972-80 period. The 1972-80 period was chosen to estimate the recent values because

this more recent period was considered to reflect more accurately the present level of recruitment rather than a longer time period. If a longer time period (1959-80) had been chosen, the estimate of recruitment would have been 65 million fish.

d) Catch projections

Population numbers-at-age from a cohort analysis at F = 0.15 in 1983 together with geometric mean recruitment (35 million) at age 3 and the parameters shown in Table 11 were used to project midyear biomass (age 3+) in 1985. The catch in 1984 was assumed to be 26,000 tons, and $F_{0.1}$= 0.18 was used as the fishing mortality in 1985.

Table 11. Cod in Div. 3N and 3O: parameters used in the projections of stock biomass and catch.

Age (yr)	Population (000)	1983 catch (000)	Mean wt. (kg)	Partial recruitment
3	35,000	1,179	0.90	0.09
4	9,681	647	1.20	0.51
5	16,675	1,893	1.74	0.89
6	9,513	1,204	2.51	1.00
7	5,420	686	3.73	1.00
8	9,102	1,152	5.26	1.00
9	6,116	774	6.96	1.00
10	1,880	238	8.66	1.00
11	640	81	9.27	1.00
12	475	41	11.15	1.00

This stock has been in a depressed condition, and a cautious approach to management has been recommended to permit rebuilding. Recent assessments have indicated that the stock was showing signs of improvement, and the present assessment also indicates continued improvement in terms of biomass, catch rate and abundance. Uncertainties concerning the catch-rate information still exist, although there appears to be an increasing trend.

In 1982, the Fisheries Commission decided that the TAC for this stock would not be increased above the level of 26,000 tons until the annual mean biomass (age 3+) fish reached 200,000 tons. The present assessment indicates that the age 3+ annual mean biomass in 1985 will be approximately 226,000 tons. Therefore STACFIS advises that the yield in 1985, calculated to correspond to fishing at $F_{0.1}$, is 33,000 tons.

The Committee points out that the available abundance indices did not consistently show the same trend in abundance and hence imply different levels of fishing mortality in recent years. Assumed recruitment for three year-classes accounts for approximately 40% of the age 3+ biomass calculated for 1985.

5. Cod in Subdivision 3Ps (SCR Doc. 84/VI/25, 50, 53; SCS Doc. 84/VI/21)

a) Introduction

Catches from this stock have ranged from a high of 84,000 tons in 1961 to a low of 27,000 tons in 1978. Prior to 1977, the fishery was conducted mainly by Canada, France, Spain, Portugal and USSR.

Since that time, only Canada and France have prosecuted the fishery, and, because of restrictions on offshore allocations, inshore gears have taken the larger portion of the total catch (66% in 1983). Catches by the longline component of the inshore fishery have shown an increasing trend in recent years while those of codtraps have generally declined. Cod catches in Subdivision 3Ps since 1976 and the corresponding TACs set by Canada are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	47.5	32.5	25	25	28	30	33	33	25[1]
Catch (000 tons)	37	32	27	33	38	39	34[2]	38[2]	-

[1] Established by Canada.
[2] Provisional data.

Management regulations were also established by EEC for 1983 and 1984 (Reference: Regulation 3624 of 20-12-1983 - OJ L365/83, and Regulation 320 of 8-2-1984 - OJ L37/84).

b) Input data

i) Commercial fishery catch-effort data

In the 1983 assessment by the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC), catch-rate data for recent years (1977-82) were available only for the Canadian (N) otter-trawl fleet which takes a small portion of the catch. In the present assessment, data were also available for Canada (M) and France (SP) trawlers. Catch-rate data were available from France (SP) only since 1978, and the series was previously considered too short for inclusion in the model. Catch-rate data for Canada, France (SP), Spain and Portugal were analyzed, using a multiplicative model. Catch-rate indices fluctuated between 1978 and 1982 at a higher level than had been observed in the mid-1970's and increased substantially in 1983.

ii) Research surveys

Stratified-random research vessel surveys have been conducted in this area by Canada since 1972 and by France since 1977. Because of inconsistent sampling of strata and consequent incomplete survey coverage, estimates of missing data values for the non-sampled strata in the Canadian surveys were obtained, using a multiplicative model. The model, which uses analysis of variance on catch-per-tow data, provided adjusted catch-per-tow estimates for missing values. The Canadian surveys were conducted at various times (February to June) in different years. Unadjusted abundance estimates were thought to have a bias because catch rates decline from winter to summer when a portion of the stock moves to inshore waters. Abundance estimates were adjusted for seasonality, using parameters obtained from the commercial rate standardization. Abundance estimates from the Canadian surveys were low during the mid-1970's, but showed an increasing trend until 1981. The estimates declined subsequently and were very low in 1984. The surveys in 1983 and 1984 were conducted by a

different research vessel than that used in previous years and suitable conversion factors for fishing power are not well established.

French surveys were conducted each year in the period February and/or March and needed no adjustment for seasonality. However, the results of the first year's survey (1977) were not considered due to inadequate sampling of strata. These data show an increasing trend in abundance and biomass since 1978.

The age compositions of the catches from the French and Canadian surveys in 1984 indicated that the 1978 year-class was the strongest in the series, with the abundance estimates for ages 2 and 3 fish being higher in recent years from the French survey than those from the Canadian survey.

Recoveries, during January-March, of adult cod tagged during February 1980 on northwestern St. Pierre Bank were mainly from the area in which they were tagged. Recoveries during April-December were mainly from shallow areas on the central and northern part of St. Pierre Bank and from inshore waters of Placentia Bay, Forture Bay, south coast of Newfoundland and St. Mary's Bay. About 87% of the tag recoveries were in Subdiv. 3Ps and most of the remainder were from adjacent areas.

iii) Catch-at-age data

Catch and average weight-at-age data for the commercial fishery were derived from sampling data by Canada and France in 1983. The catch-at-age data from the French fishery in 1982 were adjusted to updated catch weight estimates and were combined with Canadian estimates to provide a new catch-at-age vector for 1982. The 1978 year-class was found to be the most abundant in both the French and Canadian fisheries in 1983.

c) Estimation of parameters

i) Cohort analysis

Catch and average weight-at-age data for the commercial fishery over the 1959-83 period were used in cohort analyses. Partial recruitment at age to the fishery in 1983 was estimated from the weighted mean of the selectivities for each gear type in the fishery and by averaging fishing mortalities for fully recruited age-groups from cohort analysis. Estimates of partial recruitment from preliminary cohort analyses were anomalously low for ages 3-5 in 1983 (1978-80 year-classes). Since relative abundance indices for these year-classes at age 3 were similar in both Canadian and French surveys (Table 12), partial recruitment values for ages 3, 4 and 5 were estimated as values which would produce estimates of these year-classes at age 3 in the cohort, the relative abundances of which were similar to those determined from the combined survey index of abundance. The partial recruitment values obained were as follows:

Age (years)	3	4	5	6	7	8	9	10	11	12	13	14
Partial recruitment	0.02	0.30	0.65	0.74	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Natural mortality was assumed to be 0.20, and the fishing mortality on the oldest cohort age (14) was set equal to the total fishing mortality at ages 7-11 each year.

ii) Fishing mortality in 1983

Unweighted least squares regression of exploitable biomass on commercial catch-rate indices indicated that F in 1983 was approximately 0.25. The Canadian survey abundance estimates (age 4+), which had been adjusted for missing data points and for seasonality, were combined with French survey estimates and averaged over common years (1978-84). The relationship of the combined mean number per tow estimates (age 4+) for both countries and cohort age 4+ abundance estimated the F to be approximately 0.20 in 1983. It was decided that a fishing mortality of 0.25 best fitted the data in terms of its agreement with survey recruitment estimates. (It was also determined that a value for terminal F of 0.25 produced a fishing mortality in 1982 similar to that estimated for 1982 in the previous assessment by CAFSAC.)

iii) Recruitment

Catch-at-age indices for French and Canadian research surveys were averaged to provide combined indices of abundance at age 3, and these estimates were related to age 3 abundance from cohort analysis for the same year-classes (1969-77 year-classes). The 1978 and 1979 year-classes were not used in the analysis, as cohort analysis estimates are strongly influenced by input parameters. From least squares regression analysis, estimates were obtained for the 1980 and 1981 year-classes of 72 and 81 million fish respectively (Table 12).

Table 12. Cod in Subdiv. 3Ps: abundance indices (age 3) from Canadian and French surveys (number per tow) and from cohort analysis (millions), and regression analysis of 1969-77 values.

Year-class	Mean number per tow (age 3) Canada[1]	France	Combined	Age 3 from Cohort	Regression analysis
1969	1.50	-	1.50	40	Combined survey results
1970	1.03	-	1.03	31	*versus* cohort numbers
1971	2.72	-	2.72	42	for 1969-77 year-classes
1972	2.78	-	2.78	57	
1973	2.78	-	2.78	58	Slope 13.72
1974	3.42	-	3.42	79	Intercept 21.44
1975	0.93	1.49	1.21	43	R^2 ..... 0.72
1976	0.67	0.42	0.55	30	
1977	1.96	1.91	1.94	58	Predicted 1980 y.c. 72
1978	4.41	5.64	5.03	108	Predicted 1980 y.c. 81
1979	2.13	1.91	2.02	49	
1980	1.73	5.64	3.68	-	
1981	0.49	8.24	4.37	-	

[1] Values adjusted for seasonality and missing strata.

d) Catch projections*

Population numbers-at-age from a cohort analysis at F = 0.25 in 1983, together with recruitment at age 3 for the 1980 and 1981 year-classes as obtained from the combined survey index, and the parameters shown in Table 13, were used in the projections to 1985. The 1982 year-class was assumed to be equal to the geometric mean value of 55 million fish. The catch in 1984 was assumed to be the average catch of the last 5 years (36,000 tons) and a fishing mortality of $F_{0.1}$= 0.2 was assumed in 1985. The mean weights-at-age used in the projections are averages of values derived for 1981-83.

Based on the assessment parameters estimated above, the expected catch of 36,000 tons in 1984 will produce a fishing mortality of 0.21 and the catch which will result from fishing at $F_{0.1}$= 0.20 in 1985 is 41,000 tons.

Table 13. Cod in Subdiv. 3Ps: parameters used in the projections of stock biomass and catch.

Age (yr)	Population (000)	1983 catch (000)	Mean wt. (kg)	Partial recruitment
3	72,000	783	0.50	0.02
4	40,002	2,623	0.80	0.30
5	66,806	9,106	1.27	0.65
6	25,946	3,984	1.86	0.74
7	8,469	1,705	2.41	1.00
8	5,663	1,140	3.14	1.00
9	5,111	1,029	4.01	1.00
10	1,177	237	5.33	1.00
11	447	90	6.72	1.00
12	174	35	8.70	1.00
13	89	18	9.03	1.00
14	49	8	10.93	1.00

6. Redfish in Subarea 1

a) Introduction

The nominal catches have fluctuated greatly since 1951, increasing from 150 tons in 1951 to a maximum of 61,000 tons in 1962, decreasing to a low level of 3,000 tons in 1971-74, and increasing thereafter to a level of about 7,000-8,000 tons in 1980-83. There is an indication that catches in 1977 to 1979 were overestimated in the official statistics. The redfish is taken in a directed trawl fishery or as by-catch in a directed trawl fishery for cod. Recent catches are as follows:

Year	1976	1977	1978	1979	1980	1981	1982	1983
Catch (000 tons)	14	31	8	9	8	6	8[1]	8[1]

[1] Provisional data.

* Estimates of partial recruitment used in the current projections were higher than those used in 1983 Canadian assessment and a substantial increase in estimates of recruitment particularly of the 1979-81 year-classes would appear to be a major reason for the difference in projected catches. Estimates of recruitment used previously were 30, 45 and 55 millions for the 1979, 1980 and 1981 year-classes while in the current assessment they are estimated at 48, 72 and 81 million respectively. These year-classes would account for approximately 14,000 tons of the $F_{0.1}$ catch in 1985. The estimated fishing mortality in 1982 from the present analysis (0.4) on fully recruited age groups is somewhat lower than the value of 0.45 from the earlier assessment.

b) Catch projection

The *Sebastes marinus* stock was assessed at the June 1979 Meeting of ICNAF (*Redbook 1979*, page 74). Further assessment has not been possible due to the lack of sufficiently good fishing effort data for recent years. The 1979 assessment, based on a general production model analysis, indicated a MSY level of about 10,000 tons and an equilibrium catch at 2/3 F (MSY) of about 9,000 tons. However, the correlation coefficient for the regression of CPUE on fishing effort (r = 0.63) indicated that catch levels derived from the model have fairly large variances.

7. Redfish in Division 3M (SCR Doc. 84/VI/32, 41; SCS Doc. 84/VI/14, 17)

a) Introduction

Provisional data for 1983 indicate that the TAC was almost fully utilized. As in previous years, the USSR catch represented about 75% of the total. Recent catches and TACs are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	16	16	16	20	20	20	20	20	20
Catch (000 tons)	17	20	17	20	16	14	15[1]	20[1]	

[1] Provisional data.

b) Input data

Catch-effort data from ICNAF/NAFO statistical series were incorporated in the multiplicative model to derive a standardized catch-rate series. Only data for 1972-1982 were used because of the numerous gaps in the time series in earlier years and a change in the fleet composition at about the same time. Two length frequencies of USSR commercial catches in 1983 were available for examination, along with some data from the 1983 Portuguese fishery. Both Canadian and USSR survey data were available. The Canadian abundance index covered the 1978-84 period and that of the USSR was for 1971-83. USSR research length frequencies were available for 1979-83, and Canadian length frequencies and numbers at age were available for 1983 and 1984.

c) Estimation of parameters

The considerable inadequacies in commercial sampling over the years do not permit the development of a reliable catch-at-age matrix, and no analytical assessment can be done at present. Also, the short catch-rate series rules out a general production analysis.

d) Catch projections

Based on a comparison of the USSR commercial length frequencies and those from research surveys, it was concluded that the fishery in 1983 was concentrating on the year-classes of the early 1970's. Recruitment of these year-classes to the fishery accounts for the increase in catch rates in recent years. As these year-classes are now fully recruited to the fishery, their gradual depletion will result in a decline. In fact, a slight decrease was observed from 1981 to 1982.

USSR survey data show an increase in redfish biomass during the mid to late 1970's, which

corresponds to growth of the relatively strong year-classes of the early 1970's. The biomass level has remained about the same from 1979 to 1983. Canadian data show a gradual decline in biomass for the 1978-84 period.

Both survey series indicated the presence of two strong year-classes (probably those of 1978 and 1980) up to 1983. It had previously been thought that these year-classes would recruit to the fishery in the late 1980's and halt the anticipated decline in catch-rate. These year-classes, however, were largely absent in the 1984 Canadian survey catches, and the Committee considered that a degree of caution should be observed. Since it will be a few years before these year-classes recruit to the fishery, it is anticipated that future surveys will give further insight into the relative strength of these year-classes.

The Committee noted that the present TAC may be conservative in light of the increase in biomass as indicated by the USSR survey series and the fact that, with the exception of 1983, the TAC was not achieved in recent years. Based on the data available, however, an appropriate level of increase could not be determined. Because the stock size is expected to decline until at least the late 1980's and the present TAC was set at a long-term average level, STACFIS therefore advises that the 1985 TAC remain at the present level of 20,000 tons.

e) Other information (SCR Doc. 84/VI/21)

Redfish length frequencies submitted to ICNAF/NAFO have routinely consisted of three types of measurements: fork length to the nearest centimeter, total length to the nearest centimeter, and total length to the centimeter below. To incorporate these data in any analysis using numbers at age, it is first necessary to convert these different measurements to that used during otolith collection. Geometric mean regressions were used to establish the relationship between fork length and the two total length measurement types. There was no significant difference between males and females in these analyses.

8. Redfish in Divisions 3L and 3N (SCR Doc. 84/VI/31; SCS Doc. 84/VI/14, 17)

a) Introduction

In 1983, 80% of the TAC was caught with slightly under 60% of the catch coming from Div. 3N. The trend in distribution of catches between countries, that had been observed since about 1975, continued in 1983. Canada caught the largest portion in Div. 3L, and the USSR catches dominated in Div. 3N. In recent years, the USSR proportion has been decreasing in Div. 3N as the catches by Cuba and Spain were gradually increasing. Recent catches and TACs are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	20	16	16	18	25	25	25	25	25
Catch (000 tons)	21	17	12	14	16	24	22[1]	20[1]	

[1] Provisional data.

b) Input data

Catch-effort data from ICANF/NAFO statistics for the 1959-82 period were incorporated in the multiplicative model to derive a standardized catch-rate series.

Length frequency data for 1983 were available from the Canadian, USSR and German Democratic Republic fisheries in Div. 3L, the USSR fishery in Div. 3N and the Portuguese fishery in Div. 3L and 3N. Research frequencies were available from USSR surveys in Div. 3N for 1979-83. Abundance indices for redfish in Div. 3L, 3N and 30 combined, as determined from USSR surveys, were also available.

c) Estimation of parameters

Due to inadequacies in commercial sampling in some years, it has not been possible to construct a reliable catch-at-age matrix for this stock. This precludes any analytical assessment. In the catch-rate series, the 1968 and 1974 points are anomalously low. With these two points omitted, a least squares regression of standardized catch rate on standardized effort was not significant, and a general production analysis was therefore not done.

d) Catch projections

The catch rates for this stock remained quite stable from 1959 to 1979 (excluding 1968 and 1974). A sharp increase occurred from 1979 to 1980, but the rates have stabilized at the higher level since then. The reason for this sudden increase is unknown at present, but it should be noted that an increase of this magnitude in redfish biomass in one year is not to be expected. The USSR survey results do, however, show an increase in biomass in Div. 3L, 3N and 30 (combined) from 1977 to 1979, with a subsequent gradual decrease.

The research length frequencies from Div. 3N consistently show a mode at about 22-25 cm. This may be a result of the depths surveyed, as redfish are stratified by depth. There are, however, a wide range of lengths present in each year, indicating that the stock is in good condition. In addition, a relatively strong year-class has been detected in Div. 3N since 1981 and this is expected to recruit to the fishery in a few years.

Concern was expressed regarding the fact that the current TAC level was derived from a general production analysis which included the 1968 and 1974 points and, therefore, may not reflect the long-term yield at 2/3 F_{MSY}. It was noted that, with relatively constant catch rates over the period of this fishery, the average catch has been about 22,000 tons. This stock seems to be in good condition, and it was considered that the current TAC level may be conservative. The limited data available do not, however, allow this to be quantified. STACFIS therefore advises that the TAC remain at 25,000 tons in 1985.

9. Silver Hake in Divisions 4V, 4W and 4X (SCR Doc. 84/VI/34, 35, 36, 82, 85, 86, 87)

a) Introduction

The fishery for silver hake has been conducted primarily between 60°W and 66°W since it commenced

in 1962. Prior to Canadian jurisdiction in 1977, the fihsery was unrestricted with regard to codend mesh size used, and area and season fished. Since 1977, the fishery for silver hake has been restricted to the slope area of the Scotian-Shelf seaward to the small-mesh-gear-line. The season has been limited to the period from April 15 to November 15. Codend mesh sizes have also been increased from 40 mm to 60 mm. The fishery has and continues to be dominated by the USSR fleet of tonnage class 7 otter trawlers.

Nominal catches for this stock have fluctuated between 300,000 tons in 1973 and 34,000 tons in 1983. Catches since 1976 have averaged 45,000 tons, which is 58% of the average TAC. The ratios of catches to TACs are not as representative of stock abundance since 1977 as those previously. This is due primarily to non-utilization of allocations by Canada, but also to some extent to the restriction of fishing activity to an area seaward of what is referred to as the small-mesh-gear-line (SMGL). The 1982 catch was the largest in the most recent series and was related to the presence of lower than normal water temperatures on the shelf. The 1983 fishery lasted only 3 months. Catch rates decreased significantly in July, whereas the proportion of other regulated species increased in relation to silver hake. The catch in 1983 was the lowest in the recent series and may be related to early warming of the Scotian Shelf waters and the subsequent early migration of silver hake from the slope to the shelf. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	100	70	80	70	90	80	80	80	100
Catch (000 tons)	97	37	48	52	45	41	60[1]	34[1]	

[1] Provisional data.

b) Input data

i) Commercial fishery data

The catch rates for the 1983 fishery were above those of 1980 and 1981 and are similar to those reported in the early 1970's, although lower than the anomalously high 1982 catch rate. Recent USSR silver hake catch rates reported to NAFO and those obtained by Canadian observers were found to be highly correlated. This analysis permitted the Committee to compare the observed April-May 1984 catch rates with those reported in 1977-82 (Table 14). The 1984 observed commercial catch rates for April and May were above average and similar to the very high 1982 catch rates for the same months.

The age compositions of removals in the 1970-81 period were from the previous assessment (SCR Doc. 83/VI/59). The 1982 catch composition was adjusted to the reported nominal catch in that year. The 1983 catch composition was developed from length and age samples collected at sea aboard commercial vessels. Age compositions were estimated independently by both USSR and Canadian scientists and showed good agreement. The 1983 catch-at-age was dominated by the

Table 14. Silver hake in Div. 4VWX: catch rates (tons/hour) based on Canadian observer program data for the fishery in 1977-84.

Year	Apr	May	Jun	Jul	Aug	Sep
1977	-	-	0.5	1.8	0.9	1.2
1978	1.3	1.6	1.3	1.5	2.4	0.7
1979	-	2.0	2.0	2.2	1.5	2.2
1980	1.2	1.3	1.3	1.6	0.7	0.6
1981	1.3	1.4	1.2	1.2	1.4	-
1982	5.5	4.2	4.1	2.4	0.6	-
1983	2.4	2.1	1.2	0.3	-	-
1984	4.7	4.5	-	-	-	-

1981 year-class which composed 42% of the catch by numbers and 32% by weight. The 1982 year-class was not well represented in 1983. The 1980 and 1979 year-classes combined were estimated to comprise 42% of the catch in numbers and 50% in weight. The contribution of fish older than age 4 in 1983 was estimated to be 10% of the catch in numbers and 18% by weight. Preliminary data on size composition of catches in 1984 indicate that the fishery is largely supported by the 1981 year-class, whereas the 1982 year-class is weak. There is an indication that the 1983 year-class may contribute moderately to the catch in 1984.

ii) Research data

Minimum population estimates from July research surveys indicate that the stock has stabilized at a level close to that observed in the early 1970's. However, survey abundance estimates do not correspond well with commercial catch rates.

Studies to estimate recruitment from research surveys are continuing (SCR Doc. 84/VI/34, 87). the historical time series is, however, confounded not only by changes in the gear and vessels used but by a change in the time of the survey from September-October to October-November, which casts doubt on the comparability of the estimates between the 1978-80 and 1981-83 periods. Analysis of a 1983 comparative study between both gears and methodology used in these 0-group surveys gave results which were inconclusive. Another comparative study is planned for 1984 (SCR Doc. 84/VI/65). Despite differences in gear and methodologies, the stratified mean catch-per-tow estimates of year-classes (SCR Doc. 84/VI/87) were in general agreement with evidence from the commercial fishery. The 1978 year-class was strong according to both research vessel and 0-group surveys. The 1981 year-class has already shown up strongly in the 1983 and early 1984 fishery, and the 0-group survey indicates that this year-class is the strongest of the 1978-83 year-classes. The 0-group survey indicates that the 1982 year-class is very poor, whereas the 1983 year-class is good. These observations are consistent with preliminary results from the 1984 commercial fishery.

c) Estimation of parameters and assessment results

Several methods to estimate fishing mortality in 1983 were attempted without satisfactory results (SCR Doc. 84/VI/85). The Committee abandoned the use of sequential population analysis to estimate

the size of the stock in 1983, but noted that attempts to assess this stock by sequential methods should continue. There was sufficient evidence to conclude that F in 1983 was probably below $F_{0.1}$ (0.40), although a precise value could not be determined.

d) Catch projections

Because the 1982 year-class appears weak, the fishery in 1985 will depend on the 1983 year-class, which is predicted to be strong from the 0-group surveys, and the strong 1981 year-class, which has already contributed to the fishery for 2 years. Because of this and the fact that the fishing mortality in 1983 was considered to have been below $F_{0.1}$, STACFIS advises that the 1985 TAC should remain at the 1984 level of 100,000 tons.

10. American plaice in Division 3M (SCS Doc. 84/VI/17)

a) Introduction

This stock has been regulated by TAC since 1974, and nominal catches have ranged from 600 to 2,000 tons. The reported catches apparently are by-catches in the cod and redfish fisheries. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	2	2	4	2	2	2	2	2	2
Catch (000 tons)	1	2	1	1	1	1	1[1]	1[1]	

[1] Provisional data.

b) Assessment and catch projections

USSR survey results indicate that this stock has been relatively stable since 1978, but Canadian research vessel survey results have been more variable over this period. As there is no evidence to indicate a change, STACFIS advises that the TAC for 1985 should remain at the present level of 2,000 tons.

11. American plaice in Divisions 3L, 3N and 3O (SCR Doc. 84/VI/30, 48; SCS Doc. 84/VI/17)

a) Introduction

This stock has been exploited since the early 1950's and the nominal catch reached a peak of 94,000 tons in 1967. USSR vessels took significant catches between 1965 and 1976, but the fishery has been conducted mainly by Canadian vessels since that time. In most years, the majority of the catches have come from Div. 3L, with recent catches from this division averaging about 30,000 tons. TAC regulation was introduced in 1973 and the nominal catch in Div. 3LNO has averaged close to 50,000 tons in recent years. The TACs were not fully utilized during 1981-83, the low catch in 1983 being due to a significant reduction in fishing effort. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	47	47	47	47	47	55	55	55	55
Catch (000 tons)	52	44	50	49	49	50	51[1]	38[1]	

[1] Provisional data.

b) Input data

i) Commercial fishery data

Catch rates by Canadian otter trawlers fishing for American plaice in Div. 3L and 3N increased steadily from 0.41 to 0.60 tons/hour during 1977-80 and declined slightly to 0.56 tons/hour in 1982. The 1983 rate was 0.62 tons/hour. However, the catch in the directed fishery of 18,000 tons in 1983 was only 55% of the average in the 1977-82 period. Numbers and weights-at-age for 1983 were calculated from samples taken from the Canadian commercial fishery in Div. 3L and 3N during that year. Numbers and weights-at-age for 1960-82 were taken from the previous asssessment of this stock.

Estimates by age-group of American plaice discarded by Canadian trawlers fishing in Div. 3L and 3N were available for 1978-82. These data showed that significant numbers of age 6-10 fish were discarded and that the discard rate appeared to increase significantly from 1980 to 1982 (approximately 24% at ages 6-10 in 1980 and approximately 44% at ages 6-10 in 1982). No comparable figures were available for the 1983 catch. Because of the relatively short time series of discard estimates, no adjustments were made to the numbers caught at age in any of the years, and therefore the catch matrix represents numbers landed rather than numbers caught.

ii) Research vessel data

Canadian research vessel surveys which were conducted in the spring during 1971-82 in Div. 3L and 3N indicate a decline in total abundance from 1980 to 1982, although the number of age 8 and older fish increased over this period. There was no comparable survey in 1983, and the 1984 survey was carried out by a different vessel-gear combination and was complete for Div. 3N only. Preliminary analysis of a comparative fishing experiment showed that the vessel-gear combination used in the 1984 survey differs considerably in its efficiency in catching American plaice than the vessel-gear combination used during 1971-82 surveys. The analysis also indicated that the difference in efficiency varied significantly with the size of American plaice caught.

Canadian research vessel surveys conducted in the autumn during 1981-83 in Div. 3L indicate a slight decline in abundance over this period. However, the 1983 results must be interpreted with caution, because this survey was also carried out by a different vessel-gear combination than the one used in 1981-82.

Surveys conducted by the USSR in Div. 3L, 3N and 3O during the 1979-83 period show a relatively stable population size.

c) Estimation of parameters

The parameters itemized below were used in the cohort analysis of this stock.

i) Partial recruitment

Values for partial recruitment in 1983 were calculated from average fishing mortalities over the period 1980-83 from a preliminary cohort anlaysis. The resulting F-values were then averaged and used in successive cohort analyses until the difference between input values and averaged output values was minimal. The resulting partial recruitment values, normalized to age 13, were as follows:

Age (year)	6	7	8	9	10	11	12	13+
Partial recruitment	0.014	0.068	0.130	0.240	0.391	0.625	0.897	1.000

ii) Natural mortality

The value of 0.2 used in previous assessments was retained.

iii) Fishing mortality

The value of terminal F was determined on the basis of two regressions: (a) The first involved an unweighted least squares regression of average midyear exploitable biomass from cohort against CPUE of Canadian otter trawlers (tonnage class 5) fishing in Div. 3L and 3N for the period 1965-83. Average midyear exploitable biomass was calculated by multiplying midyear biomass estimates at age from cohort analysis by average (1960-83) selectivity coefficients at age determined from fishing mortalities. The correlation coefficient had the same value for the regressions at the levels of terminal F equal to 0.25 and 0.30, and the sum of the 1982 and 1983 residuals was closer to zero for the cohort anlaysis at terminal F = 0.30 than for the analysis at F = 0.25. (b) The second regression involved the unweighted least squares regression of midyear population numbers (age 8 and older) from cohort analysis against abundance of age 8 and older fish from Canadian spring research surveys in Div. 3L and 3N during 1971-82, excluding 1973 and 1976 when surveys were incomplete. The correlation coefficient was higher and the 1982 residual was closer to zero for the regression at F = 0.25 than for the regression at F = 0.30. The Committee decided that the value for terminal F in 1983 was between 0.25 and 0.30 and selected 0.275 as the midpoint of this range.

d) Assessment results

The cohort analysis at terminal F = 0.275 showed a relatively stable population size (age 6+) during 1977-83, although the calculated average midyear exploitable biomass increased over this period.

Data in SCR Doc. 84/VI/30 indicated that American plaice on the Grand Bank is more dependent on variations in the environment than yellowtail flounder and also appears to be more sensitive to overfishing. The Committee noted that this was not in agreement with current views on these stocks. The paper also presented a general-production-model assessment and a yield-per-recruit assessment, based on two proposed ecological states on the Grand Bank. From the catch-effort data

for 1965-71, the value at 2/3 effort MSY was estimated at 57,000 tons, whereas the 2/3 effort MSY using the 1973-82 values was calculated as 38,000 tons. Based on the Beverton-Holt production equation and the Ricker stock-recruitment curve, the yield at $F_{0.1}$ for the 1960-66 and 1974-76 year-classes was estimated at 34,000 tons and the yield for the 1967-73 year-classes was estimated at 57,000 tons.

e) Catch projections

Catch projections were carried out using the parameters listed in Table 15. The partial recruitment values used for projection are the same as those used in the previous assessment of this stock. Recruitment at age 6 in 1984 and 1985 was assumed to be 224 million fish, this value being the geometric mean of age 6 population size in 1976-82 from the cohort analysis at F = 0.275.

Table 15. American plaice in Div. 3L, 3N and 30: parameters used in the catch projections.

Age (yr)	Population in 1983 (000)	Catch in 1983 (000)	Mean wt. 1981-83 (kg)	Partial recruitment (1979-81)
6	269,025	937	0.365	0.067
7	158,843	2,668	0.430	0.194
8	141,043	4,492	0.495	0.305
9	115,580	6,698	0.562	0.369
10	69,131	6,399	0.597	0.502
11	54,042	7,757	0.616	0.668
12	35,864	7,135	0.726	0.872
13	20,228	4,428	0.916	1.000
14	10,868	2,379	1.173	1.000
15	5,345	1,170	1.487	1.000
16	1,617	354	1.995	1.000
17	557	122	2.244	1.000
18	196	43	2.617	1.000
19	59	13	3.027	1.000

The projected catch in 1985 for Div. 3L and 3N at the $F_{0.1}$ value of 0.262 is 44,400 tons. This assumes that a catch of 47,000 tons, generated by a fully-recruited F of 0.293, will be taken in 1984. It should be noted that these projections apply to Div. 3L and 3N only and that, as in previous years, an amount for Div. 30, usually approximately equal to the average catch in the division in recent years, has been added to the Div. 3L and 3N total to produce a TAC for the stock. Catches in Div. 30 averaged 4,300 tons during 1978-82. These calculations imply that a catch of 49,000 tons in Div. 3L, 3N and 30 in 1985 would correspond with the $F_{0.1}$ level. Therefore, STACFIS advises that the TAC in 1985 should be 49,000 tons.

12. Witch Flounder in Divisions 3N and 30 (SCR Doc. 84/VI/63)

a) Introduction

Catches of witch flounder over the last 10 years ranged from a high of 8,000 tons in 1974 to a low of approximately 2,400 tons in both 1980 and 1981. Catches ranged from 2,000 to 4,000 tons during

1978-83. Recent catches and TACs are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	10	10	10	7	7	5	5	5	5
Catch (000 tons)	6	6	3	3	3	2	4[1]	4[1]	

[1] Provisional data.

b) Input data

Catch and effort statistics for Canadian tonnage-class 5 trawlers were presented. The fishery was considered to be a directed one when witch flounder was reported as the predominant species by weight in the catch. Since 1974, the highest catch rate was 0.67 tons/hour in 1982, although catch rates since 1972 have averaged about 0.38 tons/hour, which was approximately the catch rate in 1983. The average catch rate in 1981-83 was higher than that of the previous 9 years, and STACFIS considered that the stock was probably in good condition.

c) Catch projection

Catch-at-age data for 1982 and 1983 indicated substantial differences between divisions, with the overall age structure being relatively stable in the 2 years. Catches in 1983 were comprised of ages 6-16 fish, with age-group 9-11 predominating. Although an analytical assessment was not possible, the available data indicate that the stock is probably not declining and, according to catch-rate data, may be stable or showing some increases. STACFIS therefore advises that the TAC of 5,000 tons should remain in effect for 1985.

13. Yellowtail Flounder in Divisions 3L, 3N and 3O (SCR Doc. 84/VI/30, 49; SCS Doc. 84/VI/17)

a) Introduction

Nominal catches peaked at 39,000 tons in 1972, declined to 8,000 tons in 1976, and averaged about 14,000 tons since 1978. USSR vessels took significant catches in the 1966-75 period, but the fishery has been conducted almost exclusively by Canadian trawlers since 1975. The TACs were not fully utilized during 1980-83, and the low catch in 1983 was due to a significant reduction in fishing effort. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	9	12	15	18	18	21	23	19	17
Catch (000 tons)	8	12	16	18	12	15	12[1]	9[1]	

[1] Provisional data.

b) Input data

Catch rates for Canadian trawlers (tonnage class 5) increased steadily from 0.33 tons/hour in 1976 to 0.64 tons/hour in 1980, and then decreased to 0.53 tons/hour in 1982. The catch rate in 1983 was 0.56 tons/hour.

Canadian research vessel surveys in Div. 3L and 3N indicated a relatively stable population size

over the 1978-82 period, with a slight decline in 1981, explained by incomplete survey coverage. There was no comparable survey in 1983 and the 1984 survey, although showing a significant increase in abundance over that from the 1982 survey, was carried out by a different vessel. Preliminary analysis of the survey data indicated that the vessel-gear combination used in the 1984 survey may be 1.5-1.8 times more efficient in catching yellowtail than the vessel-gear combination used in the 1971-82 surveys. The increase in the mean number per tow in 1984 by a factor of 1.6 over the 1982 level may be attributable to this difference in efficiency.

USSR survey results showed a slight increase in abundance from 1978 to 1981, followed by a slight decrease from 1981 to 1983.

c) Parameter estimation and assessment results

A cohort analysis was performed, using the catch-at-age matrix for 1968-83, partial recruitment values derived from average F's over this period, and weights at age for the same period. It was possible to correlate age 4+ and age 5+ population biomass from cohort analysis with commercial catch rates, age 4+ fishing mortality weighted by population numbers from cohort analysis with fishing effort, and age 4+ population biomass from cohort analysis with average weight per tow from Canadian research vessel surveys. The analysis showed a relatively stable stock size over the 1979-83 period. However, the Committee considered that the cohort anlaysis was not reliable, because of very high fishing mortalities (1.0 to 3.0) evident for ages 7-10 in many years and the lack of correlation between calculated exploitable biomass and commercial and research vessel abundance indices. Based on commercial catch rates, the stock size appears to have increased since the mid-1970's. The Committee considered that these high values of fishing mortality were unlikely and that significant declines in population numbers after age 7 could be due to reasons other than fishing.

Information was presented on yellowtail flounder (SCR Doc. 84/VI/30) which indicated that this species was less susceptible to fluctuations in the environment on the Grand Bank than American plaice and appeared to be less sensitive to overfishing. The Committee also noted that information in this document on stock-recruitment relationship, productivity, and yield estimates (with a long-term yield of about 38,000 tons at $F_{0.1}$) were not in agreement with current views on this stock.

d) Catch projections

Given the apparent stability of the stock size in recent years, STACFIS advises that the TAC for 1985 be set at 15,000 tons, which corresponds to the level of the average catch from 1978-82.

14. Greenland halibut in Subareas 0 and 1 (SCR Doc. 84/VI/37, 60)

a) Introduction

Nominal catches peaked at 25,000 tons in 1975 but have been less than 20,000 tons since that time. Provisional data for 1983 indicate a catch of about 5,800 tons with 1,600 tons being taken in

Subarea 0 and 4,200 tons in Subarea 1. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	20	20	20	25	25	25	25	25	25
Catch (000 tons)	16	13	12	19	8	6	7[1]	6[1]	

[1] Provisional data.

b) Input data

In recent years, the fishery for Greenland halibut in Subarea 0 has been conducted mainly by USSR vessels. Catch rates by the USSR fleet since 1979 fluctuated from 1.38 tons/hour in 1980 to 0.80 tons/hour in 1983, with fishing being carried out at an average depth in excess of 800 m. Length frequency data from USSR sampling indicate that catches have been comprised mainly of the 1971-76 year-classes since 1979, with the mode increasing from year to year. This was considered to be a result of immigration of the strong 1972-74 year-classes from the southern areas upon approaching maturity. Length-frequency data from Faroese longline catches in Subarea 0 in 1983 indicate the presence of large numbers of older mature Greenland halibut probably migrating to the spawning area of Davis Strait.

c) Catch projections

With the lack of adequate data to perform an analytical assessment of this stock, STACFIS advises that the precautionary TAC of 25,000 tons in 1984 should remain in effect for 1985.

15. Greenland Halibut in Subarea 2 and Divisions 3K and 3L (SCR Doc. 84/VI/61, 62)

a) Introduction

The major fishery for Greenland halibut in this area essentially began in the mid-1960's by Canada (N), with heavy exploitation in Trinity Bay, Newfoundland, after the introduction of highly efficient synthetic gillnets. During 1969-77, the stock was exploited mainly by Canada (N) in the deepwater bays of eastern Newfoundland with gillnets and by Poland, USSR and to a lesser extent German Democratic Republic on the continental slopes with large trawlers. During this period, catches were in the range of 25,000-30,000 tons annually. After 1977, Canada (N) has been the main exploiter of this fishery. Catches have usually been taken from Div. 2J, 3K and 3L, but a substantial portion of the annual catch has come from Div. 2H in recent years. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	30	30	30	30	35	55[1]	55[1]	55[1]	55[1]
Catch (000 tons)	25	32	39	34	33	31	26[2]	22[2]	

[1] TAC for Div. 2J, 3K and 3L only.
[2] Provisional data.

b) Input data

Some data on directed fishing effort were available from Canada (N) trawlers (tonnage class 5)

since 1980, although these were based upon relatively low levels of directed catch. Similar information was available for Poland from the Canadian scientific observer program for 1979-83 with the exception of 1980. Catch rates for both countries indicated a general decline in Div. 3K, with a substantial increase in the more northerly divisions, particularly Div. 2H. This was believed to be a result of the strong 1972-74 year-classes migrating from the more southerly divisions northward as they approached maturity.

Research vessel data indicate that Greenland halibut are widely distributed along the Labrador and eastern Newfoundland coasts to the northern slope of the Grand Bank. The areas of highest abundance are generally associated with the deep water of the continental slope and the deep channels between the fishing banks. Larger fish tend to be found in deeper water and in the more northerly areas. It is considered that the optimum depth range for high biomass of Greenland halibut is 400-1000 m at a temperature range of 3.0-5.0°C.

Research vessel surveys in Div. 2J, 3K and 3L indicated that the minimum trawlable biomass for this portion of the stock area was in excess of 180,000 tons in 1982 and 1983. However, survey coverage in Div. 3L was less in 1983 than that of 1982. This estimate is considered a minimum because much of the deeper strata, where the largest fish and probably the highest biomass are found, are not surveyed. Research vessel data from shrimp surveys in Div. 2H indicated that the 1979 and 1980 year-classes were quite strong, particularly in comparison with the strong 1974 year-class.

c) Estimation of parameters and assessment results

The catches by age-group (numbers and weight) for 1975-82 were taken directly from the previous assessment, and the corresponding catch vectors for 1983 were from the sampling scheme presented in SCR Doc. 84/VI/62.

Partial recruitment for the 1983 fishery was derived from a comparison of research vessel catch-at-age for Div. 2J+3K and the estimated commercial catch-at-age from the 1983 fishery. The partial recruitment vector for 1983 was dome-shaped, as expected for this fishery, and the partial recruitment values for the older age-groups are considered minimal because survey coverage of the deeper zones and northern areas was incomplete.

An estimate of fishing mortality on fully-recruited age-groups in 1983 was not possible from the available data. In 1982, however, the estimate was derived from a catch curve of the strong 1972-74 year-classes which comprised most of the catches in 1978-82, indicating that the average fishing mortality for the period was less than $F = 0.10$. This procedure was not considered appropriate for 1983, because emigration of these year-classes from the survey area would give an overestimate of fishing mortality from the catch curve. It was believed, however, that fishing mortality on fully-recruited age-groups in 1983 was probably much less than 0.10. Cohort analyses, with F ranging from 0.05 to 0.20 in increments of 0.05, indicated that fishing mortality in

1975-76 was probably about 0.10, when the total catch was about 25,000 tons and year-class sizes were less than those in more recent years. As a result, STACFIS concluded that fishing mortality on this stock in recent years has been very low.

d) Catch projections

In previous assessments of this stock, concern was expressed that competition may occur between inshore gillnet fishermen and offshore trawler fishermen, particularly in Div. 3K. STACFIS advised that any increase in TAC for this stock be directed to Div. 2G and 2H. However, based upon recent investigations of distribution and relative abundance of the stock components, this concern is no longer justified. STACFIS therefore advises that a TAC of 75,000 tons in 1985 for Subarea 2 and Div. 3K and 3L, based on fishing at $F_{0.1} = 0.29$, would be conservative.

16. Roundnose Grenadier in Subareas 0 and 1 (SCR Doc. 84/VI/20)

a) Introduction

Again in 1983, only a small portion of the TAC was taken (68 tons). The USSR catches were by-catches in the Greenland halibut fishery in Subarea 0, whereas Greenland catches were by-catches in the cod fishery in Subarea 1. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	14	8	8	8	8	8	8	8	8
Catch (000 tons)	9	3	6	7	2	+	+	+	

b) Catch projections

Previous assessments of this stock indicated a TAC of 8,000 tons. In recent years, there has not been a directed fishery and the TAC has not been fully utilized. In the absence of new data on this stock, STACFIS advises that the TAC for 1985 remain at 8,000 tons.

17. Roundnose Grenadier in Subareas 2 and 3 (SCR Doc. 84/VI/20, 37)

a) Introduction

The catch of roundnose grenadier in 1983 was well below the TAC, amounting to only 3,500 tons. Most of the catch was again taken in Div. 3K. Although USSR vessels have consistently taken the bulk of the catches since the initiation of this fishery in the late 1960's, catches by German Democratic Republic vessels accounted for 74% of the total in 1983. Recent TACs and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	35	35	35	35	30	27	27	11	11
Catch (000 tons)	21	15	21	8	2	7	4[1]	4[1]	

[1] Provisional data.

b) Input data

Catch and effort statistics, as published in ICNAF and NAFO Statistical Bulletins for 1967-82 and

data from Canadian observers for 1983, were incorporated in the multiplicative model to derive a standardized catch-rate series. There is no recent information on age compositions of commercial catches, nor are there any recent data from research surveys.

c) Estimation of parameters

The lack of commercial catch-at-age data precludes the use of analytical assessment techniques for this stock. Least-squares regressions of the standardized catch rate on the standardized effort were not significant, and thus a general production analysis could not be carried out.

d) Catch projections

The low catches relative to the TACs since 1979 have been due in part to limitation in the allowable by-catch of Greenland halibut. The very limited amount of new data available do not indicate any improvement in the status of this stock. STACFIS therefore advises that the precautionary TAC of 11,000 tons be maintained in 1985.

e) Greenland halibut by-catches

Concern has been expressed by the USSR in recent years that low catches of roundnose grenadier were mainly the result of by-catch constraints at a level of 10% of Greenland halibut. From data presented to STACFIS at the June 1983 Meeting, it was considered that this was due to the presence of the strong 1972-74 year-classes of Greenland halibut migrating into deeper water and moving northward into depths where high abundance of roundnose grenadier normally occurs. It was concluded that by-catches of Greenland halibut in the roundnose grenadier fishery in excess of 20%, with provision for increased by-catches from south to north, would not be unrealistic. Taking into account additional data presented at this meeting from the USSR roundnose grenadier fishery, STACFIS advises that by-catch levels of Greenland halibut in the roundnose grenadier fishery at 20% for Div. 3K and 30% for Subarea 2 would be more realistic than the present 10% limitation for the stock as a whole.

18. Wolffishes in Subarea 1

a) Introduction

The nominal catch reported for this area includes two species: Atlantic wolffish (*Anarhichas lupus*) and the spotted wolffish (*A. minor*). The total catches of both species have, since 1957, been in the range of 3,000-6,000 tons. There is some indication that the officially-reported catches in 1977-79 are overestimated. Recent catches are as follows:

Year	1976	1977	1978	1979	1980	1981	1982	1983
Catch (000 tons)	6	6	6	17	5	4	4[1]	3[1]

[1] Provisional data.

Specific statistics have not been provided for the two species, but use of the guidelines given in *NAFO Sci. Coun. Rep.* for 1981 (page 46) leads to the following breakdown of the provisional 1983

catch by species:

Species	Catch (tons)	%
Spotted wolffish (*A. minor*)	2,588	77
Atlantic wolffish (*A. lupus*)	772	23

About half of the catches of both species is taken as by-catch in the trawl fishery for cod, and part of the remainder in a directed longline fishery by small vessels, mainly in inshore areas of Div. 1C.

b) Catch projections

Until more biological data and detailed fishery statistics for the two species become available, it is not possible to carry out a detailed assessment. However, taking into account the available statistics and information presented earlier (*NAFO Sci. Coun. Studies*, No. 1, pages 35-40 and *NAFO Sci. Coun. Rep.*, 1979-80, pages 85-86), a catch in the range of 5,000-6,000 tons, corresponding to the long-term average catch, seems to be reasonable.

19. Capelin in Divisions 3L, 3N and 3O (SCR Doc. 84/VI/39, 40, 54, 55, 56)

a) Introduction

Nominal catches of caplein in these divisions increased from about 1,600 tons in 1971 to 166,000 tons in 1975 and declined to 12,000 tons in 1979. No offshore fishing was allowed in the region during 1979-83. Provisional statistics for 1983 indicate a total catch of 25,000 tons in the inshore fishery of Div. 3L by purse seines, beach seines and traps during June and July. Recent TAC and catches are as follows:

Area	1976	1977	1978	1979	1980	1981	1982	1983
3LNO TAC (000 tons)	180	200	200	10	16	30	30	30
Catch (000 tons)	144	74	30	12	14	24	27[1]	25[1]

[1] Provisional data.

b) Input data

i) Commercial fishery (SCR Doc. 84/VI/54)

A logbook survey of the inshore capelin fishery in Div. 3L, designed to provide estimates of catch-per-unit-effort, was initiated in 1981. The return rate of logbook records in 1983 was lower than in 1982, 60% for purse-seine fishermen and 71% for fixed gear fishermen. Purse-seine catch rates, based on landing per day and per set, were similar to 1982 and 1983 and higher than in 1981. Purse-seine catch rates based on catches (including discards) per day and per set increased from 1981 to 1983. The catch rates for capelin traps followed a pattern similar to those for purse-seines. Trends in rates, based on landings per day and per haul, were highest in 1982 and lowest in 1981 with the 1983 rate being slightly less than that for 1982. The catch rates for traps (including discards) increased from 1981 to 1983.

Discarding of capelin in 1983 was higher than in 1981 and 1982. The presence of "redfeed" in female capelin was the most important reason for capelin being released at sea or being dumped. The by-catch of cod respresented 0.6% of the total reported (logbook) catch in capelin traps which was less than 1.4% estimated in 1982.

The 1980 year-class accounted for 61% of the commercial catch (by numbers) in the 1983 inshore fishery, and the 1979 year-class at 34% was next in abundance.

ii) Research data (SCR Doc. 84/VI/39, 40, 54, 55, 56)

A Canadian acoustic survey, conducted in Div. 3L during 26 April-9 May 1983 provided a capelin biomass estimate of 122,000 tons. This compares with a biomass estimate of 525,000 tons from the Div. 3L survey in 1982. This decrease in abundance is attributed to the fact that the strong 1979 year-class, which dominated the age composition in the 1982 survey, was much reduced in the 1983 survey, which was dominated by the 1980 and 1981 year-classes.

A Canadian acoustic survey was also conducted in Div. 3LN during 16 June-4 July 1983. Small capelin of the 1982 year-class dominated in Div. 3L, whereas the 1979 year-class was dominant in Div. 3N. The biomass estimate of 164,000 tons was lower than the estimate of 217,000 tons in Div. 3L in June 1982. The capelin biomass on the spawning grounds in Div. 3N in 1983 was 190,000 tons, compared with an estimate of 446,000 tons for the 1982 Div. 3NO survey. The 1979 year-class dominated the age structure of the data from both the 1982 and 1983 surveys in Div. 3N.

A USSR acoustic survey was conducted in Div. 3LNO during 7-20 June 1983 and provided a biomass estimate of 346,000 tons. The 1979 year-class was dominant in both Div. 3N and Div. 3O, whereas the 1980 year-class was dominant in Div. 3L.

The results of a USSR trawl survey for larval and one-year-old capelin in Div. 3LNO were presented. Absolute abundance of young capelin could not be calculated, but such surveys conducted over a number of years offer potential for estimating relative year-class strength of capelin. Because accurate estimates of recruitment of capelin are critical for projections, the Committe encouraged further research into such studies.

Mature capelin were tagged with yellow streamer and anchor tags in Conception Bay, Newfoundland, in May and June 1983 to ascertain the extent of their inshore migration during the spawning period. The return rate of streamer tags (2.8%) was twice as high as for anchor tags (1.5%). Only verifiable recapture information was used to examine migration patterns. Of the 346 tags returned with reliable information, 331 recoveries were in Conception Bay, 14 in Trinity Bay and 1 in Bonavista Bay. These data indicate that mature capelin, especially males, can undergo extensive movement in Div. 3L prior to spawning. The 1983 tagging experiments have also shown that capelin can be successfully tagged with external tags. Future experiments will expand the tagging coverage to include other areas in Div. 3L to

determine the degree of mixing among areas and to verify the hypothesized south to northward movement of mature capelin in the inshore area.

c) Catch projections

Stock-size projections for capelin in Div. 3L were made by using estimates of year-class size derived from acoustic surveys. Results from past years indicated that age-groups 3 and 4 will comprise the bulk of the mature stock in 1985. Evidence from the acoustic surveys indicated that the 1980 year-class was approximately twice the strength of the 1981 year-class, whereas the 1982 year-class is considerably stronger but may not be as strong as that of 1979. Accordingly, an estimate of 100 billion fish was used in the stock projection. Other parameters used in the projections were the same as those used in the 1983 assessment, as follows:

Age (years)	3	4	5	6
Spawning mortality	1.39	1.69	2.23	2.23
Proportion mature	0.47	0.87	0.93	1.00
Mean weight (g)	21.2	28.4	31.1	32.4

The results of the projections, using the above estimates of year-class strength and parameters and assuming M = 0.30 and a spawning date of 1 June, are given in Table 16.

Table 16. Capelin in Div. 3L: projections of stock size for 1985.

Age (yr)	Number of fish (millions) Jun 1983	Jan 1984	Jan 1985	Jun 1985
1	100,000			
2	1,918	86,100		
3	3,630	1,650	63,800	56,300
4		1,972	896	790
5			488	510
	Biomass of mature fish (tons)			596,000

STACFIS continues to consider an exploitation rate of 10% to be appropriate for capelin and, accordingly, advises a TAC of 60,000 tons for Div. 3L in 1985. No stock projections were made for capelin in Div. 3NO because reliable estimates of year-class size were not available. The estimate of stock size for 1983 (190,000 tons) was less than half of the comparable estimate (446,000 tons) for 1982. Furthermore, the strong 1979 year-class has now passed through the fishery and subsequent year-classes appear to be somewhat weaker. Due to these reasons and the fact that the biomass is still below historical levels, STACFIS advises a continuation of the fishery closure for Div. 3N and 3O for 1985.

20. Squid-*Illex* in Subareas 2 to 6 (SCR Doc. 83/VI/62; 84/VI/13, 27, 68, 69, 71; SCS Doc. 84/VI/6)

a) Introduction

Nominal catches of short-finned squid, *Illex illecebrosus*, in the Northwest Atlantic from 1976 to

1983 are given in Table 17. In Subareas 2-4, the total catch peaked at 162,000 tons in 1979 and declined to about 13,000 tons in 1982 and to less than 500 tons in 1983. In Subareas 5 and 6, the total catch peaked at 25,000 tons in 1966 and 1967 and averaged 17,000 tons during 1978-82. Provisional data for 1983 indicate a catch of 14,500 tons.

Table 17. Nominal catches (tons) of short-finned squid in the Northwest Atlantic, 1976-83.

Year	SA 2	SA 3	SA 4	Total SA 2-4	SA 5+6
1976	-	11,257	30,510	41,767	24,936
1977	6	32,748	50,726	83,480	24,883
1978	7	41,369	52,688	94,064	17,568
1979	1	88,832	73,259	162,092	17,341
1980	1	34,779	34,826	69,606	17,864
1981	-	18,061	14,142	32,203	15,574
1982[1]	-	11,164	1,744	12,908	17,776
1983[1]	-	5	417	422	14,506

[1] Provisional data.

In Subarea 3, no short-finned squid were caught in Newfoundland inshore waters in 1983, compared with about 11,000 tons in 1982. Although French catches in Subarea 3 have averaged 1,200 tons during 1976-82, no *Illex* were taken around St. Pierre and Miquelon or in the offshore areas by French vessels in 1983. Also, there was no offshore fishery by other countries in 1983.

In Subarea 4, only two countries (Italy and Japan) participated in the offshore fishery from early August to mid-September. The monthly distribution of offshore catches in 1983 were as follows:

	Jun	Jul	Aug	Sep	Oct	Total
Directed fishery (tons)	-	-	300	33	-	333
By-catches (tons)	+	8	20	48	+	76

The only other catch of squid in Subarea 4 was 5 tons from the Port au Port area of western Newfoundland in Div. 4R.

In Subareas 5 and 6, although the total catch of *Illex* declined from 17,800 tons in 1982 to 14,500 tons in 1983, USA inshore catches continued to increase, whereas those by other countries in offshore areas were the lowest since 1971. The decline in offshore catches from about 12,000 tons in 1982 to about 5,000 tons in 1983 was primarily due to low allocations. Inshore catches in 1983 totalled 9,900 tons, nearly twice the 1982 record high level of 5,400 tons. This increase was due primarily to increased markets and joint ventures with other nations, but also reflected higher than normal availability to the inshore fishery, especially in Subarea 6.

With regard to the management regime in Subareas 3-4, recent TAC and catches are as follows:

	1976	1977	1978	1979	1980	1981	1982	1983	1984
TAC (000 tons)	25[1]	25[1]	100	120	150	150	150	150	150
Catch (000 tons)	42	83	94	162	70	32	13[2]	0.4[2]	

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

b) Input data

i) Abundance indices (SCR Doc. 84/VI/27, 69, 71)

Commercial catch rates were available only for the offshore international fishery in Div. 4VWX in 1983. This index (Table 18) reflected the same pattern which was observed in the research vessel surveys of the area, increasing from 2.4 tons per day in 1982 to 5.5 tons per day in 1983, whereas the associated fishery effort declined from 88 to 61 days fished. However, the 1983 catch rate was well below the 1977-81 average of 13 tons per day (weighted by annual fishing effort).

Abundance indices were available from Canadian research vessel surveys in Div. 4VWX and USA groundfish surveys in Subareas 5+6, and minimum trawlable biomass estimates were available from French research vessel surveys in Div. 4VWX (Table 18). The Canadian estimates of relative abundance from July surveys showed an increase from 5.5 squid per tow in 1982 to 28.4 squid per tow in 1983, associated primarily with large numbers of small (<14 cm ML) squid, with relatively few of the dominant size-groups that usually prevailed in previous years. The results from the French surveys of Div. 4VWX in September (based on 18 standard strata) indicated an increase in minimum trawlable biomass from 54 million squid in 1982 to 90 million in 1983, the latter estimate still being only about 20% of the average for 1980-81. Relative abundance estimates (mean numbers per tow), from USA surveys of Div. 5Z and Subarea 6 in September-October, showed a continued decline to 2.0 in 1983 from 4.3 in 1982 and 54.8 in 1981.

Table 18. Abundance indices for short-finned squid in Subareas 3 to 6, 1972-83, based on stratified-random trawl surveys and commercial fishery data.

	Stratified-random surveys			Commercial fishery data				
	Canada[1]	France[2]	USA[3]	France[4]	France[5]	Japan[6]	International[7]	
	4VWX	4VWX	5Z+6	3Ps	3P+4VW	4VWX	Jul-Sep in 4VWX	
Year	Jul	Aug-Sep	Sep-Nov	Jun-Oct	Aug-Oct	Sep	(t/day)	(days)
1972	8.1	-	3.5	-	-	-	-	
1973	8.3	-	1.3	-	-	-	-	
1974	11.6	-	3.0	-	-	-	-	
1975	35.4	-	12.4	-	-	-	-	
1976	187.9	-	28.7	-	-	-	-	
1977	51.3	-	15.8	-	-	-	14.6	1,921
1978	19.5	-	28.4	-	-	233	9.0	2,274
1979	73.6	-	32.1	36.9	17.0	667	17.5	1,619
1980	16.3	657	17.0	37.7	5.5	69	11.3	1,703
1981	23.9	204	54.8	6.3	-	49	15.7	626
1982	5.5	54	4.3	0.8	-	-	2.4	88
1983	28.4	90	2.0	-	-	-	5.5	61

[1] Mean number per tow, revised (SCR 84/VI/69).
[2] Abundance (millions of squid) for 18 standard strata (SCR Doc. 84/VI/71).
[3] Mean number per tow.
[4] Tons per dory season, inshore (SCR 83/VI/38).
[5] Tons per day fishing, offshore (SCR 81/VI/37).
[6] Biomass estimates (000 tons) (SCR 82/VI/22).
[7] Catch rates and fishing effort for offshore fishing fleets.

ii) Distribution (SCR Doc. 84/VI/13, 69, 71)

The available information indicates significant interannual variation in the generally widespread distribution of *Illex* in Subareas 3 and 4. During July in some years of low abundance, their distribution in Div. 4VWX appears to be restricted primarily to the slope and outer areas of the shelf and to the LaHave and Emerald Basin areas. In years of higher abundance, squid apparently become distributed more evenly over the shelf and into the Bay of Fundy. In July 1983, distribution was more limited than in previous years, and squid were found only in several restricted areas along the slope and around Sable Island. However, surveys in September 1983 indicated that squid were widely distributed throughout the survey area (Div. 4VWX), as in previous years, although no large concentrations were found. Commercial data indicated that squid were essentially absent from Subarea 3 during 1983, the only catches in Newfoundland waters being in the southern part of Div. 4R.

Investigations into the diurnal distribution of young *Illex* between the Gulf Stream and edge of the shelf in Subarea 4 during March-June 1983 indicate that juveniles of about 3 cm ML exhibit no well-defined vertical movements and remain in the zone lying between shelf and warm slope water masses (30-110 m) throughout the day. Juveniles around 5 cm ML also remain within this zone, but catches decreased during daytime, possibly because these larger squid are more active and better able to escape the trawl. Juveniles around 8 cm ML remain primarily in the zone between the lower boundary of the warm slope water to depths of minimum oxygen (180-300 m). Day and night catch rates for this size group were found to be similar, and it was suggested that, although these squid were capable of escape, lower ambient light at the greater depths probably reduced their avoidance of the trawl.

iii) Biological chacteristics

In general, the size composition of *Illex* arriving on the Scotian Shelf during early 1983 was considerably smaller than for those arriving 1-2 months earlier in previous years. Catches of juveniles in areas seaward of the shelf in March 1983 surveys were very low compared to those of previous years. Whereas large numbers of the size normally observed during February-March were taken during April. Commercial catches showed similar patterns, with 1-2 months delay in arrival of squid on the shelf and the occurrence of small sizes (mean weights) from mid-June to mid-August. Commercial and survey information, therefore, both indicate that spawning during the winter of 1982-83 occurred 1-2 months later than in previous years, probably during February-March instead of January. By mid-September, mean lenghts of squid in the commercial fishery were comparable to those in 1982.

Maturation during 1983 appears to have been similar to or somewhat retarded relative to that of 1982, the process in both years being considerably slower than observed in 1981. The percentage of stage 2 (and stage 3) males was particularly low, possibly reflecting the small

proportion of males greater than 200 mm mantle length. The size of which 50% of the squid are mature has generally not been observed for males less than about 200 mm ML.

c) Catch projections (SCR Doc. 84/VI/27, 69)

No new information was available for predication of 1985 biomass. However, the low abundance in recent years tends to support the rationale for and the maintenance of the current management regime. At the time when the regime was proposed in February 1980 (*NAFO Sci. Coun. Rep.*, 1979-80, pages 39-40 and 57-59), squid abundance levels were anomalously high.

Updating of the trawl survey abundance indices for Div. 4VWX (SCR Doc. 84/VI/69) has permitted an updating of table 4 in *NAFO Sci. Coun. Rep.* (1979-80, page 58) to include the years 1980-83. The extended series (Table 19) indicate that the addition of estimates for 4 years with lower abundance indices does not alter the percentage of years in which the TAC would have represented more than 50% or 90% of the calculated biomass.

Table 19. Possible historical impact of various TAC levels on squid (*Illex*) in Subareas 3 and 4.

Year	Calculated biomass 3+4 (000 t)	% TAC is of calculated biomass TAC 100,000 tons	TAC 150,000 tons	TAC 200,000 tons
1968	100[1]	100**	150**	200**
1969	22[1]	493**	680**	907**
1970	38	260**	390**	520**
1971	294	34	51*	68*
1972	64	157**	235**	313**
1973	178	56*	84*	112**
1974	190	53*	79*	105**
1975	496	20	30	40
1976	5,250	2	3	4
1977	1,010	10	15	20
1978	220	45	68*	91**
1979	1,406	7	11	15
1980	215	47	60*	93**
1981	544	18	28	37
1982	66	152**	227**	303**
1983	114	88*	132**	175**
No. of years when the TAC would have been more than 50% of the biomass (*and**)		8	11	11
No. of years when the TAC would have been more than 90% of the biomass (**)		5	6	10

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

Note: The percentage of years in which the TAC would have been more than 50% or 90% of the estimated biomass are almost identical to the percentages found in the original 12 year series.

The current regime and TAC of 150,000 tons implies a substantial loss of yield in years of high abundance. The drastic reduction in fishing effort during 1981-83 (SCR Doc. 84/VI/27) supports the

suggestion that, in years of low abundance, the fishery tends to be self-regulating. Although the implications are not as clear for periods of moderate abundance as they are for those of high and low abundance, it appears likely that the current regime will provide a reasonable level of protection against excessive fishing mortality (i.e. >40%) in years of moderate abundance. STACFIS therefore continues to support the management regime proposed at the February 1980 Meeting, and advises that the TAC for 1985 be maintained at 150,000 tons.

21. Northern Shrimp in Subareas 0 and 1 and in Denmark Strait (SCS Doc. 84/VI/3, 4)

The Committee noted the requests of Canada and the EEC for advice on management in 1985 of the shrimp stock in Subareas 0 and 1 as well as the EEC request for management options for shrimp in Denmark Strait (ICES Subarea XIV). Considering the substantial contribution of shrimp recruitment to annual yields and the current lack of ability to accurately predict recruitment, STACFIS advises that it is more appropriate to assess these shrimp stocks and to advise on management for 1985 at a mid-term meeting in January 1985, when data from the fishery and research surveys will be available.

STACFIS noted that the Davis Strait shrimp stock has at best remained relatively stable since 1979, and, as a result, the advised TAC level has not changed. Generally, stocks of *P. borealis* have been known to fluctuate substantially from year to year, and STACFIS is concerned that, if a meeting were held prior to January of the year for which advice is being provided, there would not be adequate information available to detect changes in the status of the stock prior to the results of such changes being experienced by the Commercial fishery.

III. ENVIRONMENTAL RESEARCH

1. Introduction

The third meeting of the Subcommittee on Environmental Research was held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, on 11-12 and 14 June 1983 with Dr. R. W. Trites (Canada) as Chairman. Its detailed report is at Annex 1.

2. Overview of Environmental Conditions in 1983 (SCR Doc. 84/VI/70)

The "pilot" project initiated in 1983, was continued in 1984. An effort was made to broaden the geographical coverage most noticeably by extending: (i) the sea-surface temperature data eastward and northward to include Flemish Cap, Labrador Shelf, Labrador Sea and the Cape Farewell area; (ii) the air temperature data to cover all of eastern Canada and the New England states; and (iii) sea-surface air pressure maps to include the entire North Atlantic.

There is increasing evidence that large horizontal-scale and the long time-scale processes play an important role in determining year-to-year variations in environmental conditions.

3. Influence of Evironmental Factors on Distribution, Movements and Migration of Marine Species in the Northwest Atlantic

In response to a proposal by STACFIS "that the Subcommittee on Environmental Research should focus its work as soon as possible on the influence of environmental factors on the distribution, movements and

migrations of marine species in the Northwest Atlantic" (*NAFO Sci. Coun. Rep.*, 1983, p. 122), and endorsed by the Scientific Council (Redbook, 1983, p. 117), a number of relevant papers were presented. In light of the discussion and the range of views expressed, a small Working Group was established to further develop and digest the ideas and material presented and to provide a report for consideration by STACFIS that would identify ways in which the Subcommittee can further develop knowledge on the topic.

4. Proposed Theme for Special Session in 1986

A decade ago, ICNAF established an environmental working group "to suggest a proposal aimed at determining the factors involved in production of good and poor year-classes in some of the major fisheries of the ICNAF Area" (*ICNAF Redbook 1974*, page 72), which subsequently led to major field studies and analyses on Georges Bank herring and Flemish Cap cod and redfish. Noting that it is desirable to evaluate the experience and results of these projects as well as any new initiatives within the NAFO Area, and noting further that the general recruitment process continues to be a problem of central importance, STACFIS adopted the proposal of the Subcommittee and

recommends

that the Scientific Council consider the following topic as its theme for a special session in September 1986: "Recent Advance in Understanding Recruitment in Marine Fishes in the Northwest Atlantic, with Particular Emphasis on Georges Bank and Flemish Cap".

5. General considerations

The large numbers of documents (33) containing environmental information, the scheduling of the Subcommittee meetings in the middle of the period allocated for stock assessment work to ensure a larger participation of fishing biologists, the initiation of a new focus, provided the ingredients for a much more successful meeting than that of 1983. However, continuing efforts should be made to increase the attendance of physical oceanographers at future Subcomittee meetings.

6. Resignation of Subcommittee Chairman

STACFIS accepted with regret the resignation of Dr. R. W. Trites as Chairman of the Subcommittee on Environmental Research, and expressed its appreciation for his service as Chairman during the past 3 years. The Chairman of STACFIS agreed to explore the possibility of appointing a replacement for Dr. Trites at the September 1984 Meeting of the Committee and requested Committee members to provide him with the names of potential candidates by 15 August 1984.

IV. REVIEW OF SCIENTIFIC PAPERS

1. Fishing Conditions for Silver Hake on Scotian Shelf (SCR Doc. 84/VI/36)

The ability of countries to catch their allocations under the current restrictions of area and season was reviewed. Examination of monthly catch rates since 1977 indicates the length of time that the fish remain seaward of the small-mesh-gear-line is variable from year to year. It was suggested this may be

dependent upon the maturity stage of the spawning population. If silver hake reach the ripening stage earlier than average and prevailing water temperatures within the preferred range for the species, the stock will move from the slope onto the shelf to spawn. The percentage of other groundfish would increase in relation to the catch of silver hake, resulting in an early closure of the silver hake fishery. If movement occurs in June, some countries may not be able to catch their allocations. In order to avoid this problem, it was suggested that one method would be to start the fishery on 1 April rather than 15 April.

2. Food of Silver Hake on Scotian Shelf (SCR Doc. 84/VI/86)

A study of silver hake feeding on the Scotian Shelf during 1976-80 and inferences on rates of cannibalism was reviewed. Analysis of about 3,800 stomachs found young hake (<30 cm) to be feeding mainly on small crustaceans (euphausiids, decapods and amphipods) and larger hake (>30 cm) to be feeding increasingly on fish and squid. The frequency of occurrence of cannibalism increased from 5% for 2-year-old hake to 40-100% for silver hake aged 6 and older. Seasonal differences in feeding were observed with small silver hake most heavily on euphausiids in the spring and decapods in the autumn. Large silver hake fed mainly on squid in late summer and on fish prey (except hake) in winter. Other organisms were preyed upon relatively evenly throughout the period studied.

V. TOPICS DEFERRED TO SEPTEMBER 1984 MEETING

1. Flemish Cap Research
2. Ageing Techniques and Validation Studies
3. Gear and Selectivity Studies
4. Review of some Research Documents not considered at this meeting (SCR Doc. 83/IX/66, 67, 68; 84/VI/10, 12, 28, 42, 43, 46, 84, 89, 90).

VI. OTHER MATTERS

1. Task Force on Larval Herring

The Task Force Leader (M. D. Grosslein) informed the Committee that delay in processing of some ichthyoplankton samples necessitates deferral of the Task Force meeting. He noted that the analysis of data related to the patch study would be an appropriate contribution to the proposed Special Session in 1986. In this respect, he was requested to co-ordinate the input of the report on the patch study for presentation to the proposed Special Session.

2. Special Session on Squids in September 1984

The Convener of the Special Session (T. W. Rowell) reported that there are 34 papers to be presented at the Special Session on Squid during 5-7 September 1984.

3. Documentation of STACFIS Assessments

Due to time limitation, STACFIS could not thoroughly review the adequacy of the guidelines for provision of assessment advice. A small working group, to be convened by Dr. W. G. Doubleday, was formed to assess the guidelines, based on the reports of STACFIS from the January and June meetings. It was proposed that this Working Group should solicit opinions from as many members of the Committee as possible and report to STACFIS at the September 1984 Meeting.

4. Acknowledgements

The Chairman thanked the Committee members for their interest and cooperation and expressed his appreciation for the support rendered by the Secretariat.

ANNEX 1. REPORT OF SUBCOMMITTEE ON ENVIRONMENTAL RESEARCH

Chairman: R. W. Trites

Rapporteurs: J. R. Keeley
J. T. Anderson

The Subcommittee met at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, on 11-12 and 14 June 1984 to consider a range of environmental and environmentally related topics and report on various matters referred to it by STACFIS and the Scientific Council. Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, and France), Japan, Portugal, Spain, USA and USSR.

The Subcommittee reviewed the following documents: SCR Doc. 83/VI/61, 62; SCR Doc. 84/VI/11, 14, 15, 16, 17, 18, 19, 22, 35, 36, 45, 57, 58, 59, 64, 66, 67, 68, 69, 70, 71, 72, 75, 76, 80, 81, and 84; SCS Doc. 84/VI/15, 16, 17, and 18. In addition, working papers and oral presentations were made by a number of participants.

1. MEDS Report for 1983/84 (SCR Doc. 84/VI/74)

   a) Data collections in 1983

   Approximately 9,000 oceanographic stations were occupied in the NAFO Area in 1983. Of these, MEDS received the data for approximately 3,100 through its usual channels. Additionally, data for 1,200 were received through its link to the IGOSS system, and data for about 2,100 CTD stations collected by Canadian ships would be coming shortly from the originators. This total number of observations is an increase of about 10% over that of last year, and represents an increase in the percentage of observations which have reached MEDS.

   b) Historical data received

   Approximately 1,000 stations of data collected prior to 1983 were submitted to MEDS in the past year. The majority of these were from the Federal Republic of Germany, but data from Iceland and USSR were also represented. MEDS will be contacting the World Data Centres in an attempt to acquire the data collections which are known to exist but which have not reached it.

   c) MEDS environmental review for 1983

   It was noted that data received from standard NAFO sections are relatively few and that some other technique for assessing the environmental conditions may be more profitable. Excerpts from the Oceanographic Monthly Summary, published by the U.S. Department of Commerce, were presented. These showed monthly sea-surface temperature (SST) anomalies for the NAFO region. Attempts to use an atlas of seasonal estimates of temperature and salinity to calculate subsurface anomalies were discussed. These attempts were to be pursued to determine the feasibility of such a computation.

2. Review and Overview of Environmental Studies for 1983

   Several papers concerning a wide range of environmental studies in the NAFO Area, including an overview of environmental conditions during 1983, were reviewed. Some of the noteworthy information is summarized below.

a) Subareas 0 and 1 (SCR Doc. 84/VI/59, 66, 70, 74; SCS Doc. 84/VI/15, 16, 17)

Winter conditions were particularly severe in these regions in 1983. Sea-surface temperatures in Subarea 1 showed strong and persistent colder than normal conditions in these regions. At the same time, it was noted that the cold portion of the West Greenland Current was colder and fresher than usual. The deepwater temperatures were about normal in summer but below normal at the end of the year, whereas this water was saltier than normal throughout the year. Formation of ice in the area between Greenland and Baffin Island-Labrador was quite extreme, and salinities were warmer and saltier than normal.

b) Subareas 2 and 3 (SCR Doc. 84/VI/67, 70, 77, 81; SCS Doc. 84/VI/17)

Temperatures and salinities in November along the Labrador coast were colder and fresher than usual in the upper water, and it was suggested that the Labrador Current had intensified. On the Grand Bank, positive sea-surface temperature anomalies were observed for the year as a whole. Station 27 data indicated that these anomalies were confined to the surface layer (usually less than 30 m) with below-normal temperatures in deeper water. Salinities were below normal in the surface layer and near normal for the deeper water. An anticyclonic gyre in the geostrophic circulation was noted over Flemish Cap in the spring, but this circulation broke down in late May. Wave heights in the Labrador area were generally lower during 1983 than in 1982. On the Grand Bank, winter wave conditions were also less severe in 1983 than in 1982. At the end of 1983, the largest significant wave heights (greater than 12 m) on record were observed on the Grand Bank. At the same time, large positive sea-level anomalies were recorded.

Air temperatures were below normal in Subarea 2 but above normal in Subarea 3, and this persisted throughout 1983. The period in which sea ice was present was longer than normal and the number of icebergs was higher in 1983 than in previous years. The number of icebergs in 1983 was the fourth highest in over 100 years of records. Analyses of sea-surface pressures anomalies for winter implied northwesterly winds in Subarea 2. This was consistent with the air temperature and oceanographic records showing colder than usual conditions in Subarea 2 in 1983 than in 1982.

c) Subareas 4 to 6 (SCR Doc. 84/VI/14, 15, 16, 17, 18, 19, 67, 70)

The surface waters on the continental shelf of these areas were generally warmer throughout 1983 than in 1982, with the highest anomalies on the Scotian Shelf. The warmer surface temperatures are consistent with the warmer air temperatures over the region and the anomalous southeasterly winds in winter and spring.

A number of documents noted the effects of passage of Gulf Stream rings on water on the shelf. Approximately 12 rings passed through the area between 60°W and Cape Hatteras, with the largest in the early part of 1983. The frontal position of the Gulf Stream was noted to be almost uniformly displaced seawards along the shelf from the 1973-77, mean with comparable standard deviations as in past years.

3. Update of Remote Sensing Activities

Information was presented which indicated that, at present, none of the satellites planned for launch around 1990 (NOAA, French TOPEX-POSEIDON, Canadian Radarsat) are firmly scheduled to carry any form of ocean color sensors to replace the experimental but highly successful Coastal Zone Color Scanner (CZCS) carried aboard the NIMBUS-7 since October 1978.

The Subcommittee, although noting that remote sensing of ocean color is still on a research basis, recognized that it provides important information on phytoplankton distributions both of a general nature and in relation to physical features at mesoscales (e.g. eddies). At present, it is the only practical method available for such studies. The method holds substantial promise for fisheries research and possible eventual management applications. It is therefore of concern that a situation may shortly arise whereby this type of large scale ocean color coverage by satellites may become unavailable for a considerable period (up to a decade) primarily due to lack of sufficient support. It is the opinion of the Subcommittee that continued research and coverage of ocean color will ultimately contribute to improved understanding of processes controlling fish production in the NAFO Area and that it is extremely important that a host satellite, regardless of nationality, be found as soon as possible for such ocean color sensors.

4. Environmental Aspects of Flemish Cap Project (SCR Doc. 84/VI/80)

A preliminary compendium of Flemish Cap cruises in the 1977-84 period, was presented. The Subcommittee requested that representatives of the countries involved in the Flemish Cap Project provide the author (S. A. Akenhead) with information sufficient to complete the compendium.

5. Distribution of Squid Larvae, Juveniles and Adults in Relation to Oceanographic Factors (SCR Doc. 83/VI/61, 62; 84/VI/68, 71)

These papers dealt with various aspects of the ecology of squids. It was noted that different squid species were caught in different water masses between the Scotian Shelf and the Gulf Stream. Gulf Stream rings possibly play an important factor in the abundance of squids in various waters. Vertical migration patterns were noted to be different for different squid species and different length groups of one species. Greatest abundance of squid was noted to occur in transition regions particularly from colder shelf to warmer slope water masses.

6. Fish Stocks and Environment

An invited lecture on the topic of recruitment patterns in Northwest Atlantic fish stocks was given by J. Anthony Koslow, Dalhousie University, Halifax, Nova Scotia. Presentation of recruitment data from several gadoid (cod, haddock) stocks, redfish, mackerel, and three herring stocks in the Northwest Atlantic indicated that changes occurred simultaneously over very large oceanographic areas. There was no latitudinal gradient of variability in the recruitment data in the Northwest Atlantic stocks. A similar pattern in gadoid recruitment to that reported in the North Sea was pointed out, with large recruitment of the 1963 year-class being a dominant feature. Multivariate Principal Component Analysis

indicated that gadoid stocks (grouped) were negatively correlated with the herring and mackerel stocks. A similar analysis, using an array of environmental variables, indicated that the oceanic climate of the Labrador Sea may be different from that on the Scotian Shelf (mostly based on temperature), whereas Station 27 salinities stood out as a separate factor. The implication of the analyses is that recruitment to Northwest Atlantic fisheries is regulated primarily by climate which may affect the ecology of stocks within a species or of related species over relatively large areas. Questions were raised concerning the interpretation of this analysis and the effect of increased fishing effort during the late 1960's and 1970's.

A paper, using principally sea-surface temperature data from the National Climatic Center (USA), examined environmental variability in the Northwest Atlantic (SCR Doc. 84/VI/66). Empirical Orthogonal Function Analysis similarly indicated large-scale patterns of the seasonal sea-surface temperature anomalies. Three natural groups were identified: Grand Bank, Scotian Shelf and New England. The sea-surface temperature anomaly patterns were related to possible forcing mechanisms of which local winds in winter appeared to be most dominant. Other causal factors might include isolation, river runoff and offshore forcing due to Gulf Stream meanders and eddies. The possible interdependence of these factors and how they might effect subsequent forcing during the different seasons was pointed out.

7. Influence of Environmental Factors on the Distribution, Movements and Migration of Marine Species in the Northwest Atlantic

In response to a proposal by STACFIS "that the Subcommittee on Environmental Research should focus its work as soon as possible on the influence of environmental factors on the distribution, movements and migrations of marine species in the Northwest Atlantic" (*NAFO Sci. Coun. Rep.*, 1983, page 122), a number of papers were presented which outlined both general and particular problems relevant to this request (SCR Doc. 84/VI/35, 36, 45, 57, 58, 59, 64, 69, 72, 75, 76, 83).

As a framework for identifying fisheries management problems associated with this topic, a background paper outlining broad problem areas and their practical importance to fisheries management in the context of marine species distributions was given (SCR Doc. 84/VI/72). While it was noted that the Council deliberately excluded the effects of environment on fish production, it become obvious that complete separation of "distributions" and "recruitment" was not always possible. Reasons for aggregations of fish and their consequent effect on catchability are clearly central to associated problems with respect to fisheries management. Variations in aggregation introduce biases in the assessment processes, as well as affecting fishing and management strategies. The utility of understanding environmental/distributional problems ultimately lies in a predictive capacity. How year-to-year distributional changes of fish in relation to environmental effects can be studies independently of recruitment effects, was not clear.

One paper (SCR Doc. 84/VI/58) dealt largely with recruitment variability and examined evidence in

support of the hypotheses that predation during post-larval and precruit stages is the mechanism exerting major control over recruitment. It was acknowledged, however, that physical factors ultimately must regulate the recruitment process, including biological mechanisms such as predators, although it is less apparent how environmental factors might affect post-larval compared with larval stages. It was noted that recruitment is frequently autocorrelated, which could result from autocorrelation in fluctuations in populations of predators or spawning potential. On the other hand, physical factors also exhibit autocorrelations, e.g. temperature trends. The coherence observed in recruitment patterns over broad geographic areas suggests control by the physical environment. However, it is difficult to see how one or more environmental factors could have the same effects on recruitment over regions as large as the NAFO Area, which exhibits such a wide range of physical and biological conditions. In any case, predictions of recruitment, based on statistical relationships with environmental factors, usually fail when projected into the future. This experience, together with other empirical and experimental evidence, indicates that recruitment is a function of multi-variable processes probably occurring throughout the first year of life, including the post-larval stage. Consequently, a better understanding of the actual mortality mechanisms in the first year of life, and their relative importance, seems essential in order to develop real predictive capability.

A review of biological questions pertaining to marine species' distributions in Newfoundland-Labrador waters indicated that most questions pertained to clearer delineation of stock boundaries. Temperature is widely believed to be the most important environmental variable that affects distributions, usually in the context of controlling movements of adult fishes. Currents were also considered to be important, not only on the distributional effects of eggs, larvae, juveniles and adults, but also on dynamics of production regimes and hence feeding associations. All questions concerned very large oceanic scales ($\sim$1000 km; months).

In light of the scope of the material presented and discussed, and the range of views expressed it was agreed, to establish a small working group to further develop and digest the ideas and the material presented and to provide a report for consideration by the Subcommittee. The report should attempt to synthesize the material presented and to identify ways in which the Subcommittee can further develop knowledge on the topic, including suggested priorities. A report should be ready for presentation at the next meeting of the Subcommittee (tentatively scheduled for September 1984). Names suggested for membership of the Working Group included: R. G. Halliday, A. T. Pinhorn or designate, M. Grosslein or designate, J. T. Anderson, and K. F. Drinkwater or R. W. Trites. (J. T. Anderson indicated that other commitments prevent him from serving on the Working Group.)

8. Proposed Theme for Special Session in 1986

In considering a proposal that recent advances in understanding recruitment in marine fishes might be a suitable topic for the Special Session, the Environmental Subcommittee noted that an Environmental Working Group (ICNAF) was established about 10 years ago "to suggest a proposal aimed at determining

the factors involved in production of good and poor year-classes in some of the major fisheries of the ICNAF Areas" (*ICNAF Redbook*, 1974, page 72). This subsequently led to identification of Georges Bank herring and Flemish Cap cod and redfish as appropriate stocks for intensive study. It was further noted that major field studies, experiments and analyses, designed to shed further light on the stock-recruitment questions, were subsequently carried out on Georges Bank and Flemish Cap, and that new initiatives on haddock recruitment in southwestern Nova Scotia and on Georges Bank are now in progress. However, the general recruitment process continues to be a problem of central importance, and it was considered desirable to evaluate experiences and results of these programs as soon as practical. The Subcommittee therefore

recommends

that an appropriate theme for the Special Session in September 1986 would be "Recent Advances in Understanding Recruitment in Marine Fishes in the Northwest Atlantic, with Particular Emphasis on Georges Bank and Flemish Cap".

9. Other Environmental Papers Not Previously Considered (SCR Doc. 84/VI/11)

This paper, which describes water temperature off Newfoundland and Labrador in 1982, was briefly presented and discussed.

10. National Representatives for Data Exchange

The Subcommittee was informed of changes in national representatives responsible for submitting oceanographic data to MEDS. The present list comprises: Canada (R. Keeley), Cuba (R. J. Dominguez), Denmark (E. Buch), France (M. Melguen), Federal Republic of Germany (D. Kohnke), German Democratic Republic (B. Schreiber), Japan (S. Kawahara), Norway (R. Leinebo), Poland (S. Grimm), USSR (G. I. Luka), United Kingdom (P. Edwards) and USA (E. Ridley).

11. Other Matters

There being no further business, the Chairman thanked the participants for their input during the course of the meeting, noting that the level of interest, the number of attendees, and the large number of environmental and environmentally-related documents submitted, showed a great improvement over that of the previous year.

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

Chairman: J. Møller Jensen Rapporteurs: D. Cross, V. Hodder, T. K. Pitt

The Committee met at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, on 18 June 1984, to consider and report on various matters referred to it by the Scientific Council (see Appendix IV). Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France and the Commission of the European Communities), Japan, Portugal, Spain, USSR and USA.

I. STATISTICS AND SAMPLING

1. Fishery Statistics

a) Progress report on activities, 1983-84 (SCS Doc. 84/VI/12)

The Committee noted with regret that late submissions of STATLANT 21B data has significantly delayed the publication of the Statistical Bulletin. It had not been possible to publish Vol. 31 (for 1981) until August 1983 and the last data for Vol. 32 (for 1982) have only recently been received. However, the Committee was pleased to record an apparent improvement in the submission of 1983 data, with only three national returns of STATLANT 21A data (deadline 15 April 1984) not having been received by the Secretariat by the start of the present Scientific Council Meeting. The work of the Council had therefore benefited from the production of SCS Doc. 84/VI/22 on provisional nominal catches in 1983. It was hoped that national reporting officers would maintain this improvement by respecting the deadline of 30 June for the return of the STATLANT 21B forms, thereby permitting the Secretariat to produce the Statistical Bulletin for 1983 by January-February 1985.

b) Updating the fishery statistics data base

The Secretariat had been informed that revisions to previous submissions of effort data by Canada (Maritimes) for 1977-80 and by the USA for 1981 were necessary. After reviewing the various alternatives as to how the revised Tables 5 of the relevant Statistical Bulletins could be published and the workload that these would place on the Secretariat, STACREC

recommends

i) that the Secretariat distribute a notice announcing the revisions to Canadian and United States effort data in Statistical Bulletin Table 5 for the years 1977-81 with the offer to provide computer tapes or listings of the revised data, and

ii) that the relevant Statistical Bulletins be revised and reissued in their entirety.

The Committee was informed that the historical series in the data base had been extended back to 1965 and, in spite of the increasingly fragmentary nature of the earlier data, work was proceeding to include data for 1964.

The Secretariat sought advice on the usefulness to the work of the Scientific Council of the

historical catches of selected species by stock area and country for the period 1973-82 (SCS Doc. 84/VI/6). The Committee considered this to be a useful document, but suggested that it could be improved by replacing the right hand "Total" column by data for one or two additional years.

c) Review of reporting forms, deadlines and requirements (STATLANT 21A and 21B)

The Committee noted that there were no proposals for modifying the STATLANT forms and agreed to maintain the deadlines of 15 April for the 21A form and 30 June for the 21B form.

d) Additional species items

The Secretariat reported that several species, not on the NAFO List of Species Items, were being reported in appreciable quantities on the STATLANT forms and, after consideration of the individual cases, STACREC

recommends

that the Secretariat take the necessary measures to check and assign appropriate common names and codes to the following species, which are to be added to the NAFO List of Species Items: (i) eelpouts (Lycodes sp.), (ii) a lanternfish (Notoscopelus sp.), and (iii) Penaeus shrimps (NS) (Penaeus sp.).

Before a decision could be taken on a species reported as *Alepocephalus bairdii*, the Committee requested advice in establishing the status of this species from any country which may have encountered it.

e) CWP activities relevant to NAFO (SCS Doc. 84/VI/9, 13)

The Committee noted the report of the *ad hoc* Inter-Agency Consultation on Atlantic Fishery Statistics which was held at Gothenburg, Sweden, in October 1983. Mr. D. G. Cross, in his capacity as Deputy Secretary of the CWP, reviewed this report and the provisional agenda of the 12th Session of the CWP to be held at Copenhagen, Denmark, during 25 July-1 August 1984. Of particular interest to NAFO would be the discussions on the criteria determining the nationality of catch, the FAO data base of conversion factors, the discrepancies between international data bases, the development of a manual on fishing logbooks, the compilation of a glossary of fishery statistics, and the development of a harmonized format for the transmission of computerized data between agencies.

The Committee noted that NAFO representatives at the CWP meeting would be Mr. J. Møller Jensen (Chairman of STACREC), Ms. N. V. Janovskaya and Mr. R. K. Zviriako (USSR), and Mr. V. M. Hodder (Assistant Executive Secretary). This representation had been agreed at the June 1983 Meeting of the Scientific Council. The report of the CWP on the NAFO statistical program, data processing and publications in 1982-84 (SCS Doc. 84/VI/9) was briefly reviewed.

2. Biological Sampling (SCS Doc. 84/VI/12)

a) Activities in 1983-84

Although some sampling data have been received, the Secretariat has not solicited data for 1982

and 1983, pending final clarification of reporting requirements. Meanwhile, the Secretariat has continued to process the historical ICNAF series, and all data for 1966-78 are now available in standard computerized format. Although sampling data for the years up to 1972 (Vol. 17) were published in Sampling Yearbooks, updated lists of data for 1966-78 have been compiled, and it was proposed that the manner of publication be referred to STACPUB.

b) Reporting procedures for 1979 and subsequent years

This matter was discussed thoroughly at the June 1983 Meeting (*NAFO Sci. Coun. Rep.* for 1983, pages 105, 109-110), but the recommendation which evolved from the Scientific Council implied that further study was needed on time periods and areas for which the data should be reported. Early in 1984, the Secretariat solicited comments from national representatives on the Scientific Council. There was only one response (USSR) which indicated that the pre-1979 requirements were satisfactory. Canadian representatives at this meeting request that further consideration be deferred to the September 1984 Meeting when their response would likely be available.

3. Scientific Observer Program

The Committee was informed that Canada has pursued the implementation of the program since its inception in 1979 and that bilateral agreements have been in effect with Cuba, Faroe Islands, German Democratic Republic, Japan, Poland and USSR. It was noted that agreement with the EEC was expected soon. Coverage by Canadian observers on vessels fishing outside the Canadian fishing zone involved 145 days (90 on Canadian vessels and 55 on vessels of other countries) in 1983 compared with 75 days in 1982. Species coverage included cod, redfish, American plaice, yellowtail flounder, witch flounder and shrimp.

4. List of Fishing Vessels (1983)

The Committee noted that the Secretariat had, in January 1984, requested each country to update its 1980 list to cover all fishing vessels which operated in the Northwest Atlantic during 1983, with a suggested deadline of 15 May 1984. From a possible 22 countries (or components), six have submitted their lists and three others reported no fishing activity. Thus, more than half of the reports are still outstanding. Reminders will be dispatched after this meeting to Scientific Council representatives with the urgent request that they pursue the matter with their appropriate national agencies.

5. Tagging Activities in 1983 (SCS Doc. 84/VI/5)

The Committee noted the summary of tagging activities in 1983, as reported to the Secretariat, and urged that the program be continued.

II. BIOLOGICAL SURVEYS

1. Review of Survey Activity in 1983

The Committee noted that the following documents contained information relevant to biological surveys:

SCR Doc. 84/I/6; 84/VI/13, 24, 33, 34, 39, 40, 41, 47, 48, 49, 52, 53, 56, 62, 64, 69, 71, 73, 76, 79, 85, 87, 88, 91, 92, 93; SCS Doc. 84/VI/17. However, all of these documents contained the results of investigations already reviewed by STACFIS, and they are not considered further here. Information on survey activities provided by participants enabled the compilation of the list of surveys in 1983 (Table 1).

Table 1. Inventory of biological surveys conducted in the NAFO Area during 1983.

Sub-area	Div.	Country	Months	Type of survey	No. of sets
A. STRATIFIED-RANDOM SURVEYS					
E. Greenl.		DEU	9-10	Groundfish	134
1	ABC	GRL	7-8	Shrimp (photo)	35
		"	7-8	Shrimp (OTB)	25
	BCDEF	DEU	11-12	Groundfish	153
2	HJ	CAN-N	7	Shrimp	170
	J	"	10-11	Groundfish	104
	J	DEU	10-11	Groundfish	90
2+3	JKL	CAN-N	11	Groundfish	96
3	K	CAN-N	11-12	Groundfish	77
	L	"	7-11	Groundfish	252
	M	"	2	Groundfish	142
	Pn	FRA	2	Cod	13
	Ps	CAN-N	4-5	Groundfish	193
		FRA	2-3	Groundfish	106
		"	10-11	Groundfish	78
4	R	FRA	1	Cod	59
	VWX	"	9-10	Squid	137
		CAN-SF	3-4	Groundfish	149
		"	7	Groundfish & comp. fish	276
		"	10	Groundfish	185
	X	"	1	Groundfish (FEP)	93
		"	5-6	Groundfish (FEP)	76
		"	8-9	Groundfish (FEP)	87
		USA	4	Groundfish	36
		"	11	Groundfish	28
5	YZ	USA	4-5	Groundfish	186
		"	10-11	Groundfish	219
6	ABC	USA	3-4	Groundfish	206
		"	9-10	Groundfish	229
B. OTHER SURVEYS					
E. Greenl.		GRL	4,9	Groundfish & shrimp (com.)	20
0	B	USSR	11	Groundfish (G. halibut)	71
1	ABCD	GRL	7	Plankton	2
		"	6-9	Whale (sighting)	-
	AC	"	9	Groundfish & shrimp (com.)	4
	ACDE	"	1-2,5-6, 10-12	Groundfish & shrimp (res.)	39
	CDE	"	1-2,5-6	Groundfish & shrimp (com.)	13
		"	10-12	Groundfish & shrimp (com.)	22
	D	"	5	Plankton	2
		"	8-10	Salmon	11
2	GHJ	USSR	12	Groundfish (G. halibut)	75
	J	"	11	Capelin (acoustic)	-
2+3	HJKLMO	CAN-N	7-8	Annual Hydrographic	-
	JK	"	9-10	Capelin (acoustic)	-
	JKL	"	3	Cod tagging	78
3	K	CAN-N	9	Cod tagging	-
		USSR	1	Groundfish (G. halibut)	33
		"	7	Groundfish	95
		"	11	Capelin (acoustic)	-
	KL	CAN-N	5-6	Capelin survey	-
		"	5	Cod (acoustic)	-
	L	"	7-8	Comparative survey	81
		"	2,7-8, 10-12	Herring & capelin larvae	-
		"	5-6,8	Crab	-
		"	4-5	Capelin (acoustic)	-
		"	11	Pelagic (acoustic)	-
		"	9-10	Mackerel (acoustic)(IDB)	-
		"	9	Gear experiment	-
	LNO	"	6-7	Capelin (acoustic)	-
		USSR	5-7	Groundfish & capelin (larvae & juveniles)	246
		"	6	Capelin (acoustic)	-
	LPs	CAN-N	6-7	Herring & capelin (larvae)	-
	M	"	2-3	Hydrographic & plankton	-
		USSR	4-5	Groundfish	122
		"	6	Redfish (acoustic)	-
		"	3-5	Ichthyoplankton	185
	NO	CAN-N	5-6	Squid	177
		"	11-12	Juvenile flatfish	80
	NOPs	"	6-7	Eggs & larvae	-
	Ps	"	1-2	Herring	-
		"	7,10-11	Oceanographic	-
		"	9	Scallops	-
		FRA	3	Scallops	30
		"	10	Scallops	160
4	RS	CAN-N	9	Redfish (acoustic)	-
	V	CAN-SF	1	Herring (acoustic)	-
		"	5	Shrimp survey	29
	VW	"	10-11	Redfish	99
		USA	8-9	Clams (joint with Canada)	128
	VWX	CAN-SF	9	Squid	82
		USSR	3-6	Squid (larvae)	115
		"	3-6	Squid (juvenile)	425
		"	11	Silver hake (juvenile)	64
	W	"	3	Demonstration	12
		"	8	Zooplankton vert. mig.	-
		"	8	Juvenile haddock (Sable I)	105
		"	9-10	Silver hake	55
	WX	"	5	Deep-sea scallops	125
	X	USA	1	Ichthyoplankton	20
		"	2	Ichthyoplankton	8
		CAN-SF	2	Ichthyoplankton (SSIP)	53
		"	2	Shrimp	14
		"	2	Groundfish (acoustic)	-
		"	3	Ichthyoplankton	50
		"	3	Herring (larvae)	158
		"	4	Ichthyoplankton	49
		"	5	Ichthyoplankton	77
		USA	5-6	Ichthyoplankton	15
		CAN-SF	6	Haddock (juvenile)	72
		"	7	Lobster (larvae)	82
		"	9	Groundfish (acoustic)	-
		"	10-11	Herring (larvae)	157
		USA	11-12	Ichthyoplankton	14
4+5	XY	USA	1-2	Ichthyoplankton	82
		"	2-3	Ichthyoplankton	75
		"	2-3	Herring	90
		"	5-6	Ichthyoplankton	81
		"	11-12	Ichthyoplankton	65
	XZ	CAN-SF	8	Deep-sea scallops	250
		"	8	Haddock (juvenile)	62
5	Z	USA	5	Microdistribution fish lar.	42
		"	4-5	Warm core ring (ichthyoplankton hauls)	40
		"	7-8	Clams	117
		"	8	Scallops	210
6	A	USA	2	Herring	110
		"	2	Ichthyoplankton	9
	AB	"	7-8	Scallops	263
		"	8-9	Clams	267
	ABC	"	2-3	Ichthyoplankton	79
		"	5-6	Ichthyoplankton	81
		"	11-12	Ichthyoplankton	73

2. Survey Plans for 1984 and early 1985

Requests for information on surveys planned for the NAFO Area in 1984 and early 1985 resulted in the list given in Table 2.

Table 2. Biological surveys planned for the NAFO Area in 1984 and early 1985.

Country	Area	Type of survey	Dates
A. Surveys in 1984			
CAN-N	2HJ	Shrimp	Jul 5-30
	2J+3KL	Capelin acoustics	Sep 28-Oct 24
		Groundfish	Oct 26-Dec 6
	2J+SA3	Annual hydrographic	Jul 20-Aug 10
		Gear experiments	Sep 6-25
	3K	Crab	May 18-31
		Cod tagging	Sep 19-Oct 19
	3KL	Crab	Jul 3-20
		Cod	May 25-Jun 13
	3L	Capelin acoustics	Apr 19-May 14
		Groundfish	Jul 26-Sep 4
		Groundfish	Oct 18-Nov 27
		Cod tagging	May 28-Jun 14
		Herring larvae	Jun 18-29
		Cod tagging	Jul 3-13
		Herring & capelin larvae	Aug 15-31
		Herring & capelin larvae	Sep 13-28
		Crab	Oct 2-11
		Herring & capelin larvae	Oct 15-31
		Capelin	Jun 4-25
		Herring & capelin larvae	Jul 9-Aug 3
		Crab	Aug 6-21
		Pelagic survey	Nov 14-26
	3LNO	Groundfish	Apr 24-May 11
		Groundfish	May 15-31
		Squid	Jun 15-29
		Capelin acoustics	Jun 15-Jul 3
		Juvenile flatfish	Sep 27-Oct 16
	3N	Yellowtail larvae	Jul 5-24
	3Ps	Groundfish	Apr 5-19
		Scallops	May 16-23
		Scallops	Sep 14-26
		Oceanography	Apr 1-24
		Oceanography	Sep 4-10
	4RS	Redfish acoustics	Aug 1-22
		Scallops	Jun 28-Jul 5
CAN-SF	4V	Acoustics-herring	Jan 16-Feb 24
	4VW	Redfish	Apr 2-13
	4VWX	Acoustics	Mar 19-30
		Square mesh study	Apr 2-13
		Ichthyoplankton	Apr 16-27
		Shrimp survey	Apr 30-May 11
		Square mesh study	Apr 30-May 11
		Scallop survey	May 14-25
		Ichthyoplankton	May 14-25
		Squid survey	May 28-Jun 8
		Ichthyoplankton	Jun 11-22
		Shrimp survey	Jul 23-27
		Scallop survey	Jul 24-30
		Lobster larval survey	Aug 13-31
		Acoustics/trawling	Sep 4-11
		Squid survey	Sep 13-Oct 2
		Silver hake survey	Oct 5-22
		Scallop larvae	Oct 9-17
		Shrimp survey	Oct 19-30
		Deep trawling	Oct 24-Nov 5
		Benthic crab survey	Nov 19-30
		Pollock survey	Nov 22-Dec 13
	4W	Gear trials-plankton	Nov 7-20
	4X	Acoustics/trawling	Jan 2-18
		Benthic (FEP)	Jan 2-6
		Ichthyoplankton (SSIP)	Jan 23-Mar 30
		Bay of Fundy larval herring	Feb 27-Mar 16
		Bay of Fundy larval herring	Nov 1-16
	4VWX+5Z	Groundfish survey	Mar 2-30
		Groundfish survey	Jul 9-Aug 3
		Groundfish survey	Oct 4-Nov 2
	4X+5Z	Juvenile haddock survey	Jun 4-15
DEU	E. Greenl.	Groundfish (strat.-random)	Aug 27-Oct 7
	1BCDEF	Groundfish (strat.-random)	Oct 11-Nov 23
	2J	Groundfish (strat.-random)	Oct 8-Nov 23
GRL	E. Greenl.	Marine mammals (areal)	Jun
		Whales (areal)	Sep
		Groundfish & shrimp (comm.)	Jan-Dec
	0A+1ABC	Shrimp (photo)	Jul-Aug
		Shrimp (OTB)	Jul-Aug
	1ABC	Shrimp (comm.)	Jan-Dec
	1ABCD	Plankton	Jul
	1BCD	Whales (areal)	Jun-Jul
		Marine mammals (areal)	Jun-Jul
	1BCDEF	Cod (comm.)	Jan-Dec
	1CDE	Groundfish & shrimp (res.)	Jan-Dec
FRA	3Pn+4R	Cod	Jan 21-Feb 27
	3Ps	Groundfish	Feb 23-Mar 19
		Groundfish	Oct 4-30
		Sea scallops	Oct 31-Nov 13
	4VWX	Squid	Aug 29-Oct 2
USSR	2GHJ+3K	Greenland halibut	Nov 84-Jan 85
	2J+3K	Capelin (acoustic)	Oct
	3KLMNO	Groundfish	May-Jul
	3LNO	Capelin (acoustic)	May-Jun
	3M	Ichthyoplankton	Mar-May
	4VWX	Silver hake (juveniles)	Sep
USA	4X	Groundfish	Apr 16-25
		Groundfish	Oct 29-Nov 9
	4-6	Ichthyoplankton	May 7-Jun 7
	5YZ	Groundfish (herring)	Feb 13-24
		Groundfish	Mar 19-Apr 25
		Groundfish	Oct 1-Nov 9
	5Z	Post-larval fish	Jun 11-22
		Juvenile fish	Aug 6-18
		Juvenile fish	Oct 15-25
	5+6	Clams	Aug 13-Sep 26
		Scallops	Jul 26-Aug 31
	6	Groundfish (herring)	Feb 13-24
		Groundfish	Feb 29-Mar 30
		Groundfish	Sep 11-Oct 12
B. Surveys Planned for Early 1985			
CAN-N	3L	Groundfish	Jan 10-Feb 19
	3M	Groundfish	Jan 31-Feb 18
	3Ps	Groundfish	Mar 7-26
		Herring	Jan 7-26
	SA3	Marine salmon	Feb 4-26
	4VWX	Squid	Feb 20-Mar 13
CAN-SF	4V	Acoustics	Jan 16-Mar 1
	4VWX	Benthic crab survey	Jan 2-14
		Cod tagging	Jan 14-28
		Ichthyoplankton	Jan 30-Feb 25
		Cod tagging	Feb 27-Mar 11
		Ichthyoplankton	Mar 13-29
	4VWX+5Z	Groundfish survey	Feb 28-Mar 29
FRA	3Ps	Groundfish	Feb-Mar
		Scallops	Mar
USSR	2GHJ+3K	Greenland halibut	Nov 84-Jan 85
USA	4X	Groundfish	Apr 15-26
	4-6	Ichthyoplankton	Jan 7-Feb 8
		Ichthyoplankton	Apr 8-Jun 7
		Ichthyoplankton	Aug 25-Sep 27
	5YZ	Groundfish (herring)	Feb 5-Mar 1
		Groundfish	Mar 18-Apr 26
	5Z	Post-larval fish	Jun 10-21
		Juvenile fish	Jul 22-Aug 16
	5+6	Clams	Jun 24-Jul 19
		Scallops	Jul 22-Aug 30
		Apex predators	May 15-31
	6	Groundfish (herring)	Feb 5-Mar 1
		Groundfish	Feb 25-Mar 29
		Groundfish	Sep 9-27

3. Standard Forms for Reporting Survey Information

The Committee noted the difficulty encountered by the Chairman in collaboration with the Secretariat in compiling the survey information usually included in Tables 1 and 2 from fragmentary data provided during the course of the meeting. To facilitate the efficient compilation of these tables for inclusion in its report, STACREC

recommends

a) that the Secretariat prepare standard formats for the reporting of information on biological surveys, and

b) that the fisheries institutes which conduct biological surveys in the Northwest Atlantic submit their lists to reach the Secretariat in advance of the June meeting.

4. Review of Stratification Schemes

The Committee noted that accurate charts are still not available for Div. 2G and 2H and that the stratification schemes have not yet been prepared. It was also noted that the Subarea 1 stratification scheme is currently under review.

5. Coordination of Squid Surveys

No proposals were submitted for advice from STACREC, as these surveys are handled on a bilateral basis.

III. OTHER MATTERS

1. Review of Relevant Papers

a) Stratified-random *versus* fixed-station surveys in Div. 3M (SCR Doc. 84/VI/41)

A comparison of stratified-random and fixed-station surveys on Flemish Cap by USSR scientists led to the conclusion that variation in estimates of abundance and biomass was less in the stratified-random data than in the fixed-station data. Trawl surveys should be designed to make the most efficient use of research vessel time while retaining accuracy and precision.

b) Length measurments for grenadiers (SCR Doc. 84/VI/44)

A comparison between total length and preanal fin length of roundnose grenadier showed differences between males and females of the same total length, and the absolute and relative values of preanal fin length varied irregularly with increasing total length. Also, the variance associated with preanal fin length measurements was greater than that for total length. In view of the difficulty of obtaining reliable measurements of total length due to broken and regenerated tails, the Committee reiterated its previous recommendation that anal fin length be used in measuring grenadiers (*NAFO Sci. Coun. Rep.*, 1980, page 94).

2. Acknowledgements

There being no further business, the Chairman thanked the rapporteurs for their assistance in drafting the report and expressed his appreciation to all participants for their cooperation during the meeting and to the Secretariat for their usual efficient work.

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

Chairman: J. Messtorff Rapporteur: R. G. Halliday

The Committee met at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada on 12th and 19th June 1984. The Chairman, J. Messtorff, members Sv. Aa. Horsted (EEC), R. G. Halliday and A. T. Pinhorn (Canada), and the Assistant Executive Secretary (V. M. Hodder) were in attendance for both meetings. In the absence of S. Kawahara (Japan), H. Hatanaka attended the second meeting, as well as M. G. Larrañeta (Spain) who was appointed by the Scientific Council to replace J. P. Minet (EEC). The Chairman of the Scientific Council (V. A. Rikhter) and the Administrative Assistant (H. Champion) also attended the second meeting.

1. Review of Scientific Publications Since June 1983

a) *Journal of Northwest Atlantic Fishery Science*

i) Volume 4, containing "Guide to the early stages of marine fishes in the western North Atlantic, Cape Hatteras to the southern Scotian Shelf" by M. P. Fahay (425 pages), was published in July 1983 and distributed in early September.

ii) Volume 5(1), containing 16 peer-reviewed papers and 2 obituaries (120 pages), was published in January 1984.

iii) Volume 5(2), for which papers are now being processed, is scheduled for production in September 1984.

b) *Scientific Council Studies*

i) Number 6, containing 8 papers (104 pages), was published in December 1983 and distributed in January 1984.

ii) Number 7, for which papers are now being processed, is scheduled for production in August 1984.

c) *Scientific Council Reports*

The volume containing the reports of meetings in January, June and September 1983 (152 pages) was published in December 1983 and distributed in January 1984.

d) *Statistical Bulletin*

i) Volume 31 for 1981 (276 pages) was published in September 1983. Production was significantly delayed due to the late receipt of some data.

ii) Volume 32 for 1982 was scheduled for production in April 1984, but the late receipt of reports from three countries has delayed publication until August 1984.

e) *List of Fishing Vessels (for 1983)*

The compositions of the fishing fleets (>50 GRT) of the various countries operating in the Northwest Atlantic in 1983 were solicited by Circular Letter in January 1984 with the suggested deadline of 15 May 1984 for submission of these reports. Less than 50% of the expected reports were received by 31 May 1984.

f) *Index and List of Titles of Meeting Documents*

i) The provisional index for 1983 (36 pages) was issued in March 1984.

ii) It was noted that 1984 will provide the fifth of a 5-year series of meeting documents to be indexed (1979 being incorporated in 1980). It was decided to proceed with a 5-year index which would include all meeting documents to the end of 1984 as had been agreed some years ago. It was further decided not to proceed with publication of a 5-year index of published papers, as the volume of these is quite low. However, it was agreed that a Summary Document providing a preliminary 5-year index of published papers would be useful, with consideration to be given to publishing an index when the volume of material is greater.

g) *Sampling Yearbooks*

No volumes have been issued since Vol. 23 (for 1978). The last five volumes (for 1973-78) consisted of annual indices of samples available in the Secretariat data base, whereas earlier volumes contained summaries of the actual data. The Secretariat is now in a position to produce standardized indices of samples back to 1967. It was considered useful to publish these in two volumes for the 5-year periods 1967-72 and 1973-78, and it is proposed that these be produced as time permits.

2. Editorial Policy Regarding Scientific Council Publications

a) Promotion and distribution of publications

It was noted that there has been a steady supply of papers submitted for publication in the Journal at a level of about 30 per year. There are 10 papers presently under review. This appears adequate to support the present schedule of semi-annual publication.

Journal distribution to scientists of member governments continues to be slightly under 500 and subscriptions have increased to about 50. Purchases of Vol. 4 (Guide to the Early Stages of Marine Fishes ...) have reached about 100 to date, confirming expectations of substantial demand.

It was decided to continue annual review of the free distribution list for at least one more year as the number of changes each year is still moderately high. It is hoped that it will be possible to then move to a less frequent review, perhaps every 3 years.

Costs and revenues for Journal Volumes 2-4 were reviewed and the Committee considered that these provided a useful basis for monitoring the financial implications of Council decisions on policy for the Journal. The Committee confirmed that it wished to see such a report on an annual basis and requested the Secretariat to provide comparable analyses for the other Scientific Council publications.

b) Editorial Board for the Journal

The Committee was informed that E. J. Sandeman (Associate Editor for Invertebrate Fisheries Biology) had indicated that he could not continue as an Associate Editor and requested that he be replaced. The Editor was asked to express the Committee's regret to Mr. Sandeman that he is unable

to continue and their thanks for his service over several years. Steps were taken to obtain a replacement by drawing up a short list of candidates. The Editor was requested to ascertain a willingness to serve on the part of these candidates and report back to the Committee at its September 1984 Meeting.

3. Production of Microfiche

As a result of canvassing potential purchasers of microfiche sets of ICNAF documents, it was agreed to produce 30 sets in the first run. Based on a revised estimate of costs, which excluded purchase of a reader/printer for the Secretariat, it was decided that these sets should be offered for purchase at $750 per set. STACPUB

recommends

that the Executive Secretary include in budget estimates to be submitted to the General Council for the 1985 fiscal year, a sum appropriate to allow production of 30 sets of microfiche copies of ICNAF scientific documents.

In putting this item before the General Council, the Executive Secretary is requested to make it quite clear that the Scientific Council expects full cost recovery for this project.

4. Papers for Possible Publication

The Committee reviewed both the Research Documents deferred from 1983 and those presented to the Council so far in 1984 and requested the Editor to invite the authors of the following documents to submit suitably revised manuscripts for possible publication in the Journal or Studies series: SCR Doc. 83/62, 68; SCR Doc. 84/22, 30, 42, 43, 44, 45, 57, 61, 66, 67, 72, 75, 79, 84, 88. It was further agreed that the authors of SCR Doc. 84/34, 65 and 87 on 0-group silver hake surveys be encouraged to submit a joint analysis for consideration for publication. It was suggested that the authors of SCR Doc. 83/68 consider whether aspects of SCR Doc. 83/67 could usefully be included. Similarly, the author of SCR Doc. 84/61 should be asked to consider whether aspects of SCR Doc. 84/60 and 62 could usefully be included. The Editor should also discuss with the author of SCR Doc. 84/79 and 88 whether he wishes to combine these documents for publication. The Committee recognized the value of annual reporting of environmental trends but was unsure of how this could best be accomplished. Consideration of SCR Doc. 84/70 was therefore deferred to the September 1984 Meeting for more extensive discussion.

The above item raised the more general question about the role of Scientific Council Studies, and whether current guidelines for content and scientific standards are best suited to the Council's needs. Although Journal matters have been under continuous review, Studies has received little consideration since its inception 5 years ago. It is proposed that the role and scope of the Studies series be thoroughly reviewed at the September 1984 Meeting of the Scientific Council.

5. Other Matters

There being no other business, the Chairman thanked the Secretariat for their valuable support of the work of the Committee and thanked the members for their active participation.

APPENDIX IV. AGENDA FOR SCIENTIFIC COUNCIL MEETING, JUNE 1984

I. Opening (Chairman: V. A. Rikhter)

1. Appointment of rapporteur
2. Adoption of agenda
3. Plan of work

II. Fishery Science (STACFIS Chairman: J. E. Carscadden)

1. General review of catches and fishing activity in 1983

2. Assessment of finfish and invertebrate stocks

a) Stocks in the NAFO Regulatory Area, as required by the Fisheries Commission:

- Cod (3M)
- Redfish (3M)
- American plaice (3M)

b) Stocks within or partly within the Canadian 200-mile fishery zone in Subarea 2, 3 and 4, for which advice on conservation measures in 1985 has been requested by Canada (Annex 1):

- Cod (2J+3KL, 3NO, 3Ps*)
- Redfish (3LN)
- Silver hake (4VWX)
- American plaice (3LNO)
- Witch flounder (3NO)
- Yellowtail flounder (3LNO)
- Greenland halibut (2+3KL)
- Roundnose grenadier (2+3)
- Capelin (3L, 3NO)
- Squid-*Illex* (3+4)

c) Stocks within the EEC fishery zone in Subarea 1 and at East Greenland, for which advice on conservation measures in 1985 has been requested by the EEC (Annex 2):

- Cod (1)
- Redfish (1)
- Wolffishes (1)
- Northern shrimp (East Greenland)

d) Stocks overlapping the Canadian and EEC fishery zones in Subareas 0 and 1, for which advice on conservation measures in 1985 has been requested by Canada and the EEC (Annexes 1 and 2):

- Greenland halibut (0+1)
- Roundnose grenadier (0+1)
- Northern shrimp (0+1)

3. Environmental research (Subcommittee Chairman: R. W. Trites)

a) Marine Environmental Data Service report for 1983
b) Review of environmental studies in 1983
c) Overview of environmental conditions in 1983
d) Update of remote-sensing activities
e) Synoptic sea-surface temperature maps
f) Environmental aspects of Flemish Cap Project
g) Distribution of squid larvae and juveniles re oceanography (winter and spring survey results). (see also SCR Doc. 83/VI/61, 62)
h) Other environmentally-related work on squid
i) Influence of environmental factors on distribution, movements and migrations of marine species in the Northwest Atlantic (contributions and proposals concerning this topic are welcomed).
j) Other matters.

* Also requested by EEC as a stock overlapping EEC and Canadian waters.

4. Flemish Cap research (see Circ. Letter 84/9)

   a) Analysis of comparative ichthyoplankton sampling
   b) Analysis of fixed-station and stratified-random trawling data
   c) Other matters

5. Ageing techniques and validation studies (outstanding studies involve the following (see Circ. Letter 84/4, item 4)):

   a) Redfish ageing by Canadian and Federal Republic of Germany scientists
   b) Roundnose grenadier ageing by scientists of Federal Republic of Germany and German Democratic Republic
   c) Canada-USSR cod otolith exchange for Div. 3M
   d) Discrepancies in ageing of silver hake by Canada and USSR scientists
   e) Other studies (proposal for second workshop on ageing shrimp)

6. Gear and selectivity studies (see also SCR Doc. 83/IX/84)

7. Review of research documents not considered in items (1) to (7) above.

   a) Papers deferred from 1983 Meetings (SCR Doc. 83/IX/66, 67, 68)
   b) Papers documented for present meeting.

8. Other matters

   a) Progress report on work of Task Force on Larval Herring (The Task Force Leader, M. D. Grosslein advises that delay in processing of some ichthyoplankton samples necessitates deferral of the Task Force Meeting until the June 1985 Meeting).
   b) Progress report on contributions for the Special Session on Squids at the September 1984 Annual Meeting.
   c) Review of proposals for documenting STACFIS assessments (*NAFO Sci. Coun. Rep.*, 1983, pages 124-127).
   d) Possible theme for Annual Meeting in September 1986

III. Research Coordination (STACREC Chairman: J. M. Jensen)

1. Statistics and sampling

   a) Fishery statistics

      i) Progress report on activities, 1983-84
      ii) Updating of fishery statistics database
      iii) Review of reporting forms, deadlines and requirements (STATLANT 21A and 21B)
      iv) CWP activities relevant to NAFO

   b) Biological sampling

      i) Progress report on activities, 1983-84
      ii) Clarification of reporting requirements for 1979 and subsequent years

   c) Review of Scientific Observer Program

   d) List of fishing vessels for 1983

   e) Review of tagging activity for 1982

   f) Other matters

2. Biolgical surveys

   a) Review of survey activity in 1983
   b) Survey plans for 1984 and early 1985
   c) Review of stratification schemes
   d) Coordination of squid surveys in 1984 and 1985
   e) Other matters

3. Review of relevant research documents not considered in Items (1) and (2) above.

4. Other business

IV. Publications (STACPUB Chairman: J. Messtorff)

1. Review of scientific publications since June 1983

2. Editorial matters regarding scientific publications

   a) Editorial Board activities
   b) Promotion and distribution of publications

3. Progress regarding microfiche proposal

4. Papers for possible publication

   a) Review of proposals from 1983 meetings
   b) Proposals for possible publication from 1984 and outstanding 1983 documents

5. Other business

V. Collaboration with other Organizaitons

1. Report of second meeting of NAFO/ICES study group on redfish off Greenland (SCS Doc. 84/VI/2)

2. Twelth session of CWP at Copenhagen, Denmark, 25 July-1 August 1984 (SCS Doc. 84/VI/

VI. Adoption of Reports

1. Provisional Report of Scientific Council, January 1984 (SCS Doc. 84/I/1)

2. Committee reports (this meeting)

   a) STACFIS
   b) STACREC
   c) STACPUB

VII. Future Scientific Council Meetings, 1984 and 1985

VIII. Other Business

1. Arrangements for Special Session "Design and Evaluation of Biological Surveys in Relation to Stocks Assessments", to be held in September 1985

2. Theme for Annual Meeting in September 1986

IX. Adjournment

ANNEX 1. Canadian Request for Scientific Advice on Management In 1985 of Certain Stocks in Subareas 0 to 4

by

L. S. Parsons

Assistant Deputy Minister for Atlantic Fisheries
Department of Fisheries and Oceans, Ottawa, Canada

1. Canada requests that the Scientific Council, at its meeting in advance of the 1984 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks in 1985:

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

   It is further suggested that, subject to the concurrence of the other coastal states concerned, the Scientific Council, prior to the 1984 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1985 of the following stocks:

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

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

   a) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and management options evaluated in terms of their implications for fishable stock size in both the short and long term. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be evaluated in relation to spawning stock size. As a general reference point, the implications of continuing to fish at $F_{0.1}$ in 1985 and subsequent years should be evaluated. The present stock size should be described in relation to those observed historically and those expected at the $F_{0.1}$ level. Opinions of the Scientific Council should be expressed in regard to stock sizes, catch rates, and TACs implied by these management strategies for 1985 and the long term.

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

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

ANNEX 2. EEC Request for Scientific Advice on Management in 1985 of Certain Stocks in Subareas 0 and 1

by

E. Gallagher, Director General

Directorate General for the Fisheries Commission for the European Communities
Brussels, Belgium

1. The EEC requests the Scientific Council of NAFO to provide advice for the following stocks:

   a) Stocks occurring in Subareas 0 and 1:

      Greenland halibut
      Roundnose grenadier
      Northern shrimp

   b) Stocks occurring in Subarea 1:

      Atlantic cod
      Atlantic redfish
      Wolffish (catfish)

2. For the above mentioned stocks, the present state of exploitation should be reviewed and options for management in 1985 given. Where possible, these should be expressed graphically in terms of catch in 1985 and the size of the spawning stock biomass on 1 January 1986 for a range of values of F which covers at least -50% to +25% of F in 1983.

3. For cod in Subarea 1, it is requested that catches for each year up to and including 1987 and spawning stock biomasses for each year up to and including 1988 are calculated for maintaining F at the following levels from 1985 onwards: $F = F_{0.1}$, $F = F_{max}$ and F_{1982}. All values of F refer to that on the most heavily exploited age groups.

   Catches should also be calculated for the option of maintaining the spawning stock biomass at 175,000 tons and the resultant F estimated.

   It is also requested that F in each year up to and including 1987 and spawning stock biomasses for each year up to and including 1988 and calculated for:

   - maintaining until 1987 a constant catch equal to that in 1983;
   - maintaining until 1987 a constant catch equal to that in 1984 if the stock were fished at $F_{0.1}$ in 1984;
   - maintaining until 1987 a constant catch of 68,500 tons

   The agreed TAC for 1984 is 68,500 tons.

   Advice is requested on the effects of increasing the mesh size from the existing regulation 130 mm to 140 mm, 150 mm and 160 mm respectively. From September 1984, the fishery by Greenland fishermen will use 140 mm mesh size.

4. Management options for shrimp at East Greenland should also be given in coordination with ICES.

APPENDIX V. LIST OF PARTICIPANTS

CANADA

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APPENDIX VI. LIST OF RESEARCH AND SUMMARY DOCUMENTS

A. RESEARCH (SCR) DOCUMENTS

SCR No.	Ser. No.	Title	Author(s)
84/I/1	N770	Norwegian investigations on shrimp, *Pandalus borealis*, in East Greenland waters in 1983.	O. M. Smedstad S. Torheim
84/I/2	N771	Norwegian investigations on shrimp, *Pandalus borealis*, off West Greenland in 1983.	O. M. Smedstad S. Torheim
84/I/3	N772	Details of catch, effort and CPUE from the Canadian fishery for shrimp (*Pandalus borealis*) in Division 0A, 1983.	D. G. Parsons P. J. Veitch G. E. Tucker
84/I/4	N773	Observations of some biological characteristics of shrimp (*Pandalus borealis*) from the Davis Strait, 1978-81.	D. G. Parsons G. E. Tucker
84/I/5	N774	Data on the shrimp fishery at East Greenland in 1983 compared to earlier years.	D. M. Carlsson
84/I/6	N775	Biomass of shrimp (*Pandalus borealis*) in NAFO Subarea 1 in 1978-1983 estimated by means of bottom photography.	P. Kanneworff
84/I/7	N776	Catch, effort and biological data of shrimp (*Pandalus borealis*) in the French fishery off East Greenland in 1983.	A. Biseau B. Fontaine A. Forest
84/I/8	N777	Some data on the Icelandic catch of shrimp in the Denmark Strait area in 1983.	I. Hallgrimsson U. Skúladóttir
84/I/9	N778	Data on the shrimp fishery in NAFO Subarea 1 in 1982 and 1983.	D. M. Carlsson
84/VI/10	N780	Aggregations of cunner, *Tautogolabrus adspersus*, and cod *Gadus morhua*: co-occurence with a dominant species in a temperate marine fish assemblage.	P. Auster
84/VI/11	N784	Water temperature off Newfoundland and Labrador in 1982.	V. V. Burmakin
84/VI/12	N785	Stomach contents of the Atlantic wolffish, *Anarhichas lupus*, from the Northwest Atlantic.	W. Templeman
84/VI/13	N786	Preliminary results of the R/V *Gizhiga* research cruise on the short-finned squid, *Illex illecebrosus*, in NAFO Subareas 3 and 4 during March to June 1983.	P. P. Fedulov A. I. Arkhipkin E. N. Shevchenko T. W. Rowell
84/VI/14 Revised	N787	Sea surface temperatures in the Northwestern Atlantic in 1983.	D. R. McLain M. C. Ingham
84/VI/15	N788	Bottom temperatures on the continental shelf and slope south of New England during 1983.	R. S. Armstrong
84/VI/16	N789	Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1983.	S. K. Cook
84/VI/17	N790	Variation in the shelf water front position in 1983 from Georges Bank to Cape Romain.	R. S. Armstrong
84/VI/18	N796	Anticyclonic warm-core Gulf Stream rings off the Northeastern United States during 1983.	C. A. Price P. J. Celone

SCR Documents (continued)

84/VI/19	N791	Continuous plankton records: Massachusetts to Cape Sable, N.S., and New York to the Gulf Stream, 1983.	J. W. Jossi D. E. Smith
84/VI/20	N793	An update on the status of roundnose grenadier in Subareas 0+1 and 2+3.	D. B. Atkinson
84/VI/21	N794	The relationships between different type of length measurements of sharp-beaked redfish.	D. B. Atkinson
84/VI/22	N797	Species proportions and some reproductive aspects of three redfish species (*Sebastes marinus*, *S. fasciatus*, and *S. mentella*) on Flemish Cap, March 1983.	R. W. Penney D. J. Power D. B. Atkinson
84/VI/23	N798	Results of tagging of adult Atlantic cod in inshore areas of Newfoundland and Labrador during 1979-1982.	W. H. Lear
84/VI/24	N799	The winter distribution of cod in NAFO Divisions 2J, 3K and 3L, based on research vessel catches during 1978-83.	W. H. Lear
84/VI/25	N806	Results of tagging of Atlantic cod on St. Pierre Bank during February, 1980.	W. H. Lear
84/VI/26	N807	Offshore and inshore catches of Atlantic cod in NAFO Divisions 2J, 3K and 3L during 1958-83.	W. H. Lear
84/VI/27	N808	The 1983 fishery for *Illex illecebrosus* in SA 4 and biological characteristics of the stock.	T. W. Rowell F. Budden
84/VI/28	N809	Estimates of discarding by the Newfoundland offshore fleet in 1982.	D. W. Kulka
84/VI/29	N811	Status of the cod stock in Divisions 3L, 3M, and 3N, 1983.	L. Suarez J. Zamarro A. Vázquez
84/VI/30	N812	Dynamics of yellowtail flounder and American plaice in NAFO Divisions 3L, 3N and 3O.	M. G. Larrâneta
84/VI/31	N816	Redfish in NAFO Divisions 3LN	D. B. Atkinson
84/VI/32	N817	Flemish Cap redfish	D. B. Atkinson
84/VI/33	N818	Distribution, abundance and biomass of cod according to the data of assessment trawl survey on the Newfoundland Shelf in 1983.	A. Yu. Bulatova
84/VI/34	N819	Distribution and abundance of the young silver hake (*Merluccius billinearis*) from data of trawling surveys conducted on the Scotian Shelf in October-November 1978-1983.	A. S. Noskov A. I. Sherstyukov
84/VI/35	N820	Distribution of some groundfish species on the Scotian Shelf Slopes during the 1983 fishing season from data obtained by USSR observers.	V. A. Rikhter V. F. Turok
84/VI/36	N821	On fishing conditions and catching silver hake allocations on the Scotian Shelf southward of small mesh gear line.	V. A. Rikhter Yu. S. Gimkov
84/VI/37	N822	Roundnose grenadier-Greenland halibut ratio in bottom trawl catches taken in NAFO area in 1970-83.	A. K. Chumakov P. I. Savvatimsky
84/VI/38	N823	Assessment of stock size and allowable catch of silver hake (*Merluccius bilinearis*) on Scotian Shelf for 1985.	A. S. Noskov
84/VI/39	N824	An acoustic assessment of capelin stocks in NAFO Div. 3LNO and 2J+3K in 1983.	V. S. Mamylov V. S. Bakanev

SCR Documents (continued)

84/VI/40	N825	Trawl survey of capelin prerecruits in NAFO Divisions 3LNO in November 1983.	V. S. Bakanev A. A. Filin S. V. Chechenin
84/VI/41	N826	Assessment of groundfishes on the Flemish Cap by means of trawl surveys.	A. K. Chumakov V. Z. Salmov I. S. Shafran
84/VI/42	N827	The distribution of food energy for major commercial fisheries in the trophic chain of the Georges Bank ecosystem.	V. I. Vinogradov
84/VI/43	N828	Fat content in muscles, gonads and liver of silver hake, *Merluccius bilinearis* (Mitchill) and red hake, *Urophycis chuss* (Walbaum) caught on the shelf of southern New England (Hudson Canyon) in the end of winter.	V. I. Vinogradov
84/VI/44	N829	On correlation between total length and pre-anal length of roundnose grenadier (*Coryphaenoides rupestris*) in the North Atlantic.	P. I. Savvatimsky
84/VI/45	N830	On time and areas of spawning for *Notoscopelus elongatus kroeyeri*.	G. P. Mazhirina A. A. Filin
84/VI/46	N832	Maximum age of cod in Subareas 2 and 3 with comment on natural mortality-at-age	R. Wells
84/VI/47	N833	Status of the cod stock in NAFO Division 3M	R. Wells S. Gavaris
84/VI/48	N834	An assessment of American plaice in NAFO Divisions 3LNO	W. B. Brodie T. K. Pitt
84/VI/49	N835	Yellowtail flounder in Divisions 3LNO - an assessment update	W. B. Brodie T. K. Pitt
84/VI/50 (Revised)	N836	Calculation of partial selection for cod in Subdivision 3Ps.	S. Gavaris C. A. Bishop
84/VI/51	N838	Food of Atlantic Cod (*Gadus morhua* L.) near Bonavista, Newfoundland in 1983	G. R. Lilly
84/VI/52	N839	Assessment of the cod stock in NAFO Divisions 3NO.	C. A. Bishop S. Gavaris J. W. Baird
84/VI/53	N840	Assessment of the cod stock in Subdivisions 3Ps.	C. A. Bishop S. Gavaris J. W. Baird
84/VI/54	N841	The 1983 inshore capelin fishery in Div. 3L.	B. S. Nakashima
84/VI/55	N842	Some results of the 1983 capelin tagging experiments in Conception Bay, Newfoundland.	B. S. Nakashima
84/VI/56	N843	Capelin Acoustic Surveys in NAFO Divisions 3L and 3NO, 1983	D. S. Miller
84/VI/57	N845	Temperature-yield relationships for the Maine American lobster (*Homarus americanus*) fishery: a time series analysis approach	M. J. Fogarty
84/VI/58	N846	Why do fish populations vary?	M. P. Sissenwine
84/VI/59	N847	1983: an unusual year off West Greenland?	M. Stein E. Buch
84/VI/60	N849	The fishery for Greenland halibut in NAFO Subareas 0+1.	W. R. Bowering

SCR Documents (continued)

84/VI/61	N850	Distribution and relative abundance of the Labrador-eastern Newfoundland stock complex of Greenland halibut (*Reinhardtius hippoglossoides*).	W. R. Bowering
84/VI/62	N851	An assessment of the Greenland halibut (*Reinhardtius hippoglossoides*) stock complex in NAFO Subarea 2 and Division 3KL.	W. R. Bowering W. B. Brodie
84/VI/63	N852	Witch flounder in NAFO Division 3NO.	W. R. Bowering
84/VI/64	N853	Juvenile haddock abundance and water temperature on the Scotian Shelf in 1983.	J. S. Scott
84/VI/65	N854	Results of comparative experiments using 13.6 m and IGYPT trawls.	A. S. Noskov A. I. Sherstyukov
84/VI/66	N855	Environmental variability in the Northwest Atlantic.	R. H. Loucks R. W. Trites
84/VI/67	N856	Sea surface temperatures along the continental shelf, Hamilton Bank to Cape Hatteras.	R. W. Trites D. R. McLain M. C. Ingham
84/VI/68	N857	The 1983 fishery for short-finned squid (*Illex illecebrosus*) in the Newfoundland area.	H. J. Drew E. G. Dawe P. C. Peck
84/VI/69	N858	Update of the distribution, biomass, and length frequencies of *Illex illecebrosus* in Divisions 4VWX from Canadian research vessel surveys, 1970-1983.	T. W. Rowell J. H. Young
84/VI/70	N859	Overview of environmental conditions in the Northwest Atlantic in 1983.	R. W. Trites K. F. Drinkwater
84/VI/71	N860	Biological characteristics and biomass estimates of the squid (*Illex illecebrosus*) on the Scotian Shelf (Div. 4VWX) in late summer, 1983.	J. C. Poulard T. W. Rowell J. P. Robin
84/VI/72	N861	A framework for identifying fisheries management problems associated with the influence of environmental factors on the distribution, movements and migration of marine species.	A. T. Pinhorn R. G. Halliday
84/VI/73	N862	Assessment of the cod stock in Divisions 2J+3KL.	S. Gavaris C. A. Bishop J. W. Baird
84/VI/74	N863	Marine environmental data service report for 1983/84.	J. R. Keeley
84/VI/75	N864	Comparison of cod and haddock spawning in 1982 and 1983 on Georges Bank.	E. B. Cohen D. G. Mountain W. G. Smith
84/VI/76	N865	Survey of apex predators (sharks and swordfish) in the vicinity of a cold core Gulf Stream ring cruise results - R/V *Wieczno* Cruise 84-02.	J. G. Casey M. Pastuszak
84/VI/77	N866	Environmental extremes observed in 1983 *in-situ* wave recording and coastal tide gauge records within Canadian east coast waters.	J. Gagnon
84/VI/78	N867	Subarea 1 cod: fisheries and stock composition, 1983.	Sv. Aa. Horsted
84/VI/79	N868	Annual variability in the diet of Atlantic cod (*Gadus morhua* L.) off southern Labrador and northeast Newfoundland (Div. 2J+3K) in autumn, 1977-82.	G. R. Lilly
84/VI/80	N869	A preliminary compendium of Flemish Cap research cruises, 1977-1984.	S. A. Akenhead
84/VI/81	N870	Ocean climate at Station 27, report for 1983.	S. A. Akenhead

SCR Documents (continued)

84/VI/82	N871	Preliminary analysis of *Alfred Needler-Lady Hammond* comparative fishing experiments (silver hake, 1983).	P. Fanning
84/VI/83	N872	Catch rate variations in the French winter cod fishery.	A. Sinclair
84/VI/84	N874	Comparative morphology of pre-extrusion larvae of the sharp-beaked redfishes, *Sebastes mentella* and *S. fasciatus*.	R. Penney
84/VI/85	N875	Assessment of the Scotian Shelf silver hake population size in 1983.	D. E. Waldron C. Harris
84/VI/86	N876	Food and feeding of silver hake (*Merluccius bilinearis*) on the Scotian Shelf with special reference to cannibalism.	D. Clay L. Currie B. Swan
84/VI/87	N877	The Canada-USSR juvenile silver hake (*Merluccius bilinearis*) surveys on the Scotian Shelf: abundance indices, distribution, and comparison with independent estimates of juvenile abundance, 1978-83.	P. A. Koeller J. D. Neilson D. E. Waldron
84/VI/88	N878	Food of Atlantic cod (*Gadus morhua*) from southern Labrador and eastern Newfoundland (Div. 2J, 3K and 3L) in winter.	G. R. Lilly M. A. Almeida W. H. Lear
84/VI/89	N880	The development of a portable fish measuring station for electronic data acquisition in the field.	P. J. Rubec R. J. Planck
84/VI/90	N881	Growth of cod in Divisions 2J, 3K and 3L, 1971-83.	R. Wells
84/VI/91	N882	Survey results for cod in Division 2J as obtained by R/V *Anton Dohrn* in autumn of 1982 and 1983.	J. Messtorff
84/VI/92	N883	Stock size of cod at West Greenland by the beginning of 1984 and projections of yield and stock size 1984-87.	Sv. Aa. Horsted J. Møller Jensen J. Messtorff A. Schumacher
84/VI/93	N884	Subarea 1 cod: results of research vessel surveys conducted off West Greenland in 1982 and 1983.	J. Messtorff H. P. Cornus
84/VI/94	Not issued	Status of the cod stock in NAFO Division 3M.	M. Borges A. Vazquez R. Wells

B. SUMMARY (SCS) DOCUMENTS

SCS No.	Ser. No.	Title	Author(s)
84/I/1	N779	Provisional report of Scientific Council Special Meeting, January 1984. (+ Corrigenda)	NAFO
84/VI/2	N781	Report of joint NAFO/ICES Study Group on biological relationships of the West Greenland and Irminger Sea redfish stocks, Copenhagen, 21 February 1984. (ICES Doc. C.M. 1984/G:3)	NAFO/ICES
84/VI/3	N782	EEC request for scientific advice on management in 1985 of certain stocks in NAFO Subareas 0 and 1.	E. Gallagher
84/VI/4	N783	Canadian request for scientific advice on management in 1985 of certain stocks in Subareas 0 to 4.	L. S. Parsons
84/VI/5	N792	Tagging activities reported for the Northwest Atlantic in 1983 and additional information for earlier years.	NAFO Secretariat
84/VI/6	N800	Historical catches of selected species by stock area and country for the period 1973-82.	NAFO Secretariat

SCS Documents (continued)

84/VI/7	N801	Provisional sealing statistics for the Northwest Atlantic, 1983.	NAFO Secretariat
84/VI/8	N795	Summary of reported sampling data for 1982.	NAFO Secretariat
84/VI/9	N810	Report to the CWP on NAFO statistical program, data-processing and publications, 1982-84.	NAFO Secretariat
84/VI/10	N803	Spanish research report, 1983.	M. G. Larraneta
84/VI/11	N804	Solicited comments on proposal for second Ageing Workshop on shrimp.	NAFO Secretariat
84/VI/12	N805	Notes on statistical activities and related publications, 1983/84.	NAFO Secretariat
84/VI/13	N813	Report of *ad hoc* inter-agency consultation on Atlantic fishery statistics, 8-9 October 1983, Gothenburg, Sweden.	CWP Secretary
84/VI/14	N814	Portuguese research report, 1983.	M. L. Godinho
84/VI/15	N815	Canadian research report, 1983.	L. W. Coady J. S. Scott
84/VI/16	N831	Denmark (Greenland) research report for 1983.	E. Smidt
84/VI/17	N837	USSR investigations in the NAFO area in 1983.	A. K. Chumakov V. A. Borovkov
84/VI/18	N844	United States research report for 1983.	M. D. Grosslein E. D. Anderson
84/VI/19	N848	Japanese research report for 1983.	S. Kawahara
84/VI/20	N873	Provisional listing of papers expected to be presented at the Special Session on Squid, 5-7 September 1984.	T. W. Rowell
84/VI/21	N879	France research report for 1983.	J. C. Poulard
84/VI/22	N884	Provisional nominal catches in the Northwest Atlantic, 1983.	NAFO Secretariat
84/VI/23	N886	Provisional report of Scientific Council, 6-21 June 1984.	NAFO