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PREFACE

This fifth issue of *NAFO Scientific Council Reports* contains the approved reports of three meetings held during the calendar year 1984: (A) Scientific Meeting during 18-23 January 1984; (B) Scientific Meeting during 6-21 June 1984; and (C) Annual Meeting during 5-14 September 1984. Part D contains the agenda, list of recommendations and proposals, list of research and summary documents, and list of participants relevant to meetings of the Scientific Council and its Standing Committees during 1984.

The *NAFO Scientific Council Reports* series was initiated with the first issue in December 1980. It replaces *ICNAF Redbook* series which terminated with the last issue in 1979.

31 December 1984

V. M. Hodder
Assistant Executive Secretary

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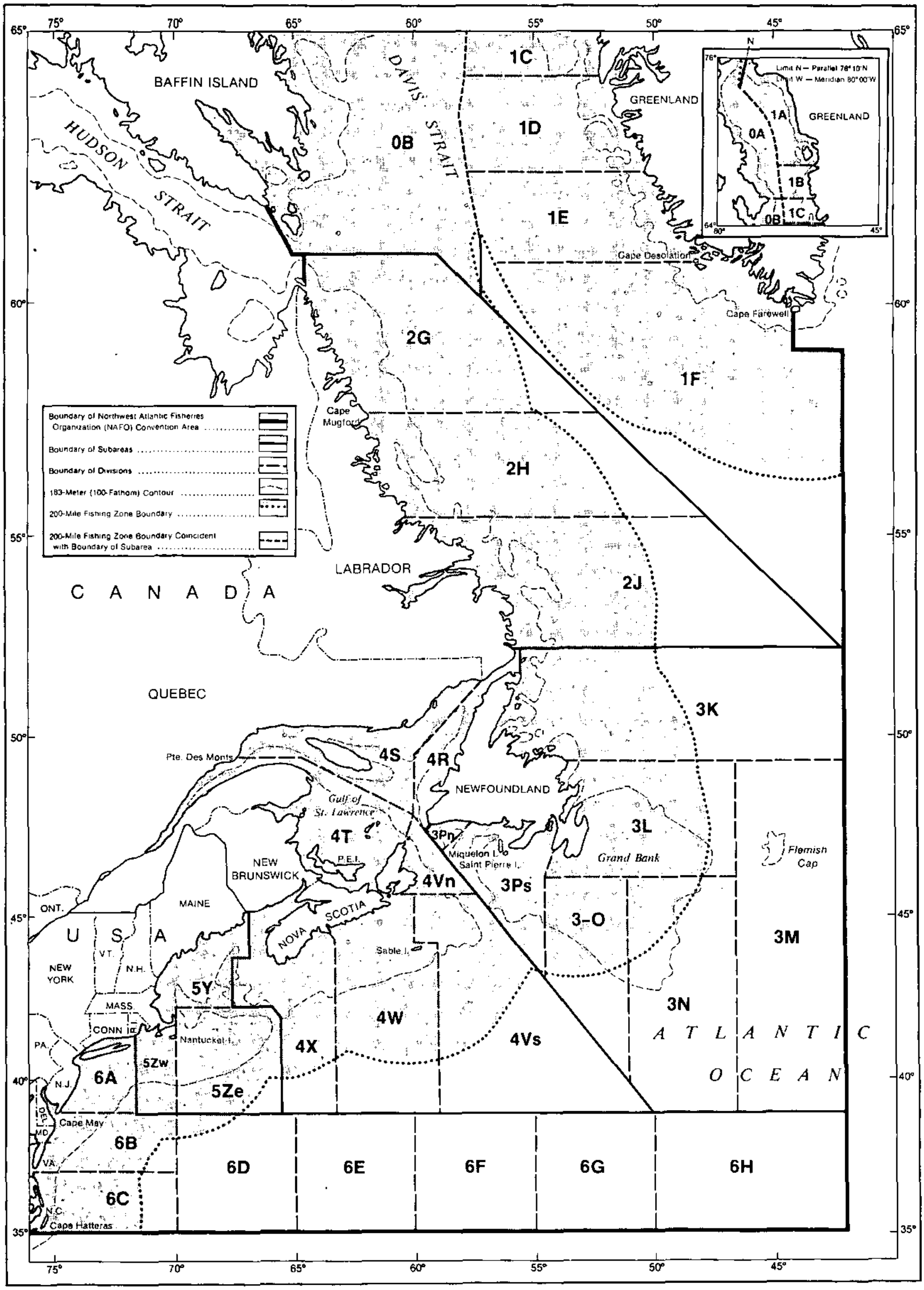

PART A

REPORT OF SCIENTIFIC COUNCIL

January 1984 Meeting

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REPORT OF SCIENTIFIC COUNCIL

January 1984 Meeting

Acting Chairman: J. E. Carscadden | Rapporteur: V. M. Hodder

The Council met at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 18-23 January 1984 to provide scientific advice for 1984 on management of the shrimp stocks in Subareas 0 and 1, as rquested by Canada and the European Economic Community (EEC). In addition, at the request of the EEC, a review of the status of the shrimp stock off East Greenland was included in the agenda for this meeting. Representatives attended from Canada, EEC (Denmark, France and the Commission of the European Communities), Iceland and Norway. In the absence of Dr. V. A. Rikhter, who communicated his regrets for not being able to attend this meeting, and Dr. J. Messtorff who was reported to be ill, it was unanimously agreed that this meeting of the Council be conducted by the Chairman of the Standing Committee on Fishery Science (Dr. J. E. Carscadden).

The stock assessments were undertaken by the Standing Committee on Fishery Science (STACFIS), whose report, as approved by the Council, is given in Appendix I. The agenda for the meeting, list of relevant documents, and list of participants are given in Part D (this volume). Brief summaries of the stock assessments and other matters considered by the Council are given below.

I. STOCK ASSESSMENTS

1. Assessment of Shrimp Stocks in Subareas 0 and 1

In 1979 and 1980, the offshore shrimp fishery in Subareas 0 and 1 was regulated by an overall total allowable catch (TAC) of 29,500 tons, the nominal catches being respectively 27,000 and 37,000 tons in these years. The same TAC was advised for 1981, 1982 and 1983 but allowable catches totalling 35,000, 34,800 and 34,625 tons respectively were set by the coastal states involved. Provisional statistics for 1983 indicate an offshore catch of about 38,000 tons (Table 1). Because of ice conditions in the first 4 months of the year, the winter and spring fishery in 1983 was severely reduced, but, during the last half of the year, the main fishery occurred on the northern and western parts of the Store Hellefiske Bank in Div. 0A and 1B. This fishing pattern was similar to the fishing pattern in 1982 but different from 1980 and 1981 when a northward shift in the fishery occurred.

Table 1. Total catches (metric tons) of shrimp in Subarea 0 and the offshore part of Subarea 1 in 1974-83, with the corresponding TACs for 1977-83.

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Catch	11,945	29,190	42,766	34,300	26,869	27,087	36,652	37,300	37,527[1]	38,259[1]
Advised TAC	-	-	-	36,000	40,000	29,500	29,500	29,500	29,500	29,500
Effective TAC	-	-	-	36,000	40,000	29,500	29,500	35,000[2]	34,800[2]	34,625[2]

[1] Provisional data.
[2] Includes TAC of 5,000 tons in Subarea 0.

All available biological information on length distribution and sexual components and all data on trends in catch rates and biomass estimates were considered in advising on management of the fishery in 1984. It was noted that, after the decline in abundance observed during 1976-78, there has been a general upward trend in overall catch rates from 1979 to 1983. However, catch rates in recent years may be biased upward due to increased efficiency of gear and the effects of ice conditions. Although the effects of these factors cannot be estimated, it is quite possible that they could account for the observed increase and the stock may not have increased over the period. The incidence of small shrimp in research and commercial length frequencies and the photographic samples showed a decrease from 1982 and from the high numbers observed in 1981.

Although the fishable stock may have remained stable since 1979, the Council noted the likely poor recruitment in 1984, and therefore advises that the overall TAC for the offshore grounds in Subarea 1 and adjacent parts of Subarea 0 in 1984 should not exceed the level advised in previous years (26,500 tons).

In order to improve the basis for assessing the stock in Subareas 0 and 1, the Council endorsed the recommendations of STACFIS regarding further research requirements.

2. Assessment of Shrimp Stock in Denmark Strait

The shrimp fishery in this area expanded rapidly from 1977 to 1980. The total catch on both sides of the midline between Greenland and Iceland was 8,300 tons in 1980 (Table 2) and declined sharply to 4,800 tons in 1981, when the fishery was regulated by a TAC of 8,000 tons set by the EEC for the area west of the midline. A TAC of 4,500 tons was set by the EEC for 1982, based on the advice of the Scientific Council from its November 1981 Meeting (NAFO Sci. Coun. Rep., 1981, page 110). Provisional statistics indicate a nominal catch of about 4,100 tons in 1983. The fishery took place in the area of Strede and Dohrn Banks as in earlier years, but like 1982, the area was more restricted than in 1980 and 1981. The available data indicated that the catch rates of Norwegian and Greenland vessels, which took the bulk of the catch, were similar in 1982 and 1983 but lower than the 1980 and 1981 levels. However, due to the effect of ice on the distribution of the fishery in both 1982 and 1983 and incomplete data for 1983, it was not possible to reach a conclusion on the reasons for the trends observed in catch rates in recent years.

Table 2. Nominal catches (metric tons) of shrimp in Denmark Strait for 1978-83, with corresponding TACs for 1981-83.

	1978	1979	1980	1981	1982	1983
Catch	363	1,285	8,260	4,792	4,902	4,129[1]
Advised TAC	-	-	-	-	4,200	4,200
Effective TAC[2]	-	-	-	8,000	4,500	5,725

[1] Provisional data.
[2] On western side of midline.

Catches were again composed of larger shrimp with no shrimp less than 19-20 mm in the 1983 length frequencies. This observation supports the earlier conclusion that young shrimp are not present on the fishing grounds, and, if the stock is self-sustaining, they likely inhabit areas farther north.

Although it was noted that STACFIS could not reach firm conclusions about the catch rates in recent years, the Council urges that a cautious approach to exploitation be maintained because little is known of the recruitment to this stock, and because this stock lives under extreme environmental conditions and may be very sensitive to over-exploitation. The Council therefore advises that the overall TAC for 1984 should not exceed the previously advised level of 4,200 tons.

In order to improve the basis for assessing the stock in Denmark Strait the Council endorsed the recommendations of STACFIS regarding future research requirements.

II. FUTURE SCIENTIFIC MEETINGS

1. Scientific Council Meeting, June 1984

The Council confirmed that its next meeting will take place at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 6-21 June 1984, to deal with its regular business, involving the work of the three standing committees (STACFIS, STACREC and STACPUB) and associated subcommittees and working groups.

2. Annual Meeting, September 1984

The Council noted that this meeting was scheduled for 5-14 September 1984, with 3 days (5-7 September) being allocated for the Special Session on "Biology and Ecology of the Squids, *Illex illecebrosus* and *Loligo pealei*, in the Northwest Atlantic".

III. OTHER BUSINESS

1. Future Meeting to Assess the Shrimp Stocks

At the September 1983 Meeting, the Council requested STACFIS to consider the invitation by the EEC representative that the next meeting to assess the shrimp stocks be held at Copenhagen in late November 1984. The Council noted the concern of STACFIS that certain data collected in 1984 could not be adequately analyzed in time for a meeting in November 1984 and that commercial fishery data for the latter part of 1984 would not be available at that time, and therefore concurs with the view of STACFIS that a meeting to provide scientific advice for the management of the shrimp stocks in 1985 should not be held prior to January 1985.

2. Shrimp Ageing Workshop

The Council endorsed the recommendation of STACFIS regarding the possible need for another Shrimp Ageing Workshop.

IV. ADJOURNMENT

The Acting Chairman expressed his thanks to the participants for their cooperation and support during the course of the meeting and acknowledged the indispensible assistance of the NAFO Secretariat in organizing and servicing the meeting. The participants expressed their appreciation to Dr. J. E. Carscadden who agreed to conduct the meeting in the absence of the Chairman and Vice-Chairman.

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 18-23 January 1984 to review the status of the shrimp stock in Subareas 0 and 1, as referred to it by the Scientific Council, based on the requests of Canada and the European Economic Community (EEC) (see Part D, this volume). In addition, as requested by the EEC, the Committee reviewed the status of the shrimp stock in Denmark Strait. Scientists attended from Canada, EEC (Denmark, France, and the Commission of the European Communities), Iceland and Norway. The results of the assessments are given in Sections I and II below.

I. ASSESSMENT OF SHRIMP STOCK IN DAVIS STRAIT (SUBAREAS 0 AND 1)

1. Introduction (SCR Doc. 84/I/2, 3, 4, 6, 9)

The nominal catch of shrimp in Subareas 0 and 1 (inshore and offshore) increased from less than 10,000 tons prior to 1973 to 50,000 in 1976, decreased to about 35,000 tons in 1978 and 1979 and increased to a level of 46,000 tons in 1981 and 1982 (Table 1). Preliminary statistics for 1983 indicate a total catch of about 46,000 tons in Subareas 0 and 1, of which 38,000 tons were taken on the offshore grounds. The inshore fishery at West Greenland has been relatively stable at 7,000-8,000 tons since 1972 (except 10,000 tons in 1974).

The offshore shrimp fishery has been regulated by TAC (total allowable catch) since 1977. In 1977 and 1978, the total offshore catches in the Davis Strait region were about 34,000 and 27,000 tons compared with TACs of 36,000 and 40,000 tons respectively. In 1979 and 1980, the offshore fishery was regulated by a TAC of 29,500 tons, with the nominal catch being 27,000 and 37,000 tons respectively.

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

Area	Country	1975	1976	1977	1978	1979	1980	1981	1982[2]	1983[2]
SA 0	Canada	-	-	-	-	-	59	1,590	859	1,938
	Denmark	-	-	68	86	67	-	1,923	946	1,365
	Faroes	-	-	239	-	115	-	1,686	700	680
	France	-	-	-	21	7	-	-	-	-
	Greenland	-	-	-	-	149	815	85	8	-
	Norway	-	65	150	15	791	-	-	-	-
	Spain	-	327	-	-	-	-	-	-	-
	Total	-	392	457	122	1,129	874	5,284	2,513	3,983
SA 1	Canada	-	-	-	-	245	590	-	-	-
	Denmark	1,142	2,717	5,842	3,382	1,327	872	995	959	401
	Faroes	5,300	11,179	12,612	8,070	6,867	3,554	1,234	529	475
	France	-	803	924	805	353	247	535	672	416
	F. R. Germany	-	-	31	-	-	-	-	-	-
	Greenland (a)[3,4]	8,700	7,300	7,800	7,600	7,500	7,500	7,500	7,500	7,500
	Greenland (b)[3]	1,089	2,478	7,081	5,531	12,527	27,501	28,197	32,016	32,500
	Japan	-	146	-	-	-	-	-	-	-
	Norway	8,678	11,658	7,353	8,959	4,639	3,014	1,055	838	484
	Spain	6,948	6,925	-	-	-	-	-	-	-
	USSR	6,033	6,468	-	-	-	-	-	-	-
	Total	37,890	49,674	41,643	34,347	33,458	43,278	39,516	42,514	41,776
	Offshore	29,190	42,374	33,843	26,747	25,958	35,778	32,016	35,014	34,276
SA 0+1 offshore catch		29,190	42,766	34,300	26,869	27,087	36,652	37,300	37,527	38,259
SA 0+1 advised TAC		-	-	36,000	40,000	29,500	29,500	29,500	29,500	29,500
SA 0+1 effective TAC		-	-	36,000	40,000	29,500	29,500	35,000[5]	34,800[5]	34,625[5]

1 Data for 1975-78 pertain to ICNAF Subareas 0 and 1, and subsequently to the new NAFO Subareas 0 and 1.
2 Provisional data.
3 a = inshore, b = offshore catches.
4 Estimated catches.
5 Includes TAC of 5,000 tons in Subarea 0.

Since 1981, Canada and EEC have set separate TACs for Subaras 0 and 1 respectively. The TAC for Subarea 0 has been 5,000 tons for the last three years, whereas the TAC in Subarea 1 was 30,000 tons in 1981, 29,800 tons in 1982 and 29,625 tons in 1983. For the same period, the Scientific Council advised that the TAC for Subarea 1 and adjacent areas of Subarea 0 should remain at the same level advised for the two preceding years (29,500).

The fishery in 1983 was severely hampered by ice conditions in the first 4 months of the year. From May to October, Greenland vessels fished mainly west and north of Store Hellefiske Bank (Div. 1B) as in 1982. The distribution of fishing effort by Greenland vessels in 1983, as in 1982, did not exhibit the northward shift that was evident in 1980 and 1981. The severe ice conditions in the spring of 1982 and 1983 thus caused delayed achievement of the allowable catch and a change in the distributional pattern of the fishery compared to the situation in the years preceding 1982. The special management area off Disko Bay was fished more heavily and for a longer period in 1982 and 1983 than in earlier years. Danish, Faroese, French and Norwegian vessels also fished in Subarea 1 in 1983, but the effort was generally lower than in 1982. As in 1982, Canadian vessels fished mainly between 58°W and 59°W longitude and 67°N and 68°N latitude in Div. 0A. The Norwegian vessels had some effort in Div. 1D, but most of their fishing activity occurred in Div. 1B. There was no information available on the distribution of fishing effort by the other countries.

In Subarea 1, a total of 48 vessels (>80 GRT) participated in the fishery in 1983 compared to 56 in 1982. In Subarea 0, a total of 9 vessels participated in 1983 compared to 8 in 1982.

2. Input Data

a) Fishing effort and CPUE (SCR Doc. 84/I/2, 3, 9)

Catch and effort information available for the shrimp fishery in 1983 included Canadian data based on logbook records and observer reports for Subarea 0, Norwegian data based on logbook records and Greenland data based on logbook records and corresponding landings for Subarea 1.

Canadian data sources showed a decrease in catch rates for the period July-September from 1982 to 1983 of about 19%. Norwegian data from Div. 1B showed no significant change in CPUE figures for the same period between 1982 and 1983. Data for Greenland trawlers (630-722 GRT) showed a declining trend in catch rates throughout the fishing season in Div. 1B in 1983 as in 1982. Because of ice conditions, no fishing occurred from mid-January until late April. Catch rates peaked in April and declined steadily through to and including September. Compared to 1982, catch rates were higher in June and July and lower in the other months (SCR Doc. 84/I/9).

Indices of mean catch rates in the July-September period 1976-83 for the different national fisheries in Div. 1B (standardized to 1976) and for the Canadian fishery in Div. 0A (standardized to the average of the other indices in 1980) are given in Table 2. In general, all indices decline by about the same proportion from 1976-1979 and fluctuate similarly between 1980-1983, except for the abnormally high 1981 figures for the French fishery (no CPUE-index is available from France for 1983) and the stabilization of the Norwegian index between 1982 and 1983; for both countries, however, the indices are derived from relatively small catches.

Table 2. CPUE indices for Greenland, Norwegian and French fisheries for shrimp in Div. 1B and the Canadian fishery in Div. 0A, 1976-83.

	Div.	1976	1977	1978	1979	1980	1981	1982	1983
Greenland	1B	1.00	0.74	0.67	0.51	0.63	0.59	0.74	0.66
Norway	1B	1.00	0.84	0.60	0.47	0.60	0.43	0.57	0.56
France[1]	1B	1.00	1.13	0.61	0.48	0.58	0.80	0.60	-
Canada[2]	0A					0.60	0.66	0.78	0.63

[1] July only.
[2] Div. 0A (1980 is average of the other 3 indices).

The influence of the introduction by some countries of more efficient gears in the shrimp fishery around 1980 on CPUE indices was discussed, but no information on the relative use of different types of gears was available. Also, the late opening of the fishery in 1982 and 1983 due to ice resulted in a reduction of fishing pressure on heavy concentrations of berried females. This might have resulted in higher than normal abundance later in the season after the shrimp were more dispersed. Therefore, it was agreed that CPUE indices for July-September 1982 and 1983 might have been biased upwards. It is not possible to quantify either of these factors.

b) Biology (SCR Doc. 84/I/2, 3, 4, 9)

Shrimp samples from Canadian research and commercial activities in Subareas 0 and 1 from 1978 to 1981 were analyzed for sex and maturity, age interpretation and natural mortality (SCR Doc. 84/I/4). The data showed that generally less than 5% of transitional and female shrimp in the area sampled failed to spawn in a given year and that females spawning for the first time appeared to lay their eggs earlier in the year. Five age-groups of juvenile and male shrimp were interpreted from the data. A conversion of carapace length-at-age to total length enabled an estimation of natural mortality using an equation relating M to L_∞, K and an average environmental temperature. It was recognized that the number of samples was limited and that a closer examination of a more extensive database must be undertaken before these estimates could be verified.

Length frequencies from the Canadian (SCR Doc. 84/I/3) and Norwegian (SCR Doc. 84/I/2) fisheries and from Greenland research samples (SCR Doc. 84/I/9) indicated a continued decrease in the abundance of small shrimp in Div. 0A and 1B from levels observed in 1981.

Proportions of ovigerous females in Canadian commercial samples from October and November (SCR Doc. 84/I/3, p. 14) indicated that most females had spawned. However, Greenland maturity data from areas farther north in Div. 1A showed a high proportion of non-maturing females (SCR Doc. 84/I/9), similar to an observation from the French fishery in July-September 1982 (NAFO Sci. Coun. Rep., 1983, page 10). Other Greenland samples (SCR Doc. 84/I/9) from Div. 1B were consistent with the Canadian observations.

c) Photographic survey (SCR Doc. 84/I/6)

A bottom photographic survey was carried out in the area from 66°N to 71°N covering depths of 100-600 m, and the sampled data were incorporated into a shrimp distribution model to derive estimates of biomass in the area from 66°00'N to 69°30'N for the 1978-1983 period. The general good agreement with the July-September CPUE figures over the sampling period, which was noted in earlier reports, was no longer observed.

A new version of the model taking into account hydrographic observations reflected a biomass trend similar to that of the catch rates. However, this model utilizes only data from the last 3 years. The Committee noted that, although some improvement of the model has been achieved, the variances associated with the photographic model still are not known and that caution should be maintained about fully accepting the results.

The proportion of small shrimp in the photographic samples indicated a decline in relative abundance from the high level observed in 1981.

d) Discarding of shrimp (SCR Doc. 84/I/2, 3)

The discarding of shrimp in Div. 0A during 1983 was similar to observations in the previous 2 years (below 5% of total shrimp catch in most months). However, discards varied among vessels, due to different discarding practices, and also during the year, possibly in response to changing catch rates. Size distributions of discarded shrimp showed unimodality at 20-23 mm carapace length and, compared to previous years, there were very low numbers of shrimp less than 19 mm in the total catch.

Observations in Div. 1B on one Norwegian trawler indicated much higher discard rates in June and July 1983 than in previous years, ranging from 10 to 40% of the shrimp catch, with a mean of 20%. The highest discard rates were observed in shallow water. Norwegian discards showed lower incidence of small shrimp of the modal length group at 17.5 mm than found in 1982. It was noted that the level of discarding may vary from vessel to vessel depending on the type of processing on board.

e) By-catches in the shrimp fishery (SCR Doc. 84/I/2, 3, 9)

Generally, by-catches in the shrimp fishery do not appear to be a problem for the fisheries in Subareas 0 and 1. Logbook records from eight Greenland trawlers showed by-catches at the same very low levels in 1983 (0.8% by weight of the total shrimp catch) as in the previous 2 years, a sharp decline from the highest by-catch rate (23.1%) in 1978. In 1983, the only reported species in the by-catch was redfish.

By-catches in the Canadian shrimp fishery in Div. 0A, were, as in previous years, dominated by redfish. However, in 1983, the redfish by-catch never exceeded 4% of the total catch weight in any month. Redfish (<15 cm) also dominated in the Norwegian by-catch, but the by-catch rate was at the same low level as 1982.

3. Conclusions and Management Advice

Catch rates from Canadian and Greenland fisheries in Div. 0A and 1B respectively for the July to September period decreased from 1982 to 1983. It is likely that the high abundance of small shrimp (<20 mm) observed in 1981 was mostly recruited in 1982 and that 1983 recruitment depended more than previously anticipated on the relatively lower abundance of small shrimp observed in the photographic samples and from research and commercial length frequencies in 1982 (NAFO Sci. Coun. Rep., 1983, page 12). Although the CPUE indices suggest that the stock has shown an increasing trend since 1979, these indices may be biased upwards in recent years because of the possible influences of improved trawl design since 1980 and ice conditions in 1982 and 1983. Although the effects of these factors cannot be estimated, it is quite possible that they could account for the observed increase, and the stock indeed may not have increased over the period (Fig. 1).

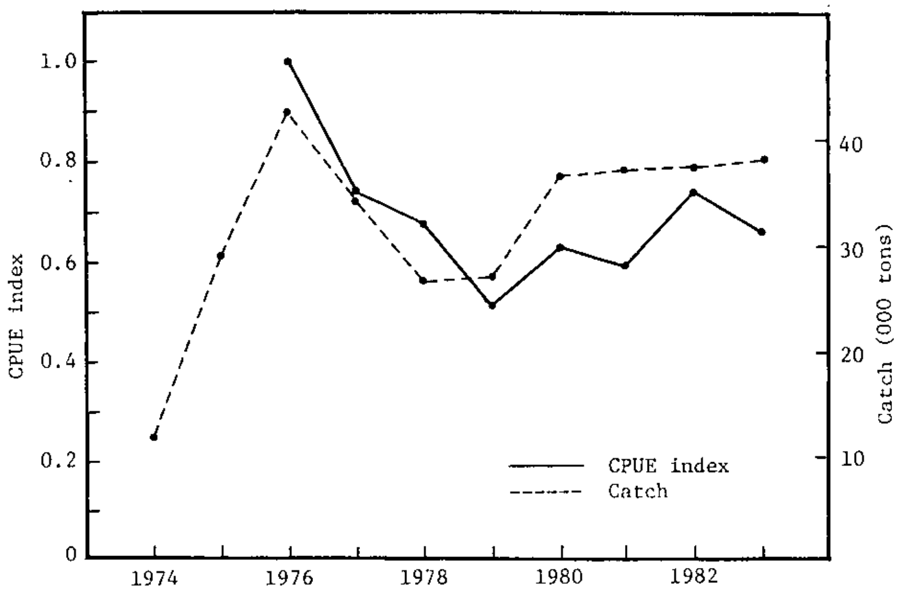

Fig. 1. Indices for mean CPUE for the period July-September, 1976-83 in Div. 1B compared to total offshore catches in Subareas 0 and 1. (Mean catch rates are based on logbook information for seven trawlers (630-722 GRT) of the Royal Greenland Trade Department. Offshore catch in 1983 is provisional.)

Recruitment to the fishery in 1984 may be poor, as evidenced by a continued decrease in the incidence of small shrimp in the commercial and research length frequencies and in the photographic samples, relative to the higher numbers observed in 1981. Thus, catch rates in 1984 may be expected to decline further from the 1982 level as the fishery becomes increasingly dependent on the older age-groups.

Although the fishable stock appears to have remained stable since 1979, concern was expressed over the likelihood of reduced recruitment and a reduction in the spawning stock in 1984. However, STACFIS could not quantify the expected reduction in the spawning stock and therefore advises that the overall 1984 TAC for the offshore grounds in Subarea 1 and the adjacent parts of Subarea 0 should not exceed the level advised for 1979-83 (29,500 tons). The Committee also noted that allowing catches to exceed the advised TAC (as has occurred since 1980) would add further pressure on the spawning stock in 1984 which in turn may adversely affect recruitment in subsequent years.

STACFIS also agreed that the practice of allowing only a small portion of the TAC for the offshore grounds in Subarea 1 to be taken in the area from 68°00'N to 69°30'N, as a potential protective measure for recruitment to the inshore stock in Disko Bay, should be continued.

4. Future Research Requirements

In response to the recommendations from the January 1983 Meeting (NAFO Sci. Coun. Rep., 1983, page 13), a number of projects were initiated to improve the knowledge of the biology of shrimp in Subareas 0 and 1. Canadian and Danish scientists initiated a study of a time series of biological data from the Greenland fishery which included observations on reproductive success. The mathematical model for the photographic survey was revised and a redefinition of the size categories of shrimp observed in the photographs was begun. The observer programs were continued in 1983, providing length frequencies, biological samples and estimates of by-catches and discards. It was generally agreed that more improvements could be made, and STACFIS therefore

recommends

i) *that stratified-random trawl surveys be conducted on a seasonal basis for a number of years to determine seasonal changes in distribution and abundance;*

ii) *that the annual photographic survey be continued along with efforts to improve the model and to redefine size categories;*

iii) *that the observer program be continued;*

iv) *that the reporting of discards should be closely monitored to ensure reliability and consistency with observer reports;*

v) *that countries participating in the shrimp fishery continue efforts to ensure that fishing vessel logbooks are completed and copies made available to scientists as soon as possible; and*

vi) *that a study be undertaken to determine the relative efficiency of gear types used in the Davis Strait shrimp fishery in recent years, in an attempt to quantify the effects of recent changes in gear on CPUE indices.*

II. ASSESSMENT OF SHRIMP STOCK IN DENMARK STRAIT (ICES Div. XIVb and Va)

1. Introduction (SCR Doc. 84/I/1, 5, 7, 8)

The shrimp fishery in this area (Table 3) was begun in 1978 by an Icelandic vessel on the eastern side of the midline between Greenland and Iceland. Nominal catches increased to 1,300 tons in 1979 when Norwegian trawlers participated in the fishery and exceeded 8,200 tons in 1980 with the additional involvement of Danish, Faroese, French and Greenland vessels. In 1981, the total catch from both sides of the midline declined to 4,800 tons, well below the level of 8,000 tons aimed at for regulation of the fishery in the area west of the midline. In 1982, the fishery was regulated by a TAC of 4,500 tons set by the EEC for the western side of the midline, whereas the Scientific Council advised an overall TAC of 4,200 tons. The reported catches in 1982 totalled 4,900 tons. In 1983, the EEC set a TAC of 5,725 tons whereas the Scientific Council advised an overall TAC of 4,200 tons (as in 1982). Provisional data indicate a catch of 4,100 tons in 1983.

Table 3. Nominal catches (metric tons) of shrimp (*Pandalus borealis*) reported from Denmark Strait, 1978-83.

Country	1978	1979	1980	1981	1982[1]	1983[1]
Denmark	-	-	702	581	740	204
Faroes	-	-	4,233	713	737	443
France	-	-	50	353	414	273
Greenland	-	-	200	1,004	1,115	1,467
Iceland	363	485	614	125	-	15
Norway	-	800	2,461	2,016	1,896	1,727
Total	363	1,285	8,260	4,792	4,902	4,129
Advised TAC	-	-	-	-	4,200	4,200
Effective TAC[2]	-	-	-	8,000	4,500	5,725

[1] Provisional data.
[2] On the western side of the midline.

The shrimp fishery in Denmark Strait in 1983 took place in the area of Strede and Dohrn Banks as in earlier years, and, like 1982, the area was more restricted than in 1981 and especially 1980. Ice conditions early in the fishing season were variable and affected the distribution of fishing. During April and May, the Norwegian fishery was conducted south of 66°N and, due to ice conditions, most of the vessels left the fishing grounds in early May. However, during the summer and autumn, some Norwegian vessels returned to the fishing grounds. In April and early May, French vessels fished south of 66°N from 30°00' to 31°30'W because of ice further north. At the end of May and beginning of June, the fishery moved northward between 66° and 67°N. Because of incomplete data, the influence of environmental conditions and distribution of shrimp on the activity of Greenland vessels were not known. However, the limited information indicated that fishing occurred between 65°N and 67°N during March and April, with the bulk of the catch coming from south of 66°N. Because of good fishing in the Icelandic coastal area and unfavourable weather and ice conditions offshore, there was very little fishing by Icelandic vessels on the eastern side of the midline in 1983.

Except for one vessel fishing in Janaury, the overall fishing period in 1983 extended from March to November. The main fishing period occurred from March to June. Forty-one vessels (excluding Icelandic vessels) participated in the fishery in 1983, compared with forty-two in 1982.

2. Input Data

a) Fishing effort and CPUE (SCR Doc. 84/I/1, 5, 7, 8)

Monthly catch rates and corresponding fishing effort, based on logbook data for the Danish, French, Greenland, Icelandic and Norwegian fisheries in 1980-83 are listed in Table 4. In 1980 and 1981, catch rates were highest during March-April, whereas in 1982 catch rates were highest in May. In 1983, the highest catch rates were from the Greenland fishery in March (except for the Icelandic estimate in October based on very low effort). Ice conditions differed considerably from month to month, making the evaluation of CPUE data difficult. This difficulty was compounded by incomplete data on catch location and fishing effort for a substantial portion of the fleet. The CPUE data from the French vessels showed a decline in April from 1981 to 1983 but were similar for May and June over the same period. However, French vessels accounted for less than 8% of the catch in those years. The Greenland and Norwegian vessels exhibited catch rates which were similar in 1982 and 1983 but lower than the 1980 and 1981 levels. However, due to the effect of ice on distribution of the fishery both in 1982 and 1983 and the incomplete data for 1983, it was not possible to reach a conclusion on the reasons for the trends observed in catch rates in recent years.

Table 4. Monthly catch rates (kg per hour trawling) and corresponding effort (hours trawling) from the logbooks available from the shrimp fishery off East Greenland, 1980-83.

		Denmark and Greenland		France		Iceland[1]		Norway	
Year	Month	CPUE	Effort	CPUE	Effort	CPUE	Effort	CPUE	Effort
1980	Mar	-	-	-	-	-	-	904	398
	Apr	672	35	-	-	-	-	704	793
	May	392	1,295	-	-	125	1,425	378	1,071
	Jun	139	315	-	-	90	1,478	98	714
	Jul	71	60	62	40	104	1,176	-	-
	Aug	17	32	-	-	123	851	95	874
	Sep	181	482	-	-	96	806	145	2,883
	Oct	107	1,165	-	-	-	-	99	3,071
	Nov	145	465	-	-	-	-	160	1,181
1981	Mar	-	-	-	-	-	-	364	137
	Apr	486	1,343	433	157	-	-	296	3,848
	May	263	914	261	522	-	-	161	4,057
	Jun	123	6	144	257	99	...[2]	119	1,101
	Jul	-	-	-	-	78	...[2]	-	-
	Aug	-	-	-	-	39	...[2]	42	167
	Sep	-	-	-	-	-	-	46	65
1982	Mar	160	763	-	-	-	-	197	1,548
	Apr	195	1,570	216	331	-	-	171	4,450
	May	280	1,394	264	563	-	-	248	3,339
	Jun	-	-	185	238	-	-	-	-
1983	Mar	345	484	-	-	-	-	-	-
	Apr	160	457	165	248	-	-	128	2,734
	May	-	-	254	245	50	2	255	1,439
	Jun	-	-	162	206	99	48	143	1,797
	Jul	-	-	-	-	-	-	133	45
	Aug	-	-	-	-	-	-	98	622
	Sep	-	-	-	-	-	-	-	-
	Oct	-	-	-	-	400	5	-	-
	Nov	-	-	-	-	135	59	-	-

[1] Data from Iceland side of midline; data from other countries from the Greenland side of the midline.

[2] Monthly data not available; total effort was 1,480 hours.

b) Biology (SCR Doc. 84/I/1, 5, 7, 8)

Data on the biology of the shrimp stock in Denmark Strait were available from Norwegian, Greenland and French trawlers in 1983 and from Icelandic fishery data for 1976-83. The length frequencies from all sources showed that most shrimp in the sampled catches ranged in size from 26 to 32 mm. Modal lengths were 29 mm from the Greenland and Norwegian data and 28 mm from the French data, while the Icelandic samples showed a dominant mode at 30 mm in August and 29 mm in October. Very few shrimp less than 26 mm were observed in both the Greenland and Norwegian samples, but the French and especially Icelandic (August) samples showed significant numbers of smaller shrimp between 20 and 26 mm.

The French and Icelandic samples also showed that males ranged in size from 20 to 28 mm and transitionals and females from 25 to 35 mm. These size ranges are similar to those observed in the French and Greenland data of the previous year (NAFO Sci. Coun. Rep., 1983, page 14). The Greenland samples were collected in April from the southern part of the fishing area and contained only females and transitionals. The French data indicated that hatching took place between mid-May and mid-June and that higher proportions of ovigerous females were found on the southernmost part of the fishing area. The Icelandic data showed that most females (60%) were ovigerous in August. It is likely that most of the females without eggs in August would spawn later in the season, but, as observed in the French (SCR Doc. 84/I/7) and Greenland (SCR Doc. 84/I/5) data, a small proportion of females do not reproduce in a given year.

As in the previous two years, small shrimp less than 19-20 mm were absent in all of the 1983 length frequencies. This supports the conclusion that young shrimp are not present on the fishing grounds, and, if the stock is self-sustaining, they likely inhabit areas farther north.

The Icelandic length distributions for August 1979 to 1983 were averaged and deviations from the average by length group for each year interpreted for growth (SCR Doc. 84/I/8). The authors concluded that the depletion of large shrimp due to the fishing is reflected in negative deviations for shrimp greater than 32 mm from 1981 to 1983, compared to positive deviations prior to 1981, and that growth of shrimp between 26 and 34 mm could be as low as 1.0 to 1.5 mm per year.

c) Discarding of shrimp (SCR Doc. 84/I/1)

Data on discarding of shrimp in Denmark Strait were available only for one Norwegian vessel. Because of the large size of the shrimp, only damaged individuals were discarded. Discarding was 0.8% (by weight) of the total catch in 1983 compared to 11.5% in 1981 and 3.7% in 1982.

d) By-catches in the shrimp fishery (SCR Doc. 84/I/1, 5, 7)

Data on by-catches of fish in the shrimp fishery were reported for French, Greenland and Norwegian vessels. The total by-catch of fish taken in the shrimp fishery by French vessels was composed mainly of redfish and capelin, although some cod was also caught. The by-catch by Greenland vessels was 2.0% by weight and consisted mainly of redfish. In the Norwegian shrimp fishery, small redfish dominated the by-catches. The mean number of cod per haul decreased from 23 in 1982 to 3 in 1983. The mean number of fish per kg of shrimp caught in the Norwegian fishery remained about the same in 1983 as in 1982 (0.18 to 0.16 respectively).

3. Conclusions and Management Advice

No estimates of the biomass of the stock in Denmark Strait were available, but the Committee noted the following points: (i) catch rates in two of the series (Greenland and Norway) were lower in 1982 and 1983 than in 1980 and 1981; while those for the French fishery were approximately the same in two of the three months of 1983 as in previous years, but it was not possible to reach a conclusion on the reasons for these recent trends; (ii) at least 5 years of growth are necessary from the larval stage to the spawning female, and the effects of fishing on future recruitment are not yet measurable; and (iii) the stock may be living under extreme and unstable environmental conditions.

Concern was expressed that this stock may be very sensitive to overexploitation, but there are insufficient new data on which to revise previous advice. STACFIS therefore advises that the overall TAC for 1984 should not exceed the advised level for 1983 (4,200 tons).

4. Future Research Requirements

More information on some biological characteristics of shrimp in Denmark Strait was contained in the Greenland, Norwegian, French and Icelandic data, but its usefulness in assessing the stock was limited by the lack of information on a year-round basis. No other data were available on the environmental and biological questions outlined at the January 1983 Meeting (NAFO Sci. Coun. Rep., 1983, page 16). STACFIS reiterates the concerns of the previous two meetings, and therefore recommends

i) that catch-rate data and biological samples from this stock in its whole area of distribution on a year-round basis be obtained;

ii) that plankton surveys be carried out to observe the drift of shrimp larvae;

iii) that a tagging experiment be carried out to determine the migration patterns of various size groups of shrimp;

iv) that a study on environmental conditions be undertaken, including the circulation of currents in the area; and

v) that the Icelandic samples collected from 1976 to 1983 be analyzed in greater detail to determine seasonal changes in maturity.

III. OTHER MATTERS

1. Mid-term Meeting for Assessment of Shrimp Stocks

At the September 1983 Meeting, the Scientific Council requested STACFIS to advise on the appropriate timing of a meeting to provide advice on both the Davis Strait and Denmark Strait stocks for 1985 (NAFO Sci. Coun. Rep., 1983, page 119). Scientists from Canada, Denmark, France and Norway indicated, at the present meeting of STACFIS, that the most appropriate time would not be earlier than January 1985. Based on past experience, sufficient information from the 1984 commercial fishery (such as vessel logbooks and catch composition data) will not be available to scientists before January 1985 and some research data (i.e. the photographic survey) cannot be completely analyzed before January. The catch-per-unit-effort data derived from the logbooks have been considered the most reliable indicator of stock status in the past, and the results of the photographic survey have provided biomass estimates. The information derived from commercial and research length frequencies is used as an indicator of recruitment to the fishable stock. A meeting held in late November 1984 would have data mainly from the 1983 commercial fishery and research survey. The size groups which supported the 1983 fishery will not contribute significantly in 1985 but shrimp recruiting in 1984 will be important to the 1985 fishery. Also, any prerecruit shrimp observed in the 1984 photographic survey will be important to assess recruitment prospects in 1985. Therefore, the inclusion of shrimp data collection in 1984 is particularly important in the provision of useful advice for 1985. Since not all of these data would be available before January 1985, STACFIS would not be able to evaluate the status of the stock in 1984 nor would it be possible to provide any advice on the projected status of the stock in 1985 even in a qualitative sense, prior to January 1985.

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.

2. Possible Need for Further Workshop on Ageing Shrimp

One of the conclusion from the Shrimp Ageing Workshop in 1981 was that more thorough investigations of biological characteristics were necessary before age structure and growth of shrimp could be fully understood (NAFO Sci. Coun. Studies, No. 6, page 97). It was agreed at that meeting that research should continue in this direction and that another workshop be held in 2-3 years to review progress. In response to the recommendation of the Ageing Workshop, STACFIS

recommends

that the participants of the 1981 Workshop be contacted to see if there has been sufficient progress to warrant another session and that a report of the survey be made available to STACFIS at the June 1984 Meeting.

3. Acknowledgements

There being no further business, the Chairman thanked the participants for their interest and cooperation during the course of the meeting, and expressed the appreciation of the Committee to the NAFO Secretariat for their usual efficiency in support of the meeting.

PART B

REPORT OF SCIENTIFIC COUNCIL

June 1984 Meeting

CONTENTS

REPORT OF SCIENTIFIC COUNCIL

June 1984 Meeting

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 (see Part D, this volume). 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 Subarea 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 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 (USA) (see Part D, this volume).

The reports of the Standing Committees, as adopted by the Council on 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 Part D of this volume. Brief summaries of the committee reports and other matters considered by the Council are given in Sections I to VI below.

I. FISHERY SCIENCE (APP. I)

1. General Fishery Trends

From final published statistics for 1982 and provisional data for 1983, the nominal catch of all fish and invertebrate species in the Northwest Atlantic (Subareas 0 to 6) decreased (9%) from 2.89 million (metric) tons in 1982 to 2.71 million tons in 1983 (see Appendix I, Table 1). The total catch of "groundfish" species decreased (7%) from 1.34 million tons in 1982 to 1.25 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 (1%) from 550,000 tons in 1982 to 560,000 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% lower than the 1982 catch of 94,000 tons. The total catch of "invertebrate" species decreased (9%) from 901,000 tons in 1982 to 816,000 tons in 1983, due mainly to decreased catches of squids (38%), scallops (13%) and other molluscs 26%. With respect to the total nominal catches of finfishes and invertebrates by subarea, increases were recorded for Subarea 1 (127,000 to 129,000 tons) and Subarea 3 (475,000 to 482,000 tons), and decreases were noted for Subarea 0 (6,000 to 5,000 tons), Subarea 2 (135,000 to 81,000 tons), Subarea 4 (750,000 to 689,000 tons), Subarea 5 (497,000 to 468,000 tons) and Subarea 6 (896,000 to 851,000 tons).

2. Assessment of Finfish and Invertebrate Stocks

The Council noted that STACFIS had reviewed the status of certain stocks in Subareas 0 to 4, as requested by Canada and the EEC (see Part D of this volume for agenda and annexes), and the three stocks in Div. 3M, as required by the Fisheries Commission, and had 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 for 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, management options for 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".

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) 1978	1979	1980	1981	1982	1983[1]	TACs (000 tons) 1978	1979	1980	1981	1982	1983	1984	1985
Cod	1	39	48	47	53	56	63	...	...	...	50	62	62	...	( )[2]
	2J+3KL	139	167	176	171	230	231	135	180	180	200	237	260	266	(266)
	3M	33	30	11	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[5]	(41)
Redfish	1	8	9	8	6	8	8	-	13	...	...	...	...	...	(9)
	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	45	60	36	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	50	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	9	9	6	20	25	25	25	25	25	25	(25)
	2+3KL[6]	39	34	33	31	26	27	30	30	35	55	55	55	55	(75)
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	...	(60)[7]
Shrimp	0+1	34	35	44	46	44	46	40	30	30	35	35	34.6	29.5	( )[8]
Squid-*Illex*	2-4	94	162	70	33	15	+	100	120	150	150	150	150	150	(150)

[1] Provisional statistics
[2] See relevant section of STACFIS Report (Appendix I)
[3] Excludes expected catches by Spain
[4] No directed fishery
[5] TAC established by Canada
[6] TACs pertain to Div. 2J+3KL before 1985
[7] TAC for Div. 3L only
[8] Deferred to mid-term meeting in January 1985

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 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) For 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 catches 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 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 squids

The Council noted that the Special Session in September 1984 should be a successful and interesting one, with the anticipated presentation of about 30 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 W. G. Doubleday to convene a small working group of scientists at the September 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 cod stock in Subdivision 3Ps

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 many research documents, for which time was insufficient at this meeting.

II. RESEARCH COORDINATION (APP. II)

1. Statistics and Sampling

a) Fishery statistics

The Council noted that late submission of STATLANT 21B catch and effort data had 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 some fishing effort data provided by Canada for 1977-80 and by USA for 1981 have been revised. It 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* Interagency 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 1967-78 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 further 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) List 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 list.

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

III. PUBLICATIONS (APP. III)

1. STACPUB Membership

In the absence of two regular members of the Committee, the Council requested H. Hatanaka to substitute for S. Kawahara who could not be present at this meeting, and appointed M. G. Larrañeta to replace J. P. Minet who has informed the Secretariat of his resignation from the Committee.

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 1967-78 updated lists of sampling data that are 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 semiannual 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 included similar analyses for other scientific publications.

The Council shared STACPUB's regret that 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 Septmeber 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. NAFO/ICES Study Group on Biological Relationships of West Greenland and Irminger Sea Redfish Stocks

The Council endorsed the report of the Study Group (SCS Doc. 84/VI/2) which met for the second time at ICES Headquarters, Copenhagen, Denmark, on 21 February 1984, with the following terms of references: (a) to review and evaluate additional information relevant to stock identification from historical data series, (b) to report on the feasibility of tagging *Sebastes marinus* in Godthåb Fjord and (c) to report on the availability of research vessels for a multiship program to observe the drift of redfish larvae from the Irminger Sea to West Greenland.

Discussion by the Study Group resulted in the following observations on these points:

a) 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.

b) 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 quantities 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*.

c) 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 (N. V. Janovskaya and 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 other NAFO representatives are J. Møller Jensen (Chairman of STACREC) and 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 of further 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 ways for handling the excessive workload of STACFIS at future June meetings.

d) Matters relevant to environmental research, including the Flemish Cap Project, guidelines for 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 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, 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 (see Part I, this volume).

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 (see Part D, this volume, for agenda). Scientists attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France and 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 that were considered by the Committee.

I. FISHERY TRENDS

1. General Trends for the Northwest Atlantic

In Table 1, the fishery statistics for 1982 are from Statistical Bulletin Vol. 32, and the provisional data for 1983 are those reported on STATLANT 21A forms for all member countries (except Italy and United Kingdom) and for the United States and South Korea.

The overall reported catch (round fresh weight) of all finfish and invertebrates at 2.71 million tons in 1983 was 6% lower than the 1982 catch of 2.89 million tons. The total groundfish catch, which represented 46% of the overall catch in 1983, decreased (7%) from 1.34 million tons in 1982 to 1.25 million tons in 1983, due mainly to decreases for silver hake (67%), American plaice (16%), haddock (15%), Greenland halibut (11%), pollock (9%) and redfish (9%), which were partly offset by increases for yellowtail and other flounders (6%). The total pelagic fish catch, which represented 21% of the overall catch in 1983, increased slightly (2%) from 550,000 tons in 1982 to 560,000 tons in 1983, due mainly to an increase for Atlantic menhaden (7%) although the catch of Atlantic herring declined by 8%. The total "other finfish" catch, which represented only 3% of the overall catch in 1983, decreased slightly from 94,000 tons in 1982 to 87,000 tons in 1983, but the catch of the major species of this group (capelin) at 41,000 tons was essentially the same in 1983 as in 1982. The total catch of invertebrates, which represented 30% of the overall catch in 1983, decreased significantly (7%) from 901,000 tons in 1982 to 816,000 tons in 1983, due mainly to decreased catches of squids (38%), scallops (17%) and some other molluscs (especially oysters, 25%). The catches of various crustaceans (shrimps, crabs and lobsters) remained about the same in 1983 (206,000 tons) as in 1982 (204,000 tons).

2. Fishery Trends by Subarea

a) Subarea 0

The unusal low catch of 5,000 tons in 1983 was slightly less than the 1982 catch of 6,000 tons, with northern prawn (3,300 tons) and Greenland halibut (1,600 tons) being the dominant species taken.

b) Subarea 1

The total nominal catch of all species increased slightly (2%) from 127,000 tons in 1982 to 129,000 tons in 1983, due almost entirely to the increased catch of cod (11%) which represented 48% of the overall catch in the subarea. The shrimp catch in 1983 (43,000 tons) was about the same level as in 1982.

c) Subarea 2

The total nominal catch of all species declined sharply (40%) from 135,000 tons in 1982 to 81,000 tons in 1983, due to significant decreases in the catches of cod (43%), Greenland halibut (27%) and redfish (75%). 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 475,000 tons in 1982 to 487,000 tons in 1983, due mainly to increased catches of cod (12%), redfish (7%) and Greenland halibut (45%), although decreases were noted for American plaice (22%), yellowtail flounder (23%), crabs (15%) and squid (11,000 tons in 1982 to zero catch in 1983.)

e) Subarea 4

The total nominal catch of all species declined (8%) from 750,000 tons in 1982 to 689,000 tons in 1983. Decreased catches were noted for most of the species, the more significant ones being for haddock (12%), redfish (12%), silver hake (40%), pollock (9%), white hake (23%), mackerel (25%) and crabs (14%), and the only significant increase was for lobsters (24%).

f) Subarea 5

The total nominal catch of all species declined (6%) from 497,000 tons in 1982 to 468,000 tons in 1983. Decreased catches of cod (10%), haddock (20%), pollock (10%), American plaice (13%), herring (28%) and scallops (25%) were partly offset by increased catches of yellowtail flounder (19%), menhaden (14%), squids (83%), clams and other molluscs (13%) and crustaceans (9%).

g) Subarea 6

The total nominal catch of all species declined (5%) from 896,000 tons in 1982 to 851,000 tons in 1983, due to decreased catches of squids (36%), clams (3%) and some other molluscs (31%), although increases were noted for menhaden (7%), scallops (47%) and crabs (6%).

Table 1. Nominal catches (000 tons) by subarea for 1982 and 1983[1]. (+ 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	+	-	56	62	95	54	242	272	247	242	72	65	+	+	713	696
Haddock	-	-	-	+	+	-	1	1	40	35	25	20	+	+	66	56
Atlantic redfishes	+	+	8	8	8	2	64	65	43	38	7	5	-	-	129	118
Silver hake	-	-	-	-	-	-	+	-	60	36	12	11	8	6	79	53
Red hake	-	-	-	-	-	+	+	+	+	1	3	1	1	1	4	3
Pollock	-	-	-	-	-	+	1	1	33	30	20	18	+	+	54	49
American plaice	-	-	1	+	+	+	55	43	14	14	15	13	+	+	85	71
Witch flounder	-	-	-	-	+	+	7	7	3	3	5	6	+	+	15	16
Yellowtail flounder	-	-	-	-	+	-	13	10	3	2	26	31	1	2	43	45
Greenland halibut	4	2	5	4	15	11	11	16	2	1	-	-	-	-	38	34
Other flounders	-	-	1	1	+	+	2	3	8	8	18	19	9	10	38	41
Roundnose grenadier	+	+	+	+	2	2	3	2	-	-	-	-	-	-	5	4
White hake	-	-	-	-	+	+	3	3	15	11	7	7	+	+	25	22
Wolffishes	-	+	4	3	+	+	3	4	3	3	1	1	-	-	11	11
Other groundfish	-	-	8	6	+	+	+	+	8	6	11	10	8	6	36	28
Atlantic herring	-	-	+	+	+	+	3	1	145	142	32	23	+	+	180	166
Atlantic mackerel	-	-	-	-	-	-	+	8	16	12	1	2	9	8	26	29
Atlantic menhaden	-	-	-	-	-	-	-	-	-	-	35	40	289	308	324	348
Other pelagics	-	-	-	-	-	-	+	1	1	1	11	7	8	7	20	17
Capelin	-	-	+	+	10	10	32	30	+	1	-	-	-	-	42	41
Other finfish	-	+	1	1	1	1	3	3	9	7	7	11	30	22	52	46
Squids	-	-	-	-	-	-	11	-	2	+	6	11	33	21	52	32
Clams	-	-	-	-	-	-	-	-	6	5	43	45	280	271	329	321
Scallops	-	-	-	-	+	+	6	5	23	22	105	79	19	28	153	133
Other molluscs	-	-	-	-	-	-	-	-	2	2	13	18	147	102	162	121
Shrimps	2	3	43	43	4	1	+	-	9	10	2	2	+	-	59	58
Crabs	-	-	-	-	-	-	13	11	36	31	2	3	52	55	103	100
Lobsters	-	-	-	-	+	-	1	1	21	26	18	19	2	2	42	48
Other invertebrates	-	-	-	-	-	-	-	-	-	-	1	1	+	2	1	3
Total	6	5	127	129	135	81	475	487	750	689	497	468	896	851	2886	2710

[1] Provisional data.

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 trawls, and partly a coastal and fjord fishery in which the major part of the catch is taken by pound-nets. 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 during the pound-net season. As a rough guideline for a breakdown of the catch by gears, it was estimated that about 75% 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 67% of the total nominal catch of cod in Subarea 1 in 1983 and just over 50% of the total catch in 1982, whereas only 25% of the catch was made by trawlers in 1981 (Table 2). The increase in catch from 1981 to 1983 was partly due to the fact that only Greenland fishermen were allowed directed fishing for cod in 1977-81, whereas fishing in 1982 and 1983 was also allowed for some non-Greenlandic fishermen, primarily those from Federal Republic of Germany. Fishing over the last 10 years has been regulated by setting minimum mesh size for trawls and total allowable catches (TACs). Trawling for cod in inshore waters is generally not allowed. EEC rules prescribe a minimum size of 40 cm (total length) for cod when landed.

Table 2. Catches and TACs (000 tons) for cod in Subarea 1, 1976-83.

	1976	1977	1978	1979	1980	1981	1982	1983	1984
Trawlers	19	46	53	57	16	14	29	42	
Other vessels	14	27	20	42	38	39	27	21	
Total	33	73[1]	73[1]	99[1]	54[1]	53	56	63[2]	
TAC	45[3]	31[3]	-[4]	-[4]	20[3]	50[5]	62	62	68

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

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-trawling gears in 1979 was based largely on the 1973 year-class, and the fishery was especially good in Div. 1E and 1F.

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, which resulted from an increase in fishing activity (effort) rather than an increase in catch rate. On the contrary, the catch rate apparently declined 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 past 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 data 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 tonnage class. Their nominal catches, effort and catch-per-unit-effort (CPUE) 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 53% of the recorded fishing time for cod by the trawlers took place in that division, whereas no single division had more than 45% of the total cod-fishing effort by these trawlers in 1980 and 1981. The decrease in CPUE was observed in 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.

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

ii) Weight-at-age data

Based upon samples of the commercial fisheries by Greenland vessels, mean weight-at-age values 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 two-thirds of the catch will be taken by trawlers and that the fishing pattern remains as in 1983, overall mean weight-at-age values were calculated, and a smoothed curve was used to give the values in the last column of Table 4. For the important age groups (4-8), these values 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 data for 1965-82 are listed in revised SCR Doc. 83/VI/60 (table 15B). The 1983 catches were heavily dominated by the 1977 year-class (age 6 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 and 1985.

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 number 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 nm^2), which should include 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% level of significance. 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 lower-than-normal temperatures were also observed to the west of the banks in the fall of 1983. Although absolute bottom temperatures throughout the area covered by the above-mentioned trawl survey do not by themselves appear restrictive to cod distribution, 1983 seems to have been an unusual year in terms of hydrographic conditions and ice. The idea cannot 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 data. 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 the 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 in January 1984 (ICES C.M. 1984/Assess:5). The 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 these calculations are given in SCR Doc. 84/VI/92 (table 1). Such an emigration would correspond to an instantaneous coefficient (E) of 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 estimated 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 = 13.2 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 13.2 million fish. For ages 3 and 4, the recruitment 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 size and emigration rates. The Committee, recognizing that stock estimates from surveys have a wide confidence interval, considers that the results cannot be interpreted as precise estimates. The Committee also points out that survey estimates of stock biomass by themselves are believed to be underestimates of the true stock size, 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 the Committee that the agreed TAC for 1984 is 68,500 tons. Therefore, projections generally are given on the assumption that the catch in 1984 will be equal 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.

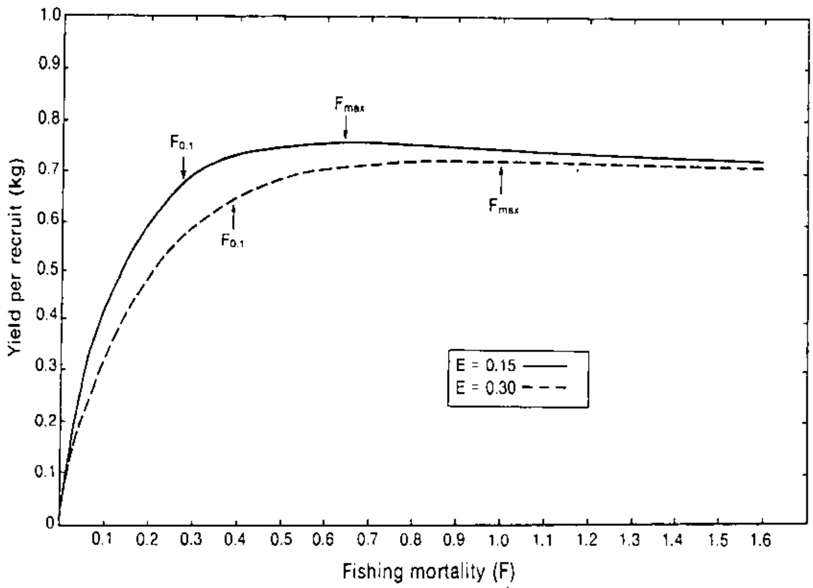

Fig. 1. Subarea 1 cod: yield-per-recruit for a range of fishing mortality (F) and two levels of emigration from West Greenland.

e) <u>Catch projections</u>

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, from the yield-per-recruit curves for E = 0.15 and E = 0.30 (Fig. 1), the $F_{0.1}$ and F_{max} estimates became higher than those obtained last year. The new $F_{0.1}$ values were estimated at

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	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.

0.27 and 0.39. The F_{max} values are not very meaningful, because they lie in the upper flat parts 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 given in Table 6 for the lower and upper estimates of stock size respectively, and these are illustrated in Fig. 2. Clearly the new data indicate 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 if no catch were taken.

Table 6. Subarea 1 cod: projections of spawning stock biomass (SSB) at the beginning of the year and catch during the year (000 tons) for eight different management strategies. Population numbers at the beginning of 1984 are based on (A) direct results of 1983 survey and (B) 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
										A. Direct Results of 1983 Survey							
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
										B. Adjusted Results of 1983 Survey							
1984	SSB	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	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	0.392
	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.

This rather drastic change in the situation is not fully understood and explained. However, because 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 recruitment 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 the stock, especially the spawning stock, have not really been used. The next chance may occur with recruitment of the 1982 year-class, but much more prudent management is called for if the stock is to be rebuilt.

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

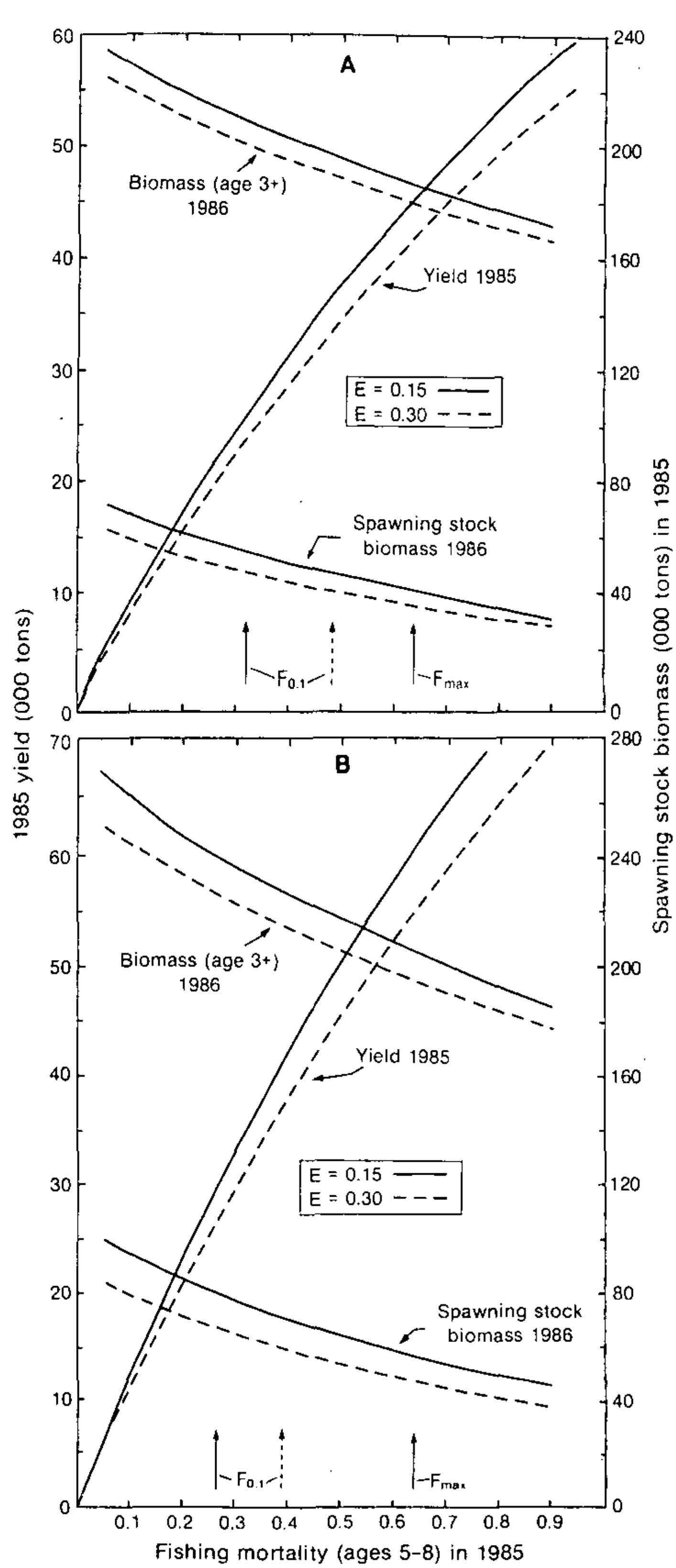

Fig. 2. Subarea 1 cod: trends in estimated yield in 1985, biomass (age 3+) and spawning stock biomass by January 1986 for various levels of fishing mortality in 1985, assuming a catch of 68,500 tons in 1984. (Trends in A and B are based on values in Table 6.)

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 were taken into account, by applying a natural mortality of 0.30 to 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 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	231[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 weight-at-age values 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 showed 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, since 1978 in Div. 3K, and since 1971 (except 1983) in Div. 3L. Surveys were also conducted by Federal Republic of Germany in Div. 2J since 1972, and by 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 from the Canadian and USSR surveys for the same period in Div. 3K. The 1978 year-class, which was dominant in the commercial catches, appeared to be strong from the surveys conducted by all three countries in 1983. From both the Canadian and Federal Republic of Germany surveys of Div. 2J in 1983, 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 (SCR Doc. 84/VI/23). 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.

The winter distribution of cod off southern Labrador and eastern Newfoundland was described on the basis of research vessel catches in 1978-83 (SCR Doc. 84/VI/24). 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 temperatures 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 southeastern Hamilton Bank, Belle Isle Bank, southwestern Fund Island Bank, northern Hamilton Bank and northern Grand Bank. The largest concentrations were found in depths of 230-420 m (average about 300 m) where bottom temperatures ranged from 1.5 to 5.5°C (average about 3°C).

Trends in the offshore and inshore catches of cod in Div. 2J, 3K and 3L were analyzed (SCR Doc. 84/VI/26). 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, although wide, geographical 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 exclusively on capelin in late June and July (SCR Doc. 84/VI/51), 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, hyperiids and Arctic cod (SCR Doc. 84/VI/79). 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 (SCR Doc. 84/VI/88). 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 1962-83 were used in cohort analyses. The 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 age 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 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.

iii) Recruitment

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 the long-term (1962-82) geometric mean of 400 million fish (Table 7). 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).

Table 7. 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.

d) Catch projections

The basic parameters used to project stock sizes and catches are given in Table 8. The weight-at-age values used for the projections are averages of values derived for 1982 and 1983. The 1984 TAC of 266,000 tons was used as the expected catch in 1984. The projection results are listed in Table 9.

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 and is projected

Table 8. 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 9. 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	0.255	0.200	
Catch (000 tons)	227	266	268	

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. Spawning biomass (age 7+) at the beginning of 1984 is estimated to be 722,000 tons and is projected to be 1.2 million tons by the beginning of 1986 (Table 9). 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 weight-at-age in recent years.

3. Cod in Division 3M (SCR Doc. 84/VI/29, 33, 41, 47, 94; SCS Doc. 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. However, cod are uncommon in depths greater than 550 m. The bottom is fairly smooth except in the south at 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. During 1963-72, 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 declined to about 23,000 tons, about 85% of which was taken by Portugal, Faroe Islands, USSR and Spain. The countries reporting catches in 1983 were Spain (4,400 tons), Portugal (2,900 tons), Faroe Islands (1,500 tons), USSR (1,300 tons), and Norway (100 tons), for a total of 10,200 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	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 ton per hour in 1978-79 and 0.1 ton per hour in 1980. This catch-rate series has not been extended because of scarcity of effect 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. The dominant groups were ages 3 and 4 in 1981, and the same year-classes were dominant at age 4 and 5 in 1982. STACFIS noted with concern that the dominant age-group in the commercial catch in 1983 was age 3 (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 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 catch in the early 1984 Canadian survey. There is a potential, therefore, for population growth, but this depends 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 (years)	3	4	5	6	7	8	9	10	11	12
Partial Recruitment	0.55	0.75	0.90	1.00	0.95	0.75	0.55	0.40	0.40	0.40

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

d) Assessment results

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

Because of the inadequacy of sampling in 1981-82 (for example, 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	Survey catch rate (kg) 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 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 weight-at-age values 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 conducted in a restricted area in the southernmost part of the zone since 1981. Other countries involved have been Canada, Portugal and 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	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-rates for 1959-75, was derived from data for 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 (1) 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, (2) use of catch-rate data for otter trawlers which take a small proportion of the total catch, and (3) 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 were no evident trends in biomass and abundance from 1971 to 1982 but the 1984 survey indicated a substantial increase in both parameters. 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 the 1981 year-class 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 weight-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 ages 2 and 3 fish. 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 weight-at-age data 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 which were obtained by dividing fishing mortality by fully-recruited fishing mortality for ages 6-10. The arithmetic means of the coefficients for 1974-82 (excluding 1976), obtained from a cohort analysis, were used as the partial recruitment multipliers for the 1983 catch-at-age vector. These partial recruitment and average weight-at-age values 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 for the oldest age (12) was set at the level for fully-recruited ages (6-10).

ii) Fishing mortality in 1983

An estimate of fishing mortality for fully-recruited age-groups in 1983 was derived from 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 fully-recruited age-groups in 1983 would be appropriate for 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 it was considered to reflect more accurately the present level of recruitment rather than the longer time period (1959-60). If a longer time period had been chosen, the estimate of recruitment would have been 65 million fish.

d) Catch projections

Population numbers-at-age from cohort analysis at F = 0.15 in 1983, together with geometric mean recruitment (35 million) at age 3 and the parameters shown in Table 10, 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.

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 showed 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, but there appears to be an increasing trend in catch rates.

Table 10. 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

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 from 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, whereas catches by 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	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 otter-trawl fleet of Canada (N) which takes a small portion of the catch. In the present assessment, data were also available for trawlers of Canada (M) and France (SP). 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. Because of inconsistent sampling of strata and consequent imcomplete 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 catch-rate standardizaiton. Abundance estimates from the Canadian surveys were low during the mid-1970's, but showed an increasing trend until 1981. The abundance 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 have been conducted in this area since 1977. Because the surveys occurred in February and/or March, the data needed no adjustment for seasonality. However, the results from the 1977 survey were not considered due to inadequate sampling of strata. The data for 1978-84 showed an increasing trend in abundance and biomass.

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 abundance estimates for ages 2 and 3 fish being higher in recent years from the French survey than those from the Canadian survey.

From the tagging of adult cod in February 1980 on northwestern St. Pierre Bank (SCR Doc. 84/VI/25), recoveries during subsequent January-March periods were mainly from the area in which they were tagged. Recoveries during April-December periods were mainly from shallow areas on the central and northern parts of St. Pierre Bank and from inshore waters of Placentia Bay, Fortune Bay, southwestern Newfoundland and St. Mary's Bay. About 87% of the tag recoveries were from 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 abundance one 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). Because relative abundance indices for these year-classes at age 3 were similar in both Canadian and French surveys (Table 11), 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 analysis, the relative abundances of which were similar to those determined from the combined survey index of abundance. The resultant partial recruitment values 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 age-group (14) was set equal to the fishing mortality of age-groups 7-11.

ii) Fishery mortality in 1983

Unweighted least squares regression of exploitable biomass estimates on commercial catch-rate indices indicated 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). From the relationship of the combined mean number-per-tow estimates (age 4+) for both countries and age 4+ abundance from cohort analysis, F was estimated 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 from the 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). Estimates for the 1978 and 1979 year-classes were not used in the analysis, because such estimates from cohort analysis are strongly influenced by input parameters. From least squares regression analysis, estimates for the 1980 and 1981 year-classes were 72 and 81 million fish respectively (Table 11).

Table 11. 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)			Age 3 from Cohort	Regression analysis	
	Canada[1]	France	Combined			
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 1981 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* (See footnote at bottom of next page)

Population numbers 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 12, 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 $F_{0.1}$ = 0.20 was assumed in 1985. The mean weight-at-age values used in the projections are averages of values derived from 1981-83.

Table 12. 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

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.

6. Redfish in Subarea 1

a) Introduction

The nominal catches have fluctuated greatly since 1951, increasing from 150 tons in that year 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 6,000-8,000 tons in 1980-83. There is an indication that catches in 1977 to 1979 were overestimated in the offical statistics. Redfish are 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	8[1]

[1] Provisional data.

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 an MSY level of about 10,000 tons and an equilibrium catch at 2/3 F(MSY) of about 9,000 tons. However, the correlation coefficient for the regression of 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 TACs and catches 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	20[1]	

[1] Provisional data.

b) Input data

Catch-effort data from the ICNAF/NAFO statistical series were incorporated in a multiplicative model to derive a standardized catch-rate series. Only data for 1972-82 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 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 is inadequate for a general production analysis.

* Estimates of partial recruitment used in the current projections were higher than those used in the 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 million fish for the 1979, 1980 and 1981 year-classes, whereas, 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.

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 concentrated on 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 showed an increase in redfish biomass during the second half of the 1970's, which corresponded 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. STACFIS considers 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.

STACFIS noted that the present TAC may be conservative in light of the increase in biomass that was indicated by the USSR survey series and the fact that the TAC was not achieved in recent years (except 1983). However, an appropriate level of increase could not be determined from the available data. 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 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 into any analysis using numbers at age, it is first necessary to convert these different length measurements to the measurement applicable to samples from which otoliths are collected. 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

About 80% of the TAC was utilized in 1983, 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. Canadian vessels caught the largest portion in Div. 3L, and the USSR catches dominated in Div. 3N. In recent years, the USSR proportion has decreased in Div. 3N as the catches by Cuba and Spain gradually increased. Recent TACs and catches 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	20[1]	

[1] Provisional data.

b) Input data

Catch-effort data from ICNAF/NAFO statistics for the 1959-82 period were incorporated in the multiplicative model to derive a standardized catch-rate series. Length frequencies 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. Length frequencies were available from USSR research surveys in Div. 3N for 1979-83. Abundance indices for redfish in Div. 3L, 3N and 3O 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, and this precludes an 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 rate 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 3O (combined) from 1977 to 1979, with a subsequent gradual decrease.

The research length frequencies from Div. 3N consistently showed modes at about 22-25 cm. This may be a result of the depths surveyed, because redfish are stratified by depth. There is, 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 fishery 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 of a small-mesh-gear-line (SMGL). 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 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 the slope area of the shelf. 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, and the proportion of other regulated species in the catches 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 shelf water 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	36[1]	

[1] Provisional data.

b) Input data

i) Commercial fishery data

The catch rate for the 1983 silver hake fishery, although lower than the anomalously high 1982 catch rate, was higher than those for 1980 and 1981 and similar to those for the early 1970's. Recent USSR catch rates derived from statistics 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 for 1977-82 (Table 13). 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.

Table 13. 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	-	-	-	-

The age composition 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 vector was dominated by the 1981 year-class which composed 42% of the catch by number 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 by number and 50% in weight. The contribution of fish older than age 4 in 1983 was estimated to be 10% of the catch by number 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, with the 1982 year-class being 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). However, the historical time series is confounded not only by changes in the gears 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. It was noted that 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 stronger 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 satifactory 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 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	2[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, more than half of the catch has come from Div. 3L, with recent catches from this division averaging about 30,000 tons annually. 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	50	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. The age composition and weight-at-age data for 1983 were derived from samples of the landings of Canadian trawlers in Div. 3L and 3N. Corresponding data for 1960-82 were the same as those used in the previous assessment of this stock.

Estimates by age-group of American plaice discarded by Canadian trawlers in Div. 3L and 3N were available for 1978-82. These data showed that significant numbers of ages 6-10 fish were discarded and that the discard rate appeared to increase significantly from 1980 to 1982 (approximately 24% in 1980 and 44% in 1982). No comparable data were available for 1983. 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

Data from Canadian research vessel surveys, which were conducted in the spring during 1971-82 in Div. 3L and 3N, indicated a decline in total abundance from 1980 to 1982, although the number of age 8 and older fish increased during 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 the 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, indicated a slight decline in abundance over this period. However, the 1983 results must be interpreted with caution, because this survey was 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 1979-83 indicated that the population was relatively stable.

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 1980-83 period from a preliminary cohort analysis. 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 assessment was retained.

iii) Fishing mortality

The value of terminal F was determined on the basis of two regressions: (1) The first involved an unweighted least squares regression of average midyear exploitable biomass from cohort analysis against CPUE of Canadian otter trawlers (tonnage class 5) in Div. 3L and 3N for 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 as determined from the fishing mortalities. The correlation coefficient was the same for the regressions at terminal-F values of 0.25 and 0.30, and the sum of the 1982 and 1983 residuals was closer to zero for the cohort analysis at terminal F = 0.30 than for the analysis at F = 0.25. (2) 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 the American plaice stock on 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 Grand Bank. From the catch-effort data for 1965-71, the yield at 2/3 f(MSY) was estimated to be 57,000 tons, whereas the yield at 2/3 f(MSY) using the 1973-82 values was calculated to be 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 to be 34,000 tons, and the yield for the 1967-73 year-classes was estimated to be 57,000 tons.

e) Catch projections

The parameters listed in Table 15 were used in the catch projections. The partial recruitment values 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 in 1983.

Table 14. 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 $F_{0.1}$ = 0.262 is 44,400 tons. This assumes that a catch of 47,000 tons, generated by F = 0.293 for fully-recruited age-groups, 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. 3O, 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. 3O averaged 4,300 tons during 1978-82. These calculations imply that a catch of 49,000 tons in Div. 3L, 3N and 3O 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 3O (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	4[1]	

[1] Provisional data.

b) Input data

Catch and effort statistics were available for Canadian tonnage-class 5 trawlers. 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 for 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-groups 9-11 predominating. Although an analytical assessment was not possible, the available data indicated that the stock is probably not declining and, according to catch-rate data, may be stable or showing some increase. 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 trawlers 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 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	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 that the population was relatively stable during 1978-82, with a slight decline in 1981, explained by incomplete survey coverage. There was no comparable survey in 1983, and the survey in 1984, 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 fishing mortalities over this period, and mean weight-at-age values 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 analyses showed a relatively stable stock size over the 1979-83 period. However, the Committee considered that the cohort analysis was not reliable because of very high fishing mortalities (1.0 to 3.0), which were 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 appeared 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 presented in SCR Doc. 84/VI/30 indicated that yellowtail flounder were less susceptible to fluctuations in the environment on 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 $F_{0.1}$) was not in agreement with current views on the stock.

d) Catch projections

In view of the apparent stability of the stock 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 in 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	9	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 frequencies from USSR sampling indicated 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 indicated the presence of large numbers of mature Greenland halibut which were probably migrating to the spawning area in 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 region essentially began in the mid-1960's by Canada (N) vessels, 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	27[2]	

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

b) Input data

Some data on directed fishing effort by Canada (N) trawlers (tonnage class 5) were available for 1980-83, although these were based upon relatively low levels of directed catch. Similar information was available for Poland from the Canadian scientific observer program in 1979-83 with the exception of 1980. Catch rates for both countries indicated a general decline in abundance in Div. 3K and a substantial increase in the more northerly divisions, particularly Div. 2H. This was believed to be a result of the northward migration of the strong 1972-74 year-classes from the more southerly divisions as they approached maturity.

Research vessel data indicate that Greenland halibut are widely distributed along the coasts of Labrador and eastern Newfoundland and on the northern slope of 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 400-1,000 m at a temperature range of 3.0 to 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 in 1982. This estimate is considered a minimum because much of the deeper strata, where the largest fish and probably the highest biomass are found, were not surveyed. Research vessel data from shrimp surveys in Div. 2H indicated that the 1979 and 1980 year-classes of Greenland halibut were quite strong, particularly in comparison with the strong 1974 year-class.

c) Estimation of parameters and assessment results

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

Partial recruitment values for the 1983 fishery were derived from a comparison of research vessel catch-at-age data for Div. 2J+3K and the estimated commercial catch-at-age data for 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 were 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 should 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. The USSR catch (44 tons) was by-catch in the Greenland halibut fishery in Subarea 0, and the Greenland catch (22 tons) was by-catch 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, German Democratic Republic vessels accounted for 74% of the total catch 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	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 standardized catch rate on the standardized effort data 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 be expressed by USSR representatives 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 which were 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 annually for this area includes two species: Atlantic wolffish (*Anarhichas lupus*) and spotted wolffish (*A. minor*). The total catch of both species have, since 1957, been in the range of 3,000-6,000 tons. There is some indication that the offically-reported catches in 1977-79 were 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	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 catch 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 capelin 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 TACs and catches are as follows:

Year	1876	1977	1978	1979	1980	1981	1982	1983
TAC (000 tons)	180	200	200	10	16	30	30	30
Catch (000 tons)	144	74	30	12	14	24	27	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 landing-per-set, were similar in 1982 and 1983 and higher than in 1981. Purse-seine catch rates, based on catch-per-day and catch-per-set (discards included) 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 landing-per-day and landing-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 represented 0.6% of the total reported (logbook) catch in capelin traps in 1983 compared with 1.4% 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 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 in 1983 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 from the 1982 survey in Div. 3NO. The 1979 year-class dominated the age structure of the data from both the 1982 and 1983 surveys in Div. 3N.

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

The Committee reviewed the results of a USSR trawl survey for larval and one-year-old capelin in Div. 3LNO (SCR Doc. 84/VI/40). Absolute abundance of young capelin could not be calculated, but such surveys, if 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 Committee 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 (SCR Doc. 84/VI/55). 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 north 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-classs was considerably stronger but may not be as strong as that of 1979. Accordingly, an estimate of 100 billion fish was used in the stock projections. 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 data of 1 June, are given in Table 15.

Table 15. 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. For these reasons and because the biomass is still below historical levels, STACFIS advises a continuation of the fishery closure for Div. 3N and 3O in 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 16. 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 16. Nominal catches (tons) of short-finned squid in the Northwest Atlantic, 1976-83.

Year	SA 2	SA 3	SA 4	Total SA 2-4	Total 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	-	11,164	1,744	12,908	18,188
1983[1]	-	-	422	422	14,000

[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, the total catch was only 422 tons, of which Japan took 403 tons, USSR 3 tons, and Cuba 3 tons in the offshore area from early August to mid-September. The only other catch of squid in Subarea 4 was 5 tons from the Port-au-Port area of western Newfoundland (Div. 4R) and 8 tons in Div. 4X by Canadian fishermen.

In Subareas 5 and 6, although the total catch of *Illex* declined from 18,200 tons in 1982 to 14,000 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 about 9,000 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 TACs 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	15	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 17) 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 fishing 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 Subareaa 5+6, and minimum trawlable biomass estimates were avilable from French research vessel surveys in Div. 4VWX (Table 17). The Canadian estimates of relative abundance from July surveys showed a increase from 5.5 squid per tow in 1982 to 28.4 squid per tow in 1983, associated primarily with the 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 two), 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 17. 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] 4VWX Jul	France[2] 4VWX Aug-Sep	USA[3] 5Z+6 Sep-Nov	France[4] 3Ps Jun-Oct	France[5] 3P+4VW Aug-Oct	Japan[6] 4VWX Sep	International[7] Jul-Sep in 4VWX (t/day)	(days)
Year								
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 evently 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 catch 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 Scotian Shelf in Subarea 4 during March-June 1983 indicated that juveniles (about 3 cm ML) exhibited no well-defined vertical movements and remained in the zone lying between surface and warm slope water masses (30-110 m) throughout the day. Larger juveniles (about 5 cm ML) also remained within this zone, but catches decreased during daytime, possibly because these larger squid were more active and better able to escape the trawl. Still larger juveniles (about 8 cm ML) remained 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 characteristics

In general, the size of *Illex*, upon arriving on the Scotian Shelf during early 1983, was considerably less than the size of those arriving 1-2 months earlier in previous years. Numbers of juveniles caught in areas seaward of the shelf in March 1983 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 smaller sizes from mid-June to mid-August. Commercial and survey information, therefore, both indicated 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 lengths of squid in the commercial fishery were comparable to those in 1982.

Maturation during 1983 appeared to have been similar to or somewhat less advanced than in 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 ML. The size at which 50% of the squid become mature has generally not been observed for males less than about 200 mm ML.

c) Catch projections (SCR Doc. 84/VI/17, 69)

No new information was available for prediction of 1985 biomass. However, the low abundance in recent years tends to support the rationale for and the maintenance of the current managment 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 18) 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 18. 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.

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 concept that the fishery tends to be self-regulating in years of low abundance. 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 current management regime 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 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 in 1984 will be available.

The Committee 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. Concern was expressed 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 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, which was 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 conditons.

3. Influence of Environmental Factors on Distribution, Movements and Migrations 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), several 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 number of documents (33) containing environmental information, the scheduling of the Subcommittee meeting to the middle of the period allocated for stock assessment work to ensure a larger participation of fishery biologists, and 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 meetings of the Subcommittee.

6. Resignation of Subcommittee Chairman

STACFIS accepted with regret the resignation of 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 that this may be dependent upon the maturity stage of the spawning population. If silver hake reach the ripening stage earlier than usual and prevailing water temperatures are 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, an approach suggested by the authors would be to start the fishery on 1 April rather than on the current starting date of 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 were reviewed. Analysis of about 3,800 stomachs indicated that young hake (<30 cm) fed mainly on small crustaceans (euphausiids, decapods and amphipods) and larger hake (>30 cm) fed 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 were observed with small silver hake feeding 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. 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 necessitated 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 (T. W. Rowell) reported that about 34 papers were expected to be presented at the Special Session on Squids 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, with W. G. Doubleday as Convener, 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. Topics Deferred to September 1984 Meeting

Due to lack of time, the following topics were deferred for consideration in September 1984:

a) Flemish Cap project.
b) Ageing techniques and validation studies.
c) Gear and selectivity studies.
d) Review of research documents (SCR Doc. 83/IX/66, 67, 68; 84/VI/10, 12, 28, 42, 43, 46, 84, 89, 90).

5. Acknowledgements

The Chairman thanked the participants 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 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; 84/VI/11, 14, 15, 16, 17, 18, 19, 22, 35, 36, 45, 57, 58, 59, 64, 66, 67, 68, 69, 70, 71, 72, 74, 75, 76, 80, 81, and 84; SCS Doc. 84/VI/15, 16, 17, and 18. In addition, undocumented 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 stations were received through its link to the IGOSS system, and data for about 2,100 CTD stations collected by Canadian ships will 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 yet been submitted to MEDS.

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 of Environmental Studies in 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 events are 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 persistently colder-than-normal conditions. 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.

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 lower and fresher respectively 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 in 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 on record (greater than 12 m) 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 pressure anomalies for winter implied northwesterly winds in Subarea 2. This was consistent with air temperature and oceanographic records which showed 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)

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 higher surface temperatures were consistent with the higher air temperatures over the region in 1983 and the anomalous southeasterly winds in winter and spring.

The effects of passage of Gulf Stream rings on shelf water were noted in several papers. 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 such as Gulf Stream 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 utimately contribute to improved understanding of processes that control 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)

Regarding the preliminary compendium of Flemish Cap cruises in 1977-84, 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 four 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 eddies 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 sizes of the same 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 for 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 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 USA National Climatic Center, 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 the most important. 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 affect subsequent forcing during the different seasons was pointed out.

7. Influence of Environmental 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 distribution, movements and migrations of marine species in the Northwest Atlantic" (NAFO Sci. Coun. Rep., 1983, page 122), a number a 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, and 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). Although the Council excluded the effects of environment on fish production, it is obvious that complete separation of "distribution" and "recruitment" was not always possible. Reasons for aggregations of fish and their consequent effects on catchability are clearly central to associated problems with respect to fisheries management. Variation in aggregations introduces biases in the assessment processes as well as affecting fishing and management strategies. The utility of understanding evironmental-distributional problems ultimately lies in a predictive capacity. It was not clear how year-to-year distributional changes of fish in relation to environmental effects can be studied independently of recruitment effects.

One paper (SCR Doc. 84/VI/58) dealt largely with recruitment variability and examined evidence in support of the hypothesis that predation during postlarval and prerecruit stages is the mechanism that exerts 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 postlarval stages compared with their effect on 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 multivariable processes which probably occur throughout the first year of life, including the postlarval stage. Consequently, a better understanding of the actual mortality mechanisms in the first year of life, and their relative importance, seems essental in order to develop real predictive capability.

A review of biological questions about distributions of marine species 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 distribution of eggs, larvae, juveniles and adults, but also on dynamics of production regimes and hence on feeding associations. All questions concerned very large spatial and temporal scales.

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 to provide a report which attempts to synthesize the material presented and to identify ways in which the Subcommittee can further develop knowledge on the topic, including suggested priorities. The report should be ready for presentation at the September 1984 Meeting of STACFIS. Names suggested for the Working Group included R. G. Halliday, A. T. Pinhorn or designate, M. D. Grosslein or designate, and K. F. Drinkwater or R. W. Trites. J. T. Anderson was also nominated, but he indicated that other commitments would prevent him from participating.

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 Subcommittee noted that an ICNAF Environmental Working Group 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 Area" (ICNAF Redbook, 1974, page 72). This subsequently led to identification of herring on Georges Bank and cod and redfish on Flemish Cap as appropriate stocks for intensive study. It was further noted that major field studies, experiments and analyses, designed to shed further light on 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 temperatures off Newfoundland and Labrador in 1982, was presented and briefly 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: R. Keeley (Canada), R. J. Dominguez (Cuba), E. Buch (Denmark), M. Melguen (France), D. Kohnke (Federal Republic of Germany), B. Schreiber (German Democratic Republic), S. Kawahara (Japan), R. Leinebo (Norway), S. Grimm (Poland), G. I. Luka (USSR), P. Edwards (United Kingdom), and E. Ridley (USA).

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 environmentally-related documents 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 Part D, this volume), dealing mainly with fishery statistics, biological sampling and biological surveys. 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 was not 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 this meeting. The work of the Council has therefore benefited from the production of SCS Doc. 84/VI/22 containing provisional nominal catches for 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 has 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 Table 5 of the relevant Statistical Bulletins could be published and considering the workload of the Secretariat, STACREC

recommends

i) *that the Secretariat distribute a notice annoucing the revisions to Canadian and United States effort data in Table 5 of the Statistical Bulletins 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 as time and finances permit.*

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 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 (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* Interagency 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 criteria for determining nationality of catch, FAO data base of conversion factors, discrepancies between international data bases, development of a manual on fishing logbooks, compilation of a glossary of fishery statistics, and 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 to 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., 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 of the Scientific Council. There was only one response (USSR) which indicated that the pre-1979 requirements were satisfactory. However, Canadian representatives at this meeting requested 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. 84/1/6; 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
POL	5+6	Groundfish and mackerel	Mar 10-Jun 9
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
POL	5+6	Groundfish and herring	Sep-Oct
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 ususally 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 now 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 measurements 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 (snout to anterior margin of anal fin) be used in measuring grenadiers (NAFO Sci. Coun. Rep., 1980, page 94).

2. Acknowledgements

There being no futher 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 12 and 19 June 1984. In attendance at both sessions were J. Messtorff (Chairman), Sv. Aa. Horsted (EEC), R. G. Halliday and A. T. Pinhorn (Canada), and V. M. Hodder (Assistant Executive Secretary). In the absence of S. Kawahara (Japan), H. Hatanaka attended the second session, 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 session. The agenda for the June 1984 Meeting is listed in Part D (this volume).

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 later in the year.

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 was 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 being 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 inventories 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 inventories of samples back to 1967. It was considered useful to publish these in one volume for the 12-year period 1967-78 as time and finances permit.

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 semiannual 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 the 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 soon be possible to move to less frequent reviews, perhaps every 3 years.

Costs and revenues for Vol. 2-4 of the Journal were reviewed, and the Committee considered that these provided a useful basis for monitoring the financial implications of Scientific 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 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. 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 be requested to 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 agreed 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 the 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.

PART C

REPORT OF SCIENTIFIC COUNCIL

Annual Meeting, September 1984

CONTENTS

REPORT OF THE SCIENTIFIC COUNCIL

Annual Meeting, September 1984

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

The Scientific Council and its Standing Committees on Fishery Science (STACFIS) and Publications (STACPUB) met at the Bedford Institute of Oceanography, Dartmouth, and at the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, during 5-14 September 1984 to consider and report on various matters listed in the agenda (see Part D, this volume). Representatives attended from Canada, Cuba, European Economic Community (Denmark, Federal Republic of Germany, France and Commission of the European Communities), German Democratic Republic, Japan, Norway, Poland, Portugal, Spain and Union of Soviet Socialist Republics (USSR), and observers were present from Mexico and United States of America (USA). The participants included scientists who presented papers at the Special Session on "Biology and Ecology of Squids in the Northwest Atlantic", which was held on 5-7 September 1984 at the Bedford Institute of Oceanography. Scientific Council sessions during 5-12 September were conducted by the Chairman (V. A. Rikhter) and the closing sesson on 14 September was conducted by the Vice-Chairman (J. Messtorff).

The reports of the Standing Committees, as adopted by the Council at this meeting are at Appendix I (STACFIS) and Appendix II (STACPUB). Brief summaries of these reports and other matters considered by the Council are given below.

I. FISHERY SCIENCE (APP. I)

1. Special Session on the Biology and Ecology of Squids in the Northwest Atlantic

The special session, convened by T. W. Rowell (Canada) and Ch. M. Nigmatullin (USSR), was held at the Bedford Institute of Oceanography on 5-7 September 1984. Twenty-four scientific papers and one oral report were presented. A bibliography of the squid genus *Illex* was also distributed to participants. Two papers were keynote presentations: a comparison of the life cycles of five ommastrephid squids, and an examination of the population dynamics of short-lived species with reference to modelling approaches for squid. Papers were presented in four topic areas: life cycles and early life histories; distribution, ecology and population modelling; feeding and predation; and maturation, ageing and methodology. The contributions added considerably to knowledge in each of the topic areas and demonstrated the progress in squid research over the past 5-6 years. The papers also provided an excellent overview of the current status of squid research and helped to elucidate critical areas and directions for future investigations.

2. Stock Assessments

The Council adopted the advice provided by STACFIS regarding further management options for the cod stock in Subdivisoin 3Ps, as requested by the EEC at the June 1984 Meeting. The Council noted that STACFIS had reviewed its report from the June 1984 Meeting in relation to the guidelines for assessments which were developed at the September 1983 Meeting, and endorsed the decision of STACFIS to continue to use the guidelines, with slight modifications. The Council also endorsed the STACFIS recommendations on improving the efficient use of time at future June meetings.

3. Environmental Research

The Council noted the continuing effort of STACFIS to identify the nature and importance of environmentally-induced variation in availability and the problems that such variations cause in stock assessments and fisheries management, and endorsed the appointment of M. Stein (EEC) as Chairman of the Subcommittee on Environmental Research.

4. Ageing Techniques

The Council noted that STACFIS had reviewed progress in ageing of grenadiers and supported further research in this area.

5. Other Scientific Documents

The Council noted that 41 research documents (12 deferred from the June 1984 Meeting) were presented at this meeting, 24 of which were reviewed at the Special Session on Squids. Of the remaining 17 papers, 14 were reviewed by STACFIS and 3 papers (SCR Doc. 84/IX/95, 96, 105) were deferred to the June 1985 Meeting.

6. Special Session in September 1985

The Council adopted the program for the Special Session in September 1985 entitled "Design and

Evaluation of Biological Surveys in Relation to Stock Assessments", which was developed by the Convener (J. Messtorff).

7. Further Workshop on Ageing Shrimp

The Council noted the decision of STACFIS not to sponsor a workshop on the ageing of shrimp within the next year and endorsed the recommendation of STACFIS that participants of the 1981 workshop be contacted in approximately 2 years (1986) to see if there has been sufficient progress to warrant another shrimp ageing workshop.

8. Request for Advice on Seals

The Council noted that STACFIS could assess the status of harp and hooded seals at the same time as the mid-term meeting for shrimp, scheduled for 16-22 January 1985, and noted that the Greenland Fisheries and Environmental Research Institute in Copenhagen was willing to host the mid-term meeting for assessment of seals as well as shrimp. Further details are given in Section VI(1) below.

II. RESEARCH COORDINATION

1. Further Consideration of Reporting Requirements for Sampling Data (SCR Doc. 84/VI/23, page 73)

Procedures for the reporting of sampling data were discussed at the June 1984 Meeting, but a final decision on areas and time periods for length frequencies and age-length keys was deferred to the present meeting when additional information was expected to be available. After reviewing the comments provided to the Secretariat by Canada, USSR and USA, the Council agreed to adopt the pre-1979 procedures and formats with flexibility to follow changes proposed by Canada for certain species/stocks (Table 1).

Table 1. Exceptions to the pre-1979 format for time and area in the submission of length and age samples. (Data for other species are normally reported by month and division for length samples and quarter and division for age samples.)

Species (area)	Length sample		Age sample	
	Time	Area	Time	Area
Cod and haddock (Div. 4X)	Month	Unit area[1]	Quarter	Unit area[1]
Cod (Div. 4Vn, Jan-Apr Silver hake Capelin Herring (except Div. 4WX) Shrimp (SA 0+1)	Month	Division	Month	Division
Herring (Div. 4WX)	Month	Square[2]	Month	Square[2]
Squid	Week	Division	-	-
Scallops[3]	Month	Subarea	Year	Subarea

[1] Unit area as defined by Canadian Department of Fisheries and Oceans
[2] Squares refer to 10'×10' quadrangles
[3] Meat weight substitutes for length

III. PUBLICATIONS (APP. II)

1. STACPUB Membership

The Council requested H. Hatanaka to substitute for S. Kawahara, who could not be present at this meeting.

2. Review of Publications

The Council, in accepting STACPUB's review of the status of publications, agreed that the necessary revisions of Statistical Bulletin for the years 1977-1981 should be made and the volumes issued as soon as possible to avoid misleading statistics being used over a long period. The Council therefore recommends

that the Executive Secretary take the necessary steps to make funds available for revision, publication and distribution in 1985, if possible, of 4 out of 5 volumes of Statistical Bulletin for the years 1977-1981.

3. Editorial Policy Concerning Publications

The Council accepted the nomination by STACPUB that G. P. Ennis (Canada) be appointed Associate Editor of the Journal of Northwest Atlantic Fishery Science for contributions relating to Invertebrate Fisheries Biology.

The Council shared STACPUB's regret that V. M. Hodder had tendered his resignation as Editor of the Journal and could not serve in that capacity after June 1985, due to many duties as Assistant Executive Secretary. The Council thanked Mr. Hodder for his effort and success in maintaining the Journal as a widely-recognized scientific publication of high standard. The Council requested STACPUB to undertake the necessary steps to nominate a new editor as soon as possible.

IV. COLLABORATION WITH OTHER ORGANIZATIONS

1. Twelfth Session of CWP, July 1984

The 12th Session of the Coordinating Working Party on Atlantic Fishery Statistics (CWP) was held in Copenhagen, Denmark, during 25-31 July 1984. The Session was hosted by the International Council for the Exploration of the Sea (ICES), and attending on behalf of NAFO were the Assistant Executive Secretary (V. M. Hodder) and the Chairman of STACREC (J. M. Jensen). Apart from NAFO and ICES, representatives attended from the International Commission for the Conservation of Atlantic Tunas (ICCAT), the International Commission for the Southeast Atlantic Fisheries (ICSEAF), the Food and Agriculture Organization (FAO), the Organization for Economic Cooperation and Development (OECD), the Statistical Office of the European Communities (EUROSTAT), the FAO Committee for the Eastern Central Atlantic Fisheries (CECAF), and the FAO Western Central Atlantic Fishery Commission (WECAFC). The Session dealt with a variety of fishery statistical matters of common interest to international organizations which are responsible for the collection and publication of Atlantic fishery statistics. The report of the 12th Session is expected to be published before the end of 1984, and 250 copies have been requested for distribution at the June 1985 Meeting of the Scientific Council.

V. FUTURE SCIENTIFIC MEETINGS

1. Special Meeting in Janaury 1985

The Council reaffirmed its decision in June 1984 to accept the invitation of the Greenland Fisheries and Environmental Research Institute and to meet in Copenhagen, Denmark, during 16-22 January 1985 to review the status of the shrimp stocks and to provide advice requested by Canada and the EEC (SCS Doc. 84/VI/3, 4).

The Council noted the joint Canada-EEC request for advice on harp and hooded seals (SCS Doc. 84/IX/26) and agreed to undertake this task at the same time and place as the shrimp assessments, when it was indicated that the Greenland Fisheries and Environmental Research Institute could accommodate the meeting at its laboratory in Copenhagen.

2. Scientific Meeting in June 1985

As agreed at the June 1984 Meeting, the Scientific Council, together with its Standing Committees on Fishery Science, Research Coordination and Publications and the Environmental Subcommittee, will meet at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 5-20 June 1985.

3. Annual Meeting in September 1985

The Council noted that it would be preferable to have the Special Session on "Design and Evaluation of Biological Surveys in Relation to Stock Assessments" at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, to ensure the participation of all possible contributors. It was consequently decided to have the session at the Bedford Institute in the week preceeding the Seventh Annual Meeting of NAFO in September 1985, irrespective of the place of the Annual Meeting. The specific dates for the Special Session will be determined as soon as the place and time of the Annual Meeting are established by the General Council.

4. Scientific Meeting in June 1986

Considering the need for the Secretariat to arrange for meeting facilities at the Bedford Institute of Oceanography, Dartmouth, Canada, more than a year in advance of scientific meetings, the Council tentatively agreed to meet during 4-19 June 1986.

VI. OTHER MATTERS

1. Provision of Scientific Advice at Meetings in the Absence of the Chairman and Vice-Chairman

The problem which arose at the Special Meeting of the Scientific Council in January 1984, when neither the Chairman nor the Vice-Chairman could be present, was discussed, with a view toward establishing a suitable guideline for similar situations in the future. After considering various options and in the absence of a quorum, the Scientific Council requested the Executive Secretary to submit the following proposed addition to Rule 3 of the Rules of Procedures of the Scientific Council for ratification by Contracting Parties prior to its meeting in January 1985: "In the circumstance that both the Chairman and Vice-Chairman of the Scientific Council are absent at the time and place of a scheduled Scientific Council Meeting, a Scientific Council representative shall be appointed as interim chairman by consensus among the Scientific Council representatives, or their alternates, who are present". The rule will be numbered 3.7.

2. Term of Office for Subcommittee Chairmen

The Scientific Council noted that the NAFO Convention defines the term of office of the Chairman and Vice-Chairman of the Scientific Council (Article IX.2) and establishes the right of the Scientific Council to set up such Committees and Subcommittees as it considers desirable for the exercise of its duties and functions (Article IX.4). In addition, the Rules of Procedure of the Scientific Council establish a term of 2 years for Chairmen of its Standing Committees, but terms of office for Chairmen of other Committees and Subcommittees have not been established. The desirability of establishing a term of office for Chairmen of such Committees and Subcommittees was recognized. Therefore, the Scientific Council agreed to follow the same procedure for term of office of Subcommittee Chairmen as applies to Chairmen of Standing Committees (i.e. Rule 5.2 of the Scientific Council Rules of Procedure).

3. Procedure for Adoption of Agenda at Meetings

The Council noted that difficulties arose in the adoption of its agenda at this meeting, due mainly to the coincidence of its opening session with the Special Session on Squids. In order to overcome such difficulties at future meetings, it was agreed that the agenda for any Special Session be adopted by the Scientific Council at a previous meeting and that the opening of the Scientific Council Meeting be held following the conclusion of the Special Session. At all Scientific Council Meetings, the first action shall be appointment of rapporteur and adoption of agenda.

4. Provisional Report of the June 1984 Meeting

The Council adopted its report of the June 1984 Meeting (SCS Doc. 84/VI/23) with minor amendments, which will be incorporated in the report before its publication in Scientific Council Reports for 1984.

VII. ADJOURNMENT

With the agenda of the meeting completed, the Chairman of the Scientific Council thanked the Chairmen of STACFIS (J. E. Carscadden) and STACPUB (J. Messtorff), the Convener of the *ad hoc* Working Group on Assessment Guidelines (W. G. Doubleday), and the Conveners of the Special Session on Squids (T. W. Rowell and Ch. M. Nigmatullin) who did an excellent job in completing their tasks. He also extended thanks to the participants for their cooperation and contributions which made the meeting a successful one, and to the Vice-Chairman (J. Messtorff) who chaired the closing session of the Council.

On behalf of the Council, the Chairman extended his appreciation to the Secretariat staff for their usual efficient work in organizing and servicing this meeting both at the Bedford Institute of Oceanography, Dartmouth, and at the Lord Nelson Hotel, Halifax.

APPENDIX I. REPORT OF THE 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 5-7 September 1984, and the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, during 10-12 September 1984, to consider and report on various matters referred to it by the Scientific Council. The Special Session on "Biology and Ecology of the Squids in the Northwest Atlantic" occupied the first 3 days of the meeting, and matters relevant to stock assessments, environmental research, ageing techniques and validation studies, gear and selectivity studies, and review of scientific documents were considered during the later period. Various participants contributed to the preparation of initial drafts of different sections of the report.

Representatives attended from Canada, Cuba, EEC (Denmark, Federal Republic of Germany, France and Commission of the European Communities), German Democratic Republic, Japan, Norway, Poland, Portugal, Spain and USSR, and observers were present from Mexico and USA.

I. SPECIAL SESSION ON BIOLOGY AND ECOLOGY OF SQUIDS IN THE NORTHWEST ATLANTIC

1. Introduction

The Special Session, convened by T. W. Rowell (Canada) and Ch. M. Nigmatullin (USSR), was held at the Bedford Institute of Oceanography during 5-7 September 1984. Twenty-three scientific papers and two oral reports were presented, and a bibliography on the squid genus *Illex* was distributed. Two papers were keynote presentations, one comparing the life cycle of five ommastrephid squids (SCR Doc. 84/IX/99) and the other examining the population dynamics of short-lived species with reference to modelling approaches for squid (SCR Doc. 84/IX/106). The papers were presented in four categories: life cycles and early life histories; distribution, ecology and population modelling; feeding and predation; and maturation, ageing and methodology. The papers contributed considerably to knowledge in each category and demonstrated the rapid progress made over the last 5-6 years. They also provided an excellent overview of the current status of squid research and helped to elucidate critical areas and directions for future research.

2. General Considerations

Early life histories, including comparisons among the closely related ommastrephids of the genus *Illex* and *Todarodes pacificus*, as well as among the more distant myopsid (*Loligo pealei*) and sepiolid squids, provided for broad-ranging discussions of the maturation, mating, spawning and larval-juvenile characteristics of squids. However, the primary focus was on elucidating the biology and ecology of *I. illecebrosus*. Biological and oceanographic information on the larval and juvenile distribution of *Illex* sp. over the Blake Plateau (off South Carolina to Florida) provided insights into the likely region of transport within the Gulf Stream system and the complex oceanographic processes which might influence the rate of transport of larvae to the northeast. Laboratory studies provided additional support for pelagic spawning and for retention of egg masses and larval *Illex* in the mesopelagic zone. The likelihood of mesopelagic spawning in the Gulf Stream frontal zone combined with the documented larval capacity for vertical migration were seen to extend the area of possible spawning along the Gulf Stream system. Discussion of larval and juvenile *Illex* distributions brought caution that, although the rhynchoteuthion "Type C" larvae in areas north of Cape Hatteras have been attributed to *I. illecebrosus*, those taken south of Cape Hatteras cannot yet be identified to the species level, because *I. oxigonius* and *I. coindetii* are also common in the area. The value of standardizing taxonomic efforts through the use of a single identification center was emphasized for large-scale programs such as those conducted in recent years under the aegis of NAFO. There was also discussion of the use of opening-closing nets *versus* open nets and the place of each in relation to basic survey objectives.

It was evident that, although general patterns of both areal and bathymetric distribution can be seen for *I. illecebrosus* during its period of on-shelf residency, the relationship of this distribution to temperature, shelf-slope frontal zone or other abiotic factors is unclear. Although bottom temperatures appear significant, it is likely that temperatures at other levels of the water column and other abiotic or biological features also influence these patterns. It was thought that more detailed analysis of available data sets could provide further insights into "preferred" regimes and hence into the distributional characteristics of the species. In the more southerly areas of *I. illecebrosus* distribution (Cape Hatteras to Florida), the absence of fishing activity and squid-directed research surveys leaves a major gap in data acquisition for what seems to be a critical area for spawning. Stomach sampling of large pelagics, such as swordfish and sailfish, was suggested as a possible source of additional information on the biology and distribution of *Illex* species in this southern area.

The application of a seasonalized von Bertalanffy growth formula with objectively fitted length-frequency data was proposed for modelling squid growth. Other methodological approaches were suggested for estimation of mortalities through length-converted catch curves and recruitment from annual catch and yield-per-recruit. The basic premise is that much can be learned from the systematic application of "fish models" to squid problems and that the deviations from the models are likely to be instructive in themselves. It was recognized that the suggested descriptive model of the abundance fluctuation mechanism for *I. illecebrosus* has promise for further improvement. It is necessary to determine in more detail the abiotic parameters of the environment which affect population dynamics and to seek the quantitative parameters of the model.

Discussion of food and feeding studies left little doubt that these were still in a very formative stage. Errors or potential errors in the methodology were pointed out, and it was clear that future studies should attempt to more carefully identifiy and quantify these errors. Currently-used gravimetric methods are very unsatisfactory, and so are the very subjective visual indexes which are sometimes used. Because squid stomach contents are often largely particulate matter in liquid, it was suggested that filtering or drying the contents might be a useful approach. Future studies would benefit substantially from work on rates of gut evacuation and from the marrying of food and feeding studies to energetics. The impact of cannibalism remains very unclear and requires careful study if its importance is to be determined. The greatest progress is likely to result from combined field and laboratory studies.

It was clear that currently-used male maturity indexes are inadequate, particularly the criteria for full maturity, and that a more useful basis for measuring maturity may be the number of spermatophores in Needham's sac. Even this criterion would require further evaluation, because the "accidental" release of sperm and/or spermatophores has been observed under conditions of stress. At the same time, the maturity scales used for females appear to be fully appropriate for field and laboratory studies, because they cover all the periods of ontogenesis, spawning and spent stages inclusively. The reproductive-ecological scale of life cycles for *I. illecebrosus*, as worked out, can serve as the basis for comparative ecological studies at the specific and interspecific levels.

Chemical marking techniques were shown to provide excellent agreement between the number of growth increments in statoliths and time in elapsed days from marking. The feeding regime does not appear to affect ring deposition, and it is hypothesized that deposition may be controlled either by photoperiod or some intrinsic mechanism. The apparent relationship between the length of statoliths and age of *I. illecebrosus* (number of rings in statoliths) may allow use of this criterion, after additional vertification, as a more rapid method of ageing. Further work is needed to develop a means of effectively relating statolith age data to more readily measurable field data (i.e. mantle length).

A few papers dealt with the biology of *Loligo pealei*. These studies related primarily to aspects of food and feeding and general aspects of the ecology of the species. Of special interest was a yield analysis for *L. pealei* of the northeastern United States. Relative to *I. illecebrosus*, little significant new biological information on *L. pealei* was presented. The ecological relationship between *I. illecebrosus* and *L. pealei* represents an important problem area which requires further sceintific investigation.

3. Objectives for Future Work

The findings of papers presented at the Special Session and their discussion allowed the formulation of several main objectives for future investigations of *I. illecebrosus*. The principle and ultimate objective is to determine the major regularities in abundance fluctuations on the basis of comprehensive studies of variability in abiotic conditions (mostly water dynamics) and in the life history of squid. The second objective, closely connected with the first, is to study the role of *I. illecebrosus* in the trophic structure of the ocean throughout its entire life cycle, with due regard to the diversity and specific features of feeding areas. This can be tackled only by conducting simultaneous work throughout the range of the species in the Northwest Atlantic under a coordinated program. The latter implies establishing a uniform method of collecting and processing field material. Additionally, the need to ensure close interrelationship between field and experimental studies, such as those conducted in the aquatron, should be emphasized.

4. Other Related Matters

The participants noted the proposal of the Scientific council that the Secretariat microfiche the ICNAF and NAFO meeting documents and expressed their support for this action. Non-governmental researchers, in particular, felt that this would greatly enhance the availability of much of the rapidly developing information on *Illex* and *Loligo* which these documents may contain.

In response to a request from the Guiding Group of Experts on the IOC (Intergovernmental Oceanographic Commission) Program of Ocean Science in Relation to Living Resources (OSLR), the participants were requested to "consider the value of an OSLR/International Recruitment Project-oriented Program in elucidating the problems involved in recruitment variability in the squid stocks". The participants saw positive benefits from such a program. Additionally, STACFIS considered the question of recruitment to be crucial for the management of squid stocks and noted that any increase in knowledge of factors which lead to the production of strong or weak year-classes would greatly assist in the provision of advice on squid management. STACFIS requested the Conveners of the Special Session to communicate these views to the IOC.

5. Papers Presented

Research documents considered at the Special Session were SCR Doc. 84/IX/97, 98, 99, 100, 101, 102, 103, 104, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, and two oral presentations were made. With regard to the possible publication by NAFO of the papers presented at the Special Session, the participants agreed that the papers should be published in a single volume. STACFIS accordingly

recommends

that STACPUB consider the matter of publication of the papers presented at the Special Session.

II. STOCK ASSESSMENTS

1. Catch and Spawning Biomass Projections for Cod in Subdivison 3Ps

Further to the assessment of this stock at the June 1984 Meeting, STACFIS undertook to meet the EEC request by examining a wider range of options than was provided earlier. Input parameters, in terms of population numbers, catch in 1983, average weights and partial recruitment factors were the same as those used previously. Also, estimates of recruitment at age 3 were the same as used earlier (81 million fish for the 1981 year-class and 55 million fish for the 1982 and 1983 year-classes).

Spawning biomass was determined by applying an average maturity-at-age ogive from Canadian survey data for 1980-84 and estimates of average weight at the beginning of the year (SCR Doc. 84/IX/122). Weight at age *n* at the beginning of the year was derived by taking the geometric mean of midyear weights at age *n-1* and *n*. Maturity-at-age data were also available from French surveys in Div. 3Ps. The results differed from those of the Canadian surveys, mainly for ages 4-6. The difference in estimation of the spawning biomass by the two ogives was approximately 8%, with the estimate for the French data being higher. Because a target spawning biomass has not been established and the present estimates serve mainly for illustration, only the maturity ogive from the Canadian surveys was used for the projections. The maturity-at-age and weight-at-age values are as follows:

Age (years)	3	4	5	6	7	8	9	10	11	12	13	14
% mature (French data)	1	12	39	73	91	96	98	99	99	100	100	100
% mature (Canadian data)	-	3	28	63	88	97	99	100	100	100	100	100
Average weight (kg)	0.40	0.63	1.01	1.54	2.12	2.75	3.55	4.63	5.99	7.56	8.87	9.93

Projections of catch in 1985 and spawning stock biomass at the beginning of 1986 for a range of fishing mortality (fully recruited) values in 1985, assuming a catch of 36,000 tons in 1984, are listed in Table 1 and illustrated in Fig. 1. The approximate equilibrium levels of spawning stock biomass for $F_{0.1}$ and F_{max} are indicated by A and B respectively. These were estimated by using average weights and partial recruitment values from SCR Doc. 84/VI/23, recruitment at age 3 of 55 million fish, and an age-span of 3-14 years.

Table 1. Cod in Subdiv. 3Ps: projected catch in 1985 and spawning biomass at beginning of 1986 for a range of fishing mortality (F), assuming a catch of 36,000 tons in 1984.

Parameter	Fishing mortality (F)						
	0.10	0.15	0.20	0.25*	0.30	0.35	0.40
Catch in 1985 (000 tons)	22	32	41	51	59	68	76
Spawning biomass (000 tons) (1 January 1986)	214	205	197	189	181	173	167

* F in 1983.

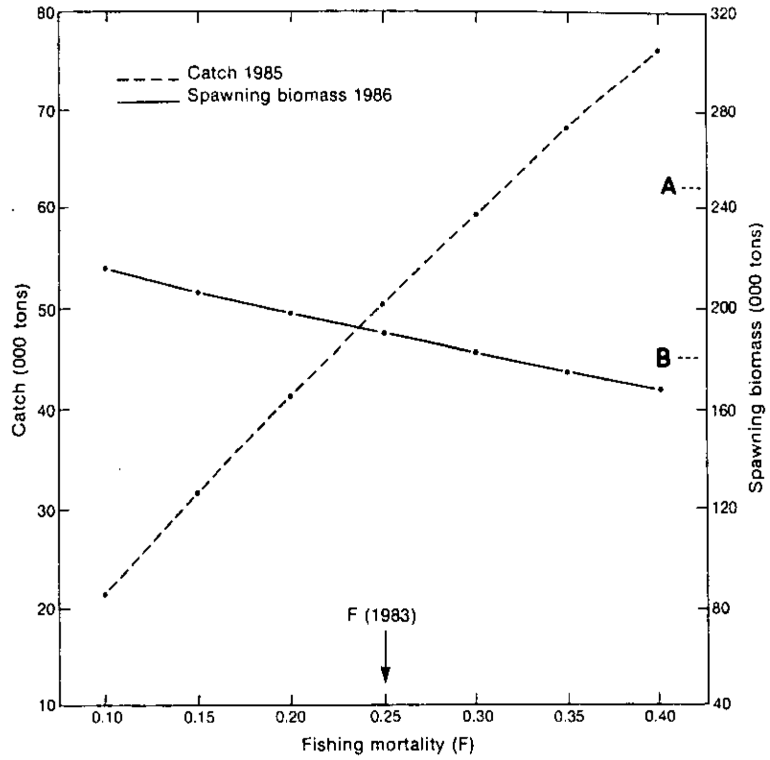

Fig. 1. Cod in Subdiv. 3Ps: projected catch in 1985 and spawning biomass at beginning of 1986 for a range of fishing mortality (F), assuming a catch of 36,000 tons in 1984. (A and B represent the approximate equilibrium levels of spawning biomass for $F_{0.1}$ and F_{max} respectively.)

2. *Ad Hoc* Working Group on STACFIS Assessment Guidelines and Organization of June Meetings

a) Introduction

At its meeting in June 1984, STACFIS was not able to review thoroughly the adequacy of the guidelines for presentation of assessment advice that were adopted in September 1983 (NAFO Sci. Coun. Rep., 1983, pages 125-127). Consequently, a working group was established to carry out this review at the September 1984 Meeting. The Scientific Council added to the Working Group's mandate the task of advising on means of handling the workload of STACFIS at future June meetings, so as to reduce the time required for assessments which involved many unscheduled night sessions in 1984.

The Working Group, with W. G. Doubleday as Convener, met on 7 and 10 September 1984. Participants included J. E. Carscadden, R. G. Halliday, Sv. Aa. Horsted, R. Mahon, J. Messtorff, A. Paciorkowski, A. T. Pinhorn, J. C. Poulard, V. A. Rikhter and D. Tremblay. G. Gomez-Sanchez of Mexico was an observer.

b) Guidelines for documenting STACFIS assessments (see Annex 1)

The descriptions of assessments of the various stocks in the STACFIS reports of meetings in January and June 1984 conformed in general to the guidelines. The intention was to provide adequate descriptions of trends in the fisheries as well as sufficient data, or citations of data, so as to allow reconstruction of the analysis upon which advice was based. While progress was made to achieve these goals, adherence to the guidelines was not always rigorous. The descriptions of trends in the fisheries tended to be rather brief and incomplete, and, in some cases, there were omissions of material necessary for the precise duplicaton of the analysis. There was some lapses from the format required and, in a few instances, citation of the documentation used was inadequate.

Analysis of the reports of the January and June 1984 Meetings indicated that the guidelines were not entirely satisfactory to cover, for example, cases where the advice was not derived from a formal projection of stock size and potential catch. In some cases, the guidelines were considered somewhat ambiguous with regard to description of biological sampling from the commercial fisheries. It was noted that biological and statistical information not relevant to the assessments need not be referred to under the guidelines, because such data are usually dealt with elsewhere in the STACFIS report. Because of the size of the STACFIS report, the omission of the many tables showing catch and average weight matrices, fishing mortalities and population numbers and weights was considered appropriate. However, such tables which form the basis of undertstanding the status of the stock, might conveniently be placed in a STACFIS research document that would be compiled at the time of the meeting. STACFIS accordingly reiterates its proposals of September 1983 (NAFO Sci. Coun. Rep., 1983, page 124), and

recommends

i) *introduction of a standard list of contents for mandatory use by rapporteurs,*

ii) *citation of page references for information and analyses referred to in the STACFIS report, and*

iii) *production of a STACFIS research document at the time of the meeting for all relevant data and final analyses considered but not included in the STACFIS report or in other published form.*

c) Organizaton of the June Meeting of STACFIS

The demanding STACFIS agenda for June 1984 could not be fully addressed in the alloted time. Consequently, several late evening sessions were held. Repeated evening sessions added to the fatique of daily meetings and created an excessive burden on participants. Consequently, STACFIS saw the need to make more efficient use of available meeting time at future June meetings.

The Working Group noted several possibilities to accelerate the work of STACFIS without compromising the quality of its advice, namely more systematic preparation for the meeting would ensure that needed data were available at the start of the meeting, more structured debate with previous advice of the Committee as a point of reference would avoid repetition of unproductive analysis, and concurrent consideration of stocks would permit more rapid resolution of the many time-consuming questions of technical details of assessments. Accordingly, STACFIS agreed to the following measures to improve the efficient use of its time at future June meetings:

i) In consultation with designated experts, the Chairman of STACFIS should write, in advance of the meeting, to experts concerned with the various stock assessments, requesting them to bring specified data with them to the meeting. This does not preclude the presentation of additional relevant data.

ii) The Chairman of STACFIS should establish two *ad hoc* working groups for the duration of the June meeting. These working groups should carry out the detailed assessments for (a) cod and (b) other species, reporting their progress daily to STACFIS and requesting guidance on matters which they cannot resolve themselves. STACFIS should permit its members to draw attention to serious deficiencies in working group assessments but should not be a forum for debate of assessment details. The latter should be dealt with in the working groups.

iii) The previous year's advice of STACFIS should serve as the point of reference for discussion of new data and analyses. An early decision should be taken on the justification for pursuing proposed initiatives for analyses different from those used in previous assessments.

III. ENVIRONMENTAL RESEARCH

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

The *Ad hoc* Working Group, established at the June 1984 Meeting to identify ways in which the Environmental Subcommittee can further develop knowledge of this topic, met on 10 September 1984, with the following attendees: K. Drinkwater, R. Halliday, M. Ingham and A. Pinhorn.

STACFIS agreed with the Working Group that understanding the causes of recruitment variability is recognized as perhaps the fundamental problem in fisheries research at this time. Nevertheless, problems relating to environmental effects on migration and distribution can also be of importance to aspects of the Council's work, and additional research attention appears merited. This need not necessarily detract from ongoing efforts which are devoted to recruitment studies.

Documentation presented at the June 1984 Meeting, and the ensuing discussion, identified a wide variety of environmental effects on migration and distribution, but most interest focussed on delineation of stock boundaries and on variation in availability. It was found to be easier .to list specific problems of direct and immediate interest to the stock assessment and fisheries management process under the heading of availability than stock delineation. Thus, problems relating to availability present the greater opportunity for focussing research attention and achieving progress in understanding environmental effects.

STACFIS agreed that the Council should encourage contributions which evaluate the nature and importance of environmentally-induced variation in availability relevant to stock assessment and fishery management matters. One useful way would be the production of a bibliography of historical studies on availability problems in the Northwest Atlantic, and it was suggested that the Council request the Assistant Executive Secretary to do this for the June 1985 Meeting. Another way would be the production of a tabulation of availability-related problems currently being faced in the stock assessment and advisory work in the Northwest Atlantic, and the Chairman of STACFIS was requested to compile such a report for the June 1985 Meeting, based on solicited contributions from scientists involved in NAFO stock assessment work, from the Canadian Atlantic Fisheries Scientific Advisory Committee, and from the U.S. National Marine Fisheries Service, Northeast Fisheries Center. Contributions would be based on stock assessment experiences in 1984. It was noted that a further suggestion to include an item on "environmental factors affecting availability to survey gear" in the agenda for the Special Session on Biological Surveys had already been considered by the Convener of the Sesson on Biological Surveys (see Section VI.1.c).

2. Chairman of Environmental Subcommittee

The nomination of M. Stein, Federal Republic of Germany, as Subcommittee Chairman was unanimously approved by STACFIS, and the Chairman of STACFIS agreed to notify Mr. Stein of his appointment to this position.

3. Flemish Cap Research

A research document relevant to the Flemish Cap Project (SCR Doc. 84/IX/95) was deferred until the June 1985 Meeting.

IV. AGEING TECHNIQUES AND VALIDATION STUDIES

1. Ageing of Roundnose Grenadier

A verbal report was presented by J. Messtorff (EEC) on age determination of roundnose grenadier (*Coryphaenoides rupestris*) from scales. The ageing method was demonstrated by a selection of color slides which showed the growth scales as they appear after impregnation with silver nitrate and being photographed or viewed under polarized light (SCR Doc. 80/VI/92). The growth zones showed up very clearly and distinctly. The same method is applied for ageing redfish by scientists of the Federal Republic of Germany. The scale samples were provided by W. Mahnke (German Democratic Republic) from the scale and otolith exchange program for comparing results of age determination by different methods and readers.

V. REVIEW OF OTHER SCIENTIFIC PAPERS

1. Zooplankton and Larval Herring Relations in Eastern Gulf of Maine (SCR Doc. 83/VI/66)

This document summarized the results of a larval herring survey in 1982, with emphasis on relations between copepods and herring larvae. The results showed that larval herring fed mainly on immature calanoid copepods, and that they were not feeding at an optimal rate because density of available food was low. The authors recommended that further efforts be devoted to determining age-specific mortalities and relative condition of larvae sampled over a specific egg-bed, together with estimates of larval drift, in assessing spawning success of coastal stocks of herring.

2. Larval Herring Surveys in Maine and New Brunswick Waters (SCR Doc. 83/IX/67)

This document presented results on the distribution and drift of larval herring off Maine and New Brunswick in 1982. Analysis of data showed a concentration of larvae in the western sector throughout the survey from October to December 1982. The location of recently-hatched larvae seemed to be more closely related to the currents retaining them than to the exact positioning of egg-beds. Three cohorts of larvae were caught in the autumn of 1982, two of which were presumably hatched late. The authors plan to continue to monitor larval abundance and to determine the patterns of larval distribution and dispersal in eastern Maine coastal waters.

3. Fecundities of Herring Spawning Populations in Gulf of Maine (SCR Doc. 83/IX/68)

Length-specific fecundities were estimated for mature female herring which were obtained from sampling of commercial catches along the Maine coast in 1982. No significant differences in fecundity between groups were found, indicating that spawning groups in the Gulf of Maine stock could not be differentiated by means of fecundity. By comparing historical fecundity-at-length data, the authors suggested that fecundity increases as spawning stock size declines. STACFIS observed that it would have been interesting to see maturity-at-age data, together with maturity-at-length, because it has been shown that depleted herring stocks tend to mature at earlier ages.

4. Co-occurrence of Cunner and Cod in a Temperate Fish Assemblage (SCR Doc. 84/VI/10)

Diving observations on cunner (*Tautogolabrus adspersus*) and cod (*Gadus morhua*) schools were made off Block Island, Rhode Island, USA, in July 1983. The behavioral observations indicated that heterotypic fish aggregations are an adaptive predator avoidance strategy. The occurrence of these aggregations is probably opportunistic, because the local distribution of cunner and cod does not overlap and because size-class differences preclude the formation of such aggregations. The heterotypic aggregations also may have the effect of reducing daily natural mortality rates.

5. Maximum Age of Cod in Subareas 2 and 3 (SCR Doc. 84/VI/46)

From about 400,000 age determinations of cod during 1940-83 in Subareas 2 and 3, only 8 specimens were older than 26 years. On examination of catch curves, it appeared that age 15 and older cod experienced a total instantaneous mortality of about 0.20 higher than younger cod, and the increase was considered by the author to reflect higher natural mortality upon these age-groups. STACFIS noted that the interpretation of the catch curves might be affected by the progression of dominant age-groups in the series and by any trend in the degree of error in interpreting ages.

6. Growth of Cod in Divisions 2J, 3K and 3L, 1971-83 (SCR Doc. 84/VI/90)

In the 1970's, substantial increases in growth of cod occurred in Div. 2J and 3K and more modest increases in Div. 3L. For Div. 2J and 3K, however, mean lengths of age-groups 7, 8 and 9 decreased in the 1980's. The possible effects of environmental changes upon growth were not discussed. It was noted that the biomass of cod in this area declined markedly from 1962 to 1976 and then showed a similarly rapid increase to 1980 and probably to 1982. Density-dependent growth is therefore a distinct possibility. STACFIS noted that this decrease in growth may well continue as the population biomass increases and may have the effect of decreasing the estimates of long-term sustainable yield.

7. Stomach Contents of Atlantic Wolffish in the Northwest Atlantic (SCR Doc. 84/VI/12)

Stomach contents of Atlantic wolffish (*Anarhichas lupus*), collected in the Northwest Atlantic from West Greenland to the Scotian Shelf, were summarized according to the proportion by volume of each food item as well as frequency of occurrence of the items. Invertebrates and fish comprised 85% and 15% of the food respectively. The most important invertebrates were molluscs (especially whelks and Icelandic scallops), echinoderms (particularly brittle stars and sea urchins) and crustaceans (mainly crabs). Redfish formed the predominant fish food. Molluscs increased and echinoderms decreased with increasing size of wolffish.

8. Estimates of Discarding by the Newfoundland Offshore Fleet in 1982 (SCR Doc. 84/VI/28)

Estimates of discards by the Newfoundland offshore fleet were obtained by observers on some of the vessels. These estimates indicate only approximate levels of discards, because it was not possible to weigh the discarded fish but merely to estimate by eye the proportions being discarded. Discards were lowest for the cod, redfish, shrimp and witch flounder fisheries, intermediate for the yellowtail flounder and Greenland halibut fisheries, and highest for the American plaice fishery.

9. Comparative Morphology of Preextrusion Larvae of Sharp-beaked Redfishes (SCR Doc. 84/VI/84)

Morphometric, meristic and pigmentation characteristics were recorded for late-stage preextrusion larvae taken from too adult *Sebastes mentalla* and from adult *S. fasciatus* from Subdiv. 3Ps. The adults were identified to species by gasbladder musculature criteria. Discriminant analysis correctly classified up to 95% of the larvae examined. STACFIS noted that the low number of adults, from which larvae were obtained, was a limiting factor in applying the criteria to larval identification in general. Also, examination of larvae at different postextrusion stages to determine separation criteria is necessary because morphometrics and pigmentation may change as the larvae grow. Further studies along this line are encouraged.

10. Food Energy of Major Commercial Species in Georges Bank Region (SCR Doc. 84/VI/42)

The paper analyzed food habits of pelagic, near-bottom and bottom species of fish on Georges Bank and in adjacent waters in relation to the formation of biomass of these groups of fish. The analysis showed that over half of the total fish stock in the surveyed area is formed at the expense of plankton food resources, about 25% of fish biomass is at the expense of nekton organisms, and only 14% through benthos.

11. Fat Content of Muscles, Gonads and Liver in Silver Hake and Red Hake (SCR Doc. 84/VI/43)

The paper analyzed the relationships between fat content of muscles and gonads and weight of liver in silver hake (*Merluccius bilinearis*) and red hake (*Urophycis chuss*) which were caught in winter on the shelf off Southern New England (Hudson Canyon). It was found that fat content was proportional to weight of liver. Equations are given that permit calculation of fat reserves in the fish by using weight of the liver.

12. Distribution of Larval Short-finned Squid in the Northwest Atlantic (SCR Doc. 84/IX/123)

A joint survey for short-finned squid (*Illex illecebrosus*) was conducted by Japan, Canada and USA during January-March 1982 aboard the Japanese research vessel *Kaiyo Maru*. Based on the data collected during the survey, geographical and vertical distributions of larvae were reported. Larvae were widely distributed in areas between 72°W and 59°W, where temperature of the surface water was higher than 13°C, and were most abundant in the water layers above the thermocline along the northern edge of the Gulf Stream. Larval transport by the Gulf Stream and timing and location of spawning were discussed.

13. Portable Fish Measuring Station (SCR Doc. 84/VI/89)

A portable fish measuring board was demonstrated. A record is automatically entered on magnetic tape when the board is activated by a magnetic probe which can be incorporated into the handle of a fish-cutting knife. There is provision for the accumulation of additional data such as sex, maturity, etc. The board is described as portable, rugged and waterproof and has been tested under field conditions.

VI. OTHER MATTERS

1. Special Session on Design and Evaluation of Biological Surveys in Relation to Stock Assessments, September 1985

STACFIS agreed to the program by the convener (J. Messtorff) as follows:

a) Survey design and operation
   - i) Stratified-random groundfish surveys (standard bottom trawls)
   - ii) Surveys designed for pelagic species (hydroacoustic surveys, midwater trawl surveys, aerial surveys)
   - iii) Surveys of commercially-exploited invertebrates (e.g. photographic surveys and trap surveys)
   - iv) Surveys of marine mammals (e.g. aerial surveys)
   - v) Surveys of early life stages of fish and invertebrates (e.g. eggs, larvae, juveniles) for stock assessment purposes

b) Survey gear, performance and possible effects on catchability
   - i) Determination of gear parameters
   - ii) Variability of parameters according to towing speed, bottom conditions and topography, currents, etc.

c) Environmental factors affecting variation in catchability of survey gears

d) Evaluation of survey data
   - i) Survey indices
   - ii) Abundance and biomass estimates
   - iii) Reliability of survey estimates

e) Importance and value of survey data to stock assessments

STACFIS requested the convener and the Secretariat to collaborate on the preparation and distribution of the usual announcement for the Special Session as soon as possible after this meeting.

2. Possible Need for Further Workshop on Ageing Shrimp (SCS Doc. 84/VI/11)

It was agreed at the Shrimp Ageing Workshop in 1981 that research into age and growth of shrimp should continue and that another workshop be held in 2-3 years to review progress (NAFO Sci.

Coun. Studies, No. 6, page 97). At the January 1984 Meeting of the Scientific Council, STACFIS reviewed the proposals from the first workshop in 1981 and recommended that the participants of the 1981 Workshop be contacted to see if there has been sufficient progress to warrant another session and that a report of the survey be made available at the June 1984 Meeting. During February-April 1984, a letter containing the proposal was sent to participants in the 1981 Shrimp Ageing Workshop and to others as information became available on their interest in ageing shrimp. Several responses to this letter were received and documented. Although only a few laboratories are actively engaged in research on ageing shrimp, there was some interest in another workshop, but the general consensus was that more time was required. STACFIS agreed that hosting another shrimp ageing workshop within the next year would be premature. However, STACFIS considered that this research is important, and accordingly

recommends

that participants in the 1981 Shrimp Ageing Workshop be contacted in approximately 2 years (January 1986) to see if there has been sufficient progress to warrant another Shrimp Ageing Workshop.

3. Request for Advice on Seals (SCS Doc. 84/IX/26)

STACFIS noted that the NAFO Secretariat had received a joint request from Canada and EEC for advice from the Scientific Council on the scientific basis for management of harp and hooded seals. The Committee noted that the deadline of 15 February 1985 for delivery of the advice would permit the joint request for advice on seals to be considered by STACFIS at the same time as the shrimp stocks are being considered (i.e. 16-22 January 1985). STACFIS also noted an invitation from the Greenland Fisheries and Environmental Research Institute in Copenhagen to host the meeting together with the shrimp meeting.

VII. ACKNOWLEDGEMENTS

The Chairman expressed his appreciation to T. W. Rowell and Ch. M. Nigmatullin who convened the Special Session on Squids, to W. G. Doubleday who convened the *ad hoc* Working Group on Assessment Guidelines and Organization of June Meetings of STACFIS, to the rapporteurs and participants for their cooperation during the various sessions, and to the Secretariat staff for their support during the meeting.

ANNEX 1. REVISED GUIDELINES FOR REPORTING STACFIS ASSESSMENTS

1. Introduction

The "Introduction" should review in detail the fishing activity in the most recent years, putting recent events in the context of trends over the most recent decade. Ancillary information not explicitly used in the assessment should be documented in this section.

a) Description of fishery

- dates and location
- changes in area fishing during the year
- composition of fishing fleets
- gears
- regulations affecting gear, by-catch, etc.

b) Nominal catches

- historical nominal catches and TACs for the last 10 years must be included in the STACFIS report
- monthly breakdowns of nominal catches by gear and/or country may be referenced in the STACFIS report but should not normally be presented in full there

c) Anecdotal information relevant to the assessment

2. Input Data

Both the data used in the assessment and the methods by which the results are calculated should be documented in the STACFIS Report or in page references to cited literature. The survey designs, sampling methods, grouping and other combindation of data must be unambiguously described. The years and weighting factors used in averaging data should be stated.

a) Commercial fishery data

- fishing effort and CPUE
- length and age composition
- biological information useful for assessments: sex ratios, maturity stages, stomach contents and parasites
- discarded catches: weight and length distribution
- by-catches: weight and length distribution by species

b) Data from research surveys

- distribution, movements and migrations
- tagging experiments
- abundance estimates: trawling, acoustic and photographic surveys
- other research surveys: recruit-prerecruit (eggs, larvae, 0-group) and experimental fishing
- selectivity studies
- length and age compositions
- biological data: sex ratio, maturity, fecundity, food and feeding, multispecies association, parasitism, ecological data (communities, ecosystems, etc.)

c) Environmental data

- temperatures, salinities and clines
- winds and currents
- ice conditions

3. Estimation of Parameters

In all cases, the underlying mathematical model must be stated or cited. The method of estimation (e.g. unweighted least squares regression) must be unambiguously stated or cited, together with the input data (see Section 2 above).

a) Sequential population analysis (SPA)

- partial recruitment values
- natural mortality (and any immigration or emigration rates)
- fishing mortality (F) for the last year and oldest age
- correlations of various assessment parameters with survey data and other independent estimates of abundance (commercial catch rates, survey catch rates, survey biomass estimates, etc.)

b) General production model

- model parameters and standard errors

c) Growth curve

- model parameters and standard errors

d) Yield-per-recruit

- partial recruitment values
- natural mortality rates
- weights-at-age
- other model parameters

e) Pooling of abundance estimates

- formula used and weighting factors
- resulting index

f) Mark and recapture estimates

- mortality rates of marked animals
- catchabilities of marked and unmarked animals
- rates of tag loss, immediate and long-term
- mixing of marked and unmarked animals
- non-reporting of tags
- stock abundance

4. Assessments Results

Detailed results of assessment calculations must be reported in research documents or in the STACFIS Report. Where results may be of direct interest to commissioners, they should be summarized in tabular and/or graphical form, where feasible, in addition to the detailed tables. Final tabular data calculated by STACFIS, which is too voluminous for inclusion in the STACFIS report, must be included in a STACFIS research document.

a) Sequential population anlaysis (SPA)

- population numbers at age
- fishing mortality at age
- biomass at age
- total biomass and biomass of exploitable stock (specify date)
- recruiting year-classes: numbers and calculations of geometric mean, if required, for prognosis input

b) Yield-per-recruit

- specific fishing mortalities (F_{max} and $F_{0.1}$)
- yield per recruit and exploitable biomass per recruit for a systematic series of F values including F_{max} and $F_{0.1}$

c) General production analysis

- maximum sustainable yield and fishing effort
- yield at 2/3 MSY effort and associated fishing effort

5. Prognoses

Relevant conclusions, projections and general prognoses should be clearly stated, and without reference to technical terms, whenever possible.

a) General biological information

- future implications of observed trends in catches and catch rates
- implications of biological information regarding year-class size, exploitatiion rates and stock abundance at present and in future
- implications of observed trends in fishing effort, fleet composition, etc., on future exploitation rates
- implications of research data regarding recent exploitation rates and current and future stock abundance

b) General production model

- current fishing effort in relation to MSY effort and 2/3 MSY effort
- projected catch at MSY effort and 2/3 MSY effort

- implications of model calculations (e.g. strong recruitment forecasts from young-fish surveys)

c) Catch projections

- table of input parameters

Age	Number (initial year)	Catch or F (initial year)	Weight (initial and subsequent years)	Partial Recruitment

- natural mortality rate (input)
- F or catch for projected years (input)
- recruitment for projected years (input)
- table of catch-at-age by number and weight for each year
- table of population-at-age by number and weight for each year
- total catch in weight
- total population biomass (and other biomass estimates, as relevant)
- average fishing mortality rate by year (specify weighting scheme)

6. Other Regulatory Measures

This section should document the basis for advice formulated on regulatory measures such as mesh sizes and seasons. Quotation and citation of input data, parameter estimates and conclusions should be consistent with the guidelines of Sections 2-5 above, with appropriate adaptation where needed.

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

Chairman: J. Messtorff

Rapporteur: Sv. Aa. Horsted

The Committee met at NAFO Headquarters in the Bedford Institute of Oceanography, Dartmouth, and at the Lord Nelson Hotel, Halifax, Nova Scotia, Canada, on 8 and 11 September 1984. Members attending one or both sessions were J. Messtorff (Chairman), R. G. Halliday and A. T. Pinhorn (Canada), Sv. Aa. Horsted (EEC), and H. Hatanaka substituted for S. Kawahara (Japan). J. E. Carscadden substituted for A. T. Pinhorn at the first session. The Executive Secretary (J. C. E. Cardoso) and the Assistant Executive Secretary (V. M. Hodder) attended both sessions.

1. Review of Scientific Publications Since June 1983

At its meeting in June 1984, the Committee reviewed the scientific publications since June 1983, and reference is made to the report of that meeting (SCS Doc. 84/VI/23, app. III). Further information was given by the Assistant Executive Secretary at the present meeting.

a) Journal of Northwest Atlantic Fishery Science

i) Volume 4 (Guide to the early stages of marine fishes in the western North Atlantic, Cape Hatteras to the southern Scotian Shelf, by M. P. Fahay) has received very wide and positive critique and was selling very well outside the usual group of subscribers to NAFO publicaitons.

ii) Volume 5(2) is in preparation, with nine contributions having been reviewed and accepted. This volume is expected to be ready for distribution before the end of the year. It was noted that 15 other contributions are under review for future issues.

b) NAFO Scientific Council Studies

Number 7 was completed in August 1984 and has been circulated.

c) NAFO Scientific Council Reports

Provided that no further meetings of the Scientific Council will take place during 1984, the reports of the meetings in January, June and September are likely to be published and circulated by the end of the year.

d) NAFO Statistical Bulletin

Volume 32 for 1982 has been further delayed due to the need for catch statistics from some joint-venture fishing to be finalized. It is hoped that the volume will be ready for circulation by November 1984.

Catches from joint-venture arrangements in 1981 also added further complications to the revision of the Statistical Bulletin for that year. The recommended revision and issue of complete revised editions of Statistical Bulletin for the years 1977-81 was discussed. It was noted that, if the necessary funds were available, it would be possible to issue four of these volumes in 1985, whereas one (for 1980) was expected to be issued in 1984. Holding the view that the revision and issue of these volumes should be made as soon as possible to avoid misleading statistics being used over a long period, the Committee

recommends

that the Executive Secretary take the necessary steps to make funds available for revision, publication and distribution in 1985, if possible, of four out of five volumes of Statistical Bulletin for the years 1977-1981.

The Committee noted that the corrected data are available as computer printout upon request to the Secretariat pending the publication of the revised volumes.

e) List of Fishing Vessels, 1983

Reports have now been received from 14 countries and some further reports are expected during the present meeting. The Assistant Executive Secretary anticipated that the list would be ready for circulation by the end of the year or early in 1985.

f) Index and List of Titles of Meeting Documents

The provisional list for 1984 could be available early next year, but, since this list would be the last part of the 5-year index for 1980-84, it is proposed that the 5-year index of meeting documents be compiled and issued in early 1985 (probably March). It was decided that the volume, labelled NAFO, would be issued as No. 4 so as to continue the series (No. 1-3) issued under the aegis of ICNAF. An index and list of titles of Journal and Studies papers for 1980-84 will be prepared as a summary document for the June 1985 Meeting.

g) Sampling Yearbook

All indexes of samples covering the two 6-year periods (1967-72 and 1973-78) were now compiled. The Committee decided that the indexes should be published as one volume rather than two.

2. Editorial Policy Regarding Scientific Council Publications

a) Editorial Board for the Journal

i) As agreed by the Committee at its June 1984 Meeting, the Assistant Executive Secretary had been in contact with some scientists that were proposed as possible candidates for Associate Editor for Invertebrate Fisheries Biology. Dr. G. P. Ennis (Canada) was willing to accept the nomination, and the Committee

recommends

that Dr. G. P. Ennis (Canada) be appointed Associate Editor of the Journal of Northwest Atlantic Fishery Science for contributions on Invertebrate Fisheries Biology.

ii) By letter of 21 June 1984, the Editor of the Journal (V. M. Hodder) announced that, after 1984, he would no longer be able to undertake the voluntary job as Editor in addition to his many duties as Assistant Executive Secretary.

The Chairman expressed the Committee's understanding and its regret of this decision and thanked Mr. Hodder for his great effort and his success in ensuring a widely-recognized scientific publication of high standard. The Committee agreed that for practical reasons the editor should preferably be from a place where he could maintain close (and cheap) contact with the Secretariat. About a dozen names were brought forward as possible candidates for a new editor. The Chairman will contact these people to obtain their views, and the Committee will discuss the matter at its meeting in June 1985. Until then, Mr. Hodder is willing to continue as editor.

b) Review of Guidelines and Terms of Reference for Editors and Associate Editors

The Committee reviewed the guidelines as set out in Annex 1 of the report of the June 1981 Meeting of STACPUB (NAFO Sci. Coun. Rep., 1981, page 77). Taking into account that in the near future the Editor may not be the same person as the Assistant Executive Secretary, who implements the Scientific Council's publication policy, the third sentence in Annex 1 should therefore be revised to read "The Editor will be responsible to STACPUB for implementation of Scientific Council editorial policy". Consideration of Annex 2 (Terms of reference for Journal editors) was deferred to the June 1985 Meeting of the Committee.

3. Production of Microfiche

The Executive Secretary reported that, as recommended by STACPUB in June 1984, he had included the necessary item for production of 30 sets of microfiche copies of ICNAF scientific documents in his budget estimates for 1985 to be considered by STACFAD at the present Annual Meeting of NAFO. In his presentation of the budget estimates, the Executive Secretary would underline that these funds were a short-term investment and would be returned within 2-3 years by the sale of microfiche sets. Positive response from laboratories interested in the microfiche would probably increase as the charge for a full set of the microfiche was now estimated to be about 750 dollars (Can.).

4. Papers for Possible Publication

The Assistant Executive Secretary reported that, following the decision of the Committee at its June 1984 Meeting, SCR Doc. 84/VI/34, 65 and 87 on 0-group silver hake surveys were now being combined intc a joint analysis by the authors, and SCR Doc. 84/VI/79 and 88 were being revised but as separate papers. SCR Doc. 84/VI/70 (review of oceanic environmental conditions during 1983), consideration of which was deferred to the present meeting of the Committee, was discussed, and it was agreed that this paper should be published in Scientific Council Studies.

The Committee reviewed the scientific papers submitted to the present meeting of the Scientific Council, including papers for the Special Session on squids. The Committee agreed that the authors of the following documents should be invited to submit suitably revised manscripts for possible publication: SCR Doc. 84/IX/97, 99, 100, 101, 102, 103, 104, 106, 108, 110, 111, 112, 113, 114, 115 and 118. It was proposed that SCR Doc. 84/IX/98, 107, 109, 116, 119, 120 and 121, and the undocumented contributions by C. F. E. Roper and by D. Webber and R. O'Dor should be circulated to and reviewed by STACPUB members when the completed and/or revised papers become available. SCR Doc. 84/IX/117 should be revised by the author to the satisfaction of the conveners of the Special Session before its possible publication. It was noted that SCR Doc. 84/IX/123 was already submitted for publication in one of the NAFO series. Because this paper considers research on squids, the Committee agreed that the paper should preferably be published in the special volume together with the other squid papers.

The Committee noted that, although some of the papers submitted to the Special Session on squids would not normally be considered for publication by themselves, a special volume of Studies containing all or nearly all contributions to the Special Session could be considered. Such a special volume should have an introduction and review of sections by topics. The Conveners of the Special Session should be invited to cooperate with the Editor in the preparation of such a volume. It was decided that the deadline for submission of papers to be referred for further consideration by STACPUB members would be 30 November 1984, whereas the deadline for submission of revised manuscripts already nominated for publication by the Committee would be the end of the year.

Consideration of SCR Doc. 84/IX/95 and 105 was deferred to the June 1985 Meeting of the Committee, while the Assistant Executive Secretary would receive comments on SCR Doc. 84/IX/96 by STACPUB members after this paper has been presented later on in STACFIS at the present meeting of the Scientific Council.

5. Role and Scope of NAFO Scientific Council Studies

Following its proposal at the June 1984 Meeting to review the role and scope of NAFO Scientific Council Studies series at the present meeting, the Committee noted that this publication seems to cover three categories of contributions: (i) papers on a specific topic, e.g. papers presented at symposia or special sessions; (ii) manuals such as the Groundfish Survey Manual and review papers such as review of environmental conditions; and (iii) papers selected from those presented to Scientific Council or submitted directly to the editor but not deemed of sufficient scope or of a standard suitable for the Journal of Northwest Atlantic Fishery Science.

Some members expressed concern that Studies was not proving a sufficiently attractive vehicle for authors to publish their papers. Some members indicated that the Special Publication series should be reinstituted for symposia-proceedings type publication. The Committee, however, generally agreed that consideration of this item deserved broader discussion in the most-involved laboratories. It was, therefore, decided to consider this matter further at the June 1985 Meeting of the Committee. The Scientific Council representatives will be reminded of this matter well in advance of the June 1985 Meeting.

6. Acknowledgements

The Chairman thanked all members for their active participation in the meeting and the Secretariat for their efficiency in supporting the Committee's work.

PART D

MISCELLANEOUS

CONTENTS

I. AGENDA FOR SCIENTIFIC COUNCIL MEETINGS, 1984

A. JANUARY 1984 MEETING

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. Shrimp in Subarea 0 and 1[1]

   a) Review of fishery trends
   b) Distribution and biology
   c) Catch and effort
   d) By-catches in shrimp fishery
   e) Biomass estimates
   f) Total allowable catches
   g) Future research needs

2. Shrimp at East Greenland[1]

   (Items (a) to (g) in 1 above)

3. Other Matters

III. Review of Future Meeting Arrangements

1. Regular Meeting, June 1984
2. Annual Meeting, September 1984

IV. Other Matters

1. Future meetings to assess the shrimp stocks

V. Adjournment

B. JUNE 1984 MEETING

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[2])
      - 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)

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[1] The Canadian and EEC requests for advice on management of the shrimp stocks in 1984 were contained in the requests considered at the June 1983 Meeting of the Scientific Council (see NAFO Sci. Coun. Rep. for 1983, pages 137-138).

[2] Also requested by EEC as a stock overlapping EEC and Canadian waters.

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

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) and (7) above

a) Papers deferred from 1983 Meetings (SCR Doc. 83/IX/66, 67, 68)
b) Paper 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. Biological 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 proposal from 1983 meetings
    b) Proposals for possible publication from 1984 and outstanding 1983 documents
5. Other business

V. Collaboration with other Organizations

1. Report of second meeting of NAFO/ICES study group on redfish off Greenland (SCS Doc. 84/VI/2)
2. Twelfth session of CWP at Copenhagen, Denmark, 25 July-1 August 1984 (SCS Doc. 84/VI/13)

VI. Adoption of Reports

1. Provision Report of Scientific Council, January 1984 (SCS Doc. 84/I/1)
2. Committee reports (this meeting)
    a) Standing Committee on Fishery Science (STACFIS)
    b) Standing Committee on Research Coordination (STACREC)
    c) Standing Committee on Publications (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 Stock Assessments", to be held in September 1985
2. Theme for Annual Meeting in September 1986

IX. Adjournment

C. ANNUAL MEETING, SEPTEMBER 1984

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

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

II. Fishery Science (Chairman: J. Carscadden)

1. Special Session on "Biology and Ecology of the Squids, *Illex illecebrosus* and *Loligo pealei*, in the Northwest Atlantic" (Conveners: T. W. Rowell and Ch. M. Nigmatullin)
    a) Early life histories and their relation to oceanic processes
    b) Size distribution and cohort components related to the life cycle
    c) Sexual maturity and growth
    d) Large-scale and micro-scale distributional characteristics in relation to environmental conditions.
    e) Age validation techniques
    f) Predator-prey relationships
    g) Sampling methodology
    h) Biological implications to management
2. Stock assessments
    a) Consideration of further management options for the cod stock in Subdiv. 3Ps, as requested by the EEC in June 1984

b) Working group (Convener: W. G. Doubleday) on evaluation of guidelines for documenting STACFIS assessments (including excessive workload of STACFIS and efficient means of handing future assessments at June meetings)

3. Environmental research

   a) Matters relevant to Flemish Cap Project
   b) Working group on influence of environmental factors on distribution, movements and migration of marine species in the Northwest Atlantic
   c) Appointment of Subcommittee Chairman

4. Ageing techniques and validation studies (deferred from June 1984 Meeting)

5. Gear and selectivity studies (deferred from June 1984 Meeting)

6. Review of some research documents not considered at the June 1984 Meeting (SCR Doc. 83/66, 67, 68; SCR Doc. 84/10, 12, 28, 42, 43, 46, 84, 89, 90)

7. Other matters

   a) Development of topical outline relevant to the theme for the special session in September 1985, namely "Design and Evaluation of Biological Surveys in Relation to Stock Assessments"
   b) Feasibility of holding another workshop on ageing shrimp, based on solicited comments of participants in the 1972 Workshop

III. Research Coordination

1. Future consideration of reporting requirements for sampling data of 1979 and subsequent years (SCS Doc. 84/23, App. II)

IV. Publications (Chairman: J. Messtorff)

1. Editorial policy regarding Scientific publications

   a) Review of guidelines and terms of reference for editors and associate editors
   b) Appointments of Editorial Board (associate editor and editor)

2. Progress report on microfiche proposal

3. Papers for possible publication

4. Other matters

V. Collaboration with Other Organizations

1. Preliminary report on CWP Session held at Copenhagen, Denmark, 25 July-1 August 1984

VI. Adoption of Reports

1. Standing Committee on Fishery Science (STACFIS) (this meeting)

2. Standing Committee on Publications (STACPUB) (this meeting)

3. Provisional report of Scientific Council Meeting, June 1984 (SCS Doc. 84/VI/23, excluding Appendices)

VII. Review of Future Meeting Arrangements

1. Assessment of shrimp stocks (deferred from June 1984 Meeting and scheduled for 16-22 January 1985 at Copenhagen, Denmark) and seals (joint request by Canada and the EEC)

2. Meeting of Scientific Council and its Committees in June 1985 (tentatively scheduled for 5-20 June at Dartmouth, Canada)

3. Annual Meeting in September 1985 (including special session on "Design and Evaluation of Biological Surveys in Relation to Stock Assessments")

4. Tentative dates for June 1986 Meeting

VIII. Other Matters

1. Provision of scientific advice at mid-term meetings by STACFIS in absence of Scientific Council Chairman and Vice-Chairman

2. Term of office for Subcommittee Chairman

3. Procedure for adoption of agenda at meetings

IX. Adjournment

ANNEX 1. CANADIAN REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1985 OF CERTAIN STOCKS IN SUBAREAS 0 TO 4

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 $F_{0.1}$ 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 biomass at levels of about two-thirds that of the virgin stock.

L. S. Parsons
Assistant Deputy Minister for Atlantic Fisheries
Department of Fisheries and Oceans
Ottawa, Canada

ANNEX 2. EEC REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1985 OF CERTAIN STOCKS IN SUBAREAS 0 AND 1

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 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.

E. Gallagher, Director General
Directorate General for the Fisheries
Commission for the European Communities
Brussels, Belgium

II. LIST OF RECOMMENDATIONS AND PROPOSALS, 1984

A. SPECIAL MEETING, JANUARY 1984

1. Research Requirements for Shrimp in Subareas 0 and 1 (page 15)

a) Stratified-random trawl surveys should be conducted on a seasonal basis for a number of years to determine seasonal changes in distribution and abundance.

b) Annual photographic surveys should be continued with efforts to improve the model and to redefine size categories of shrimp.

c) The observer program should be continued.

d) Countries participating in the shrimp fishery should continue efforts to ensure that fishing vessel logbooks are completed and copies made available to scientists as soon as possible.

e) A study should be undertaken to determine the relative efficiency of gear types used in the Davis Strait shrimp fishery in recent years, in an attempt to quantify the effects of recent changes in gear on CPUE indices.

2. Research Requirements for Shrimp in Denmark Strait (page 18)

a) Catch-rate data and biological samples for this stock in its whole area of distribution should be obtained on a year-round basis.

b) Plankton surveys should be carried out to observe the drift of shrimp larvae.

c) A tagging experiment should be conducted to determine the migration patterns of various size groups of shrimp.

d) A study of environmental conditions, including water circulation, should be undertaken in the area.

e) The Icelandic samples collected from 1976 to 1983 should be analyzed in greater detail to determine seasonal changes in maturity.

B. SCIENTIFIC MEETING, JUNE 1984

1. Presentation of STACFIS Assessments and Meeting Workload (page 23)

An *ad hoc* Working Group, with W. G. Doubleday as convener, should evaluate the guidelines for presenting STACFIS assessments and discuss ways of handling the excessive workload of STACFIS, for consideration at the September 1984 Meeting.

2. NAFO/ICES Study Group on Biological Relationships of West Greenland and Irminger Sea Redfish Stocks (page 25)

The Council endorsed the proposals of the Study Group regarding (a) the feasibility of tagging *Sebastes marinus* at some locations along the West Greenland coast, and (b) the development of a multiship research program to observe the drift of redfish larvae from the Irminger Sea to West Greenland.

3. Guidelines for Environmental Research (pages 23, 63)

An *ad hoc* working group should identify ways of developing knowledge on the influences of environmental factors on distribution and movements of marine fishes in the Northwest Atlantic, for consideration at the September 1984 Meeting.

4. Environmental Subcommittee Participation (page 64)

Continuing efforts should be made to increase the attendance of oceanographers at future meetings of the Subcommittee.

5. Theme for Special Session at 1986 Annual Meeting (pages 26, 63, 70)

Recent advances in understanding recruitment in marine fishes of the Northwest Atlantic, with particular emphasis on Georges Bank and Flemish Cap.

6. Updating of NAFO Data Base of Fishery Statistics (page 71)

   The Secretariat should distribute a notice announcing that revisions have been made to the Canadian and United States effort data of Table 5 in Statistical Bulletins Vol. 27-31 (for the years 1977-81), with the offer to provide computer tape or listing of the revised data, pending the reissue of revised editions of these volumes as time and finances permit.

7. Additional Species Items (page 71)

   The Secretariat should take the necessary steps 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: (A) eelpouts (*Lycodes* sp.), (b) a lanternfish (*Notoscopelus* sp.), and (c) penaeus shrimps (*Penaeus* sp.).

8. Standard Forms for Reporting Survey Information (page 75)

   The Secretariat should prepare standard formats for the reporting of information on biological surveys, and the fisheries institutes which conduct biological surveys in the Northwest Atlantic should submit their lists to reach the Secretariat in advance of the June meeting.

9. Index and List of Titles of Meeting Documents and Publications (page 71)

   a) A 5-year index to include all NAFO research and summary documents to the end of 1984 should be compiled and published in early 1985.

   b) A preliminary 5-year index of papers published in the Journal and Studies should be provided as a summary document, as the amount of material was considered insufficient for inclusion in a bound volume.

10. Lists of Sampling Data (page 78)

    Standardized inventories of sampling data for 1967-78 should be published as a single volume as time and finances permit.

11. Editorial Board for the Journal (page 78)

    The Editor was requested to contact potential candidates for the position of Associate Editor for Invertebrate Fisheries Biology and to report his findings at the September 1984 Meeting.

12. Production of Microfiche (pages 25, 78)

    The Executive Secretary was requested to 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.

C. ANNUAL MEETING, SEPTEMBER 1984

1. Guidelines for Documenting STACFIS Assessments (pages 91, 97-99)

   The proposals include (a) introduction of a standard list of contents for mandatory use by rapporteurs, (b) citation of page references for information and analyses referred to in the STACFIS report, and (c) production of a STACFIS research document at the time of the meeting for all relevant data and final analyses considered but not included in the STACFIS report or in other published form.

2. Organization of the June Meeting of STACFIS (page 91)

   a) The Chairman of STACFIS should contact, in advance of the June meeting, the experts concerned with the various stock assessments, requesting them to bring specified data to the meeting; this request does not preclude the presentation of additional relevant information.

   b) The Chairman of STACFIS should establish two *ad hoc* working groups to work concurrently during the time allotted for the assessments. These groups should carry out the detailed assessments of (a) cod stocks and (b) all other stocks, reporting progress daily to STACFIS and requesting guidance on contentious matters. STACFIS should permit its members to draw attention to serious deficiencies in the assessments but should not be a forum for debate of assessment details, the latter being dealt with within the working groups.

3. Influence of Environmental Factors on Marine Species (page 91)

The Secretariat and the Chairman of STACFIS were requested to prepare for the June 1985 Meeting historical and current information on problems associated with environmentally-induced variation in availability relevant to stock assessment and fishery management matters.

4. Chairman of Environmental Subcommittee (pages 83, 92)

The nomination of M. Stein (Federal Republic of Germany) was unanimously approved.

5. Future Workshop on Ageing Shrimp (pages 84, 95)

Participants in the 1981 Shrimp Ageing Workshop should be contacted in aproximately 2 years (January 1986) to see if there has been sufficient progress to warrant another Shrimp Ageing Workshop.

6. Revisions to NAFO Statistical Bulletins (pages 85, 101)

The Executive Secretary was requested to take the necessary steps to make funds available for revision, publication and distribution in 1985, if possible, of four out of five volumes of Statistical Bulletin for the years 1977-81.

7. Reporting Requirements for Sampling Data (page 84)

The Council adopted the pre-1979 procedures and formats for reporting sampling data with some flexibility to follow changes for certain species/stocks.

8. Editorial Board for the Journal

Dr. G. P. Ennis (Canada) was appointed to serve on the Editorial Board as Associate Editor for Invertebrate Fisheries Biology.

9. Publication of Squid Papers

The papers presented at the Special Session on Squids should, after review by the conveners and appropriate revision, be considered for publication in a special volume of studies.

III. LIST OF RESEARCH AND SUMMARY DOCUMENTS, 1984

RESEARCH DOCUMENTS, 1984

SCR Doc.	Serial	
84/I/1	N770	SMEDSTAD, O. M., and S. TORHEIM. Norwegian investigations on shrimp, *Pandalus borealis*, in East Greenland waters in 1983. (9 pages)
84/I/2	N771	SMEDSTAD, O. M., and S. TORHEIM. Norwegian investigations on shrimp, *Pandalus borealis*, off West Greenland in 1983. (7 pages)
84/I/3	N772	PARSONS, D. G., P. J. VEITCH, and G. E. TUCKER. Details of catch, effort and CPUE from the Canadian fishery for shrimp (*Pandalus borealis*) in Division 0A, 1983. (14 pages)
84/I/4	N773	PARSONS, D. G., and G. E. TUCKER. Observations of some biological characteristics of shrimp (*Pandalus borealis*) from the Davis Strait, 1978-81. (18 pages)
84/I/5	N774	CARLSSON, D. M. Data on the shrimp fishery at East Greenland in 1983 compared to earlier years. (12 pages)
84/I/6	N775	KANNEWORFF, P. Biomass of shrimp (*Pandalus borealis*) in NAFO Subarea 1 in 1978-1983 estimated by means of bottom photography. (24 pages)
84/I/7	N776	BISEAU, A., B. FONTAINE, and A. FOREST. Catch, effort and biological data of shrimp (*Pandalus borealis*) in the French fishery off East Greenland in 1983. (17 pages)
84/I/8	N777	HALLGRIMSSON, I., and U. SKÚLADÓTTIR. Some data on the Icelandic catch of shrimp in the Denmark Strait area in 1983. (4 pages)
84/I/9	N778	CARLSSON, D. M. Data on the shrimp fishery in NAFO Subarea 1 in 1982 and 1983. (37 pages)
84/VI/10	N780	AUSTER, P. Aggregations of cunner, *Tautogolabrus adspersus*, and cod, *Gadus morhua*: co-occurrence with a dominant species in a temperature marine fish assemblage. (4 pages)
84/VI/11	N784	BURMAKIN, V. V. Water temperature off Newfoundland and Labrador in 1982. (5 pages)
84/VI/12	N785	TEMPLEMAN, W. Stomach contents of the Atlantic wolffish, *Anarhichas lupus*, from the Northwest Atlantic. (6 pages)
84/VI/13	N786	FEDULOV, P. P., A. I. ARKHIPKIN, E. N. SHEVCHENKO, and T. W. ROWELL. 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. (15 pages)
84/VI/14 (Revised)	N787	McLAIN, D. R., and M. C. INGHAM. Sea surface temperatures in the Northwestern Atlantic in 1983. (9 pages)
84/VI/15	N788	ARMSTRONG, R. S. Bottom temperatures on the continental shelf and slope south of New England during 1983. (7 pages)
84/VI/16	N789	COOK, S. K. Water column thermal structure across the shelf and slope southeast of Sandy Hook, New Jersey in 1983. (6 pages)
84/VI/17	N790	ARMSTRONG, R. S. Variation in the shelf water front position in 1983 from Georges Bank to Cape Romain. (8 pages)
84/VI/18	N796	PRICE, C. A., and P. J. CELONE. Anticyclonic warm core Gulf Stream rings off the Northeastern United States during 1983. (18 pages)
84/VI/19	N791	JOSSI, J. W., and D. E. SMITH. Continuous plankton records: Massachusetts to Cape Sable, N.S., and New York to the Gulf Stream, 1983. (6 pages)
84/VI/20	N793	ATKINSON, D. B. An update on the status of roundnose grenadier in Subareas 0+1 and 2+3. (6 pages)

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84/VI/21	N794	ATKINSON, D. B. The relationships between different types of length meansurements of sharp-beaked redfish. (3 pages)
84/VI/22	N797	PENNEY, R. W., D. J. POWER, and D. B. ATKINSON. Species proportions and some reproductive aspects of three redfish species (*Sebastes marinus, S. fasciatus,* and *S. mentella*) on Flemish Cap, March 1983. (9 pages)
84/VI/23	N798	LEAR, W. H. Results of tagging of adult Atlantic cod in inshore areas of Newfoundland and Labrador during 1979-1982. (7 pages)
84/VI/24	N799	LEAR, W. H. The winter distribution of cod in NAFO Divisions 2J, 3K and 3L, based on research vessel catches during 1978-83. (9 pages)
84/VI/25	N806	LEAR, W. H. Results of tagging of Atlantic cod on St. Pierre Bank during February 1980. (4 pages)
84/VI/26	N807	LEAR, W. H. Offshore and inshore catches of Atlantic cod in NAFO Divisions 2J, 3K and 3L during 1958-83. (8 pages)
84/VI/27	N808	ROWELL, T. W., and F. BUDDEN. The 1983 fishery for *Illex illecebrosus* in SA 4 and biological characteristics of the stock. (11 pages)
84/VI/28	N809	KULKA, D. W. Estimates of discarding by the Newfoundland offshore fleet in 1982. (16 pages)
84/VI/29	N811	SUAREZ, L., J. ZAMARRO, and A. VAZQUEZ. Status of cod stock in Divisions 3L, 3M and 3N, 1983. (4 pages)
84/VI/30	N812	LARRANETA, M. G. Dynamics of yellowtail flounder and American plaice in NAFO Divisions 3L, 3N and 3O. (29 pages)
84/VI/31	N816	ATKINSON, D. B. Redfish in NAFO Divisions 3LN. (9 pages)
84/VI/32	N817	ATKINSON, D. B. Flemish Cap redfish. (8 pages)
84/VI/33	N818	BULATOVA, A. Yu. Distribution, abundance and biomass of cod according to the data of assessment trawl survey on the Newfoundland shelf in 1983. (13 pages)
84/VI/34 (Revised)	N819	NOSKOV, A. S., and A. I. SHERSTYUKOV. Distribution and abundance of the young silver hake (*Merluccius bilinearis*) from data of trawling surveys conducted on the Scotian Shelf in October-November 1978-1983. (8 pages)
84/VI/35	N820	RIKHTER, V. A., and V. F. TUROK. Distribution of some groundfish species on the Scotian Shelf slopes during the 1983 fishing season from data obtained by USSR observers. (14 pages)
84/VI/36	N821	RIKHTER, V. A., and Yu. S. GRINKOV. On fishing conditions and catching silver hake allocations on the Scotian Shelf southward of small-mesh-gear-line. (8 pages)
84/VI/37	N822	CHUMAKOV, A. K., and P. I. SAVVATIMSKY. Roundnose grenadier-Greenland halibut ratio in bottom trawl catches taken in the NAFO Area in 1970-1983. (15 pages)
84/VI/38 (Revised)	N823	NOSKOV, A. S. Assessment of stock size and allowable catch of silver hake (*Merluccius bilinearis*) on Scotian Shelf for 1985. (6 pages)
84/VI/39	N824	MAMYLOV, V. S., and V. S. BAKANEV. An acoustic assessment of capelin stocks in NAFO Div. 3LNO and 2J+3K in 1983. (8 pages)
84/VI/40	N825	BAKANEV, V. S. , A. A. FILIN, and S. V. CHECHENIN. Trawl survey of capelin prerecruits in NAFO Divisions 3LNO in November 1983. (8 pages)
84/VI/41	N826	CHUMAKOV, A. K., V. Z. SALMOV, and I. S. SHAFRAN. Assessment of groundfishes on the Flemish Cap by means of trawl surveys. (14 pages)
84/VI/42	N827	VINOGRADOV, V. I. The distribution of food energy for major commercial fisheries in the trophic chain of the Georges Bank ecosystem. (10 pages)

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84/VI/43	N828	VINOGRADOV, V. I. 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. (12 pages)
84/VI/44	N829	SAVVATIMSKY, P. I. On correlation between total length and pre-anal length of roundnose grenadier (*Coryphaenoides rupestris*) in the North Atlantic. (14 pages)
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84/VI/52	N839	BISHOP, C. A., S. GAVARIS, and J. W. BAIRD. Assessment of the cod stock in NAFO Divisions 3NO. (22 pages)
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84/VI/60	N849	BOWERING, W. R. The fishery for Greenland halibut in NAFO Subareas 0+1. (5 pages)
84/VI/61	N850	BOWERING, W. R. Distribution and relative abundance of the Labrador-eastern Newfoundland stock complex of Greenland halibut (*Reinhardtius hippoglossoides*). (14 pages)
84/VI/62	N851	BOWERING, W. R., and W. B. BRODIE. As assessment of the Greenland halibut (*Reinhardtius hippoglossoides*) stock complex in NAFO Subarea 2 and Divisions 3KL. (19 pages)
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84/VI/69	N858	ROWELL, T. W., and J. H. YOUNG. Update of the distribution, biomass, and length frequencies of *Illex illecebrosus* in Divisions 4VWX from Canadian research vessel surveys, 1970-1983. (12 pages)
84/VI/70	N859	TRITES, R. W., and K. F. DRINKWATER. Overview of environmental conditions in the Northwest Atlantic in 1983. (30 pages)
84/VI/71	N860	POULARD, J. C., T. W. ROWELL, and J. P. ROBIN. Biological characteristics and biomass estimates of the squid (*Illex illecebrosus*) on the Scotian Shelf (Div. 4VWX) in late summer, 1983. (14 pages)
84/VI/72	N861	PINHORN, A. T., and R. G. HALLIDAY. A framework for identifying fisheries managment problems associated with the influence of environmental factors on the distribution, movements and migration of marine species. (12 pages)
84/VI/73	N862	GAVARIS, S., C. A. BISHOP, and J. W. BAIRD. Assessment of the cod stock in Divisions 2J+3KL. (31 pages)
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84/VI/76	N865	CASEY, J. G., and M. PASTUSZAK. Survey of apex predators (sharks and swordfish) in the vicinity of a cold core Gulf Stream ring - R/V *Wieczno* Cruise 84-02. (15 pages)
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84/VI/78	N867	HORSTED, Sv. Aa. Subarea 1 cod: fisheries and stock composition, 1983. (14 pages)
84/VI/79	N868	LILLY, G. R. Annual variability in the diet of Atlantic cod (*Gadus morhua* L.) off southern Labrador and northeast Newfoundland (Div. 2J+3K) in autumn, 1977-82. (12 pages)
84/VI/80	N869	AKENHEAD, S. A. A preliminary compendium of Flemish Cap research cruises, 1977-1984. (7 pages)
84/VI/81	N870	AKENHEAD, S. A. Ocean climate at Station 27, report for 1983. (2 pages)
84/VI/82	N871	FANNING, P. Preliminary analysis of *Alfred Needler-Lady Hammond* comparative fishing experiments (silver hake, 1983). (6 pages)
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84/VI/86	N876	CLAY, D., L. CURRIE, and B. SWAN. Food and feeding of silver hake (*Merluccius bilinearis* Mitchill), on the Scotian Shelf with special reference to cannibalism. (25 pages)

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84/VI/87	N877	KOELLER, P. A., J. D. NEILSON, and D. E. WALDRON. The Canadian-USSR juvenile silver hake (*Merluccius bilinearis*) surveys on the Scotian Shelf: abundance indices, distribution, and comparison with independent estimates of juvenile abundance, 1978-83. (9 pages)
84/VI/88	N878	LILLY, G. R., M. A. ALMEIDA, and W. H. LEAR. Food of Atlantic cod (*Gadus morhua*) from southern Labrador and eastern Newfoundland (Div. 2J, 3K and 3L) in winter. (9 pages)
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84/VI/92	N883	HORSTED, Sv. Aa., J. MØLLER JENSEN, J. MESSTORFF, and A. SCHUMACHER. Stock size of cod at West Greenland by the beginning of 1984 and projections of yield and stock size 1984-87. (10 pages)
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84/VI/94	N889	WELLS, R., M. BORGES, and A. VAZQUEZ. Status of the cod stock in Division 3M. (8 pages)
84/IX/95	N890	SEREBRYAKOV, V. P., A. V. ASTAFJEVA, V. K. ALDONOV, and A. K. CHUMAKOV. USSR ichthyoplankton investigations within the framework of the Flemish Cap Project in 1978-1983. (47 pages)
84/IX/96	N891	ERNST, P. A contribution to by-catch levels of Greenland halibut (*Reinhardtius hippoglossoides* Walb.) in the roundnose grenadier (*Coryphaenoides rupestris* Gunn.) directed fishery in NAFO Subarea 2. (8 pages)
84/IX/97	N894	LANGE, A. M. T, M. P. SISSENWINE, and E. D. ANDERSON. Yield analysis for the long-finned squid, *Loligo pealei* (LeSueur). (29 pages)
84/IX/98	N895	SUMMERS, W. C. Comparative life history adaptations of some myopsid and sepiolid squids. (6 pages)
84/IX/99	N896	HATANAKA, H., S. KAWAHARA, Y. UOZUMI, and S. KAWAHARA. A comparative description of the life cycles of five ommastrephid squids fished by Japan: *Todarodes pacificus, Illex illecebrosus, Illex argentinus, Nototodarus sloani sloani* and *Nototodarus sloani gouldi*. (19 pages)
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84/IX/105	N902	WARING, G. T. Changes in population structure and abundance of spiny dogfish off the northeast coast of the United States. (14 pages)
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84/IX/108 N905 LILLY, G. R., and D. R. OSBORNE. Predation by Atlantic cod (*Gadus morhua*) on short-finned squid (*Illex illecebrosus*) off eastern Newfoundland and in the northeastern Gulf of St. Lawrence. (16 pages)

84/IX/109 N906 LANGE, A. M. T., M. C. INGHAM, and C. A. PRICE. Distribution of maturing *Illex illecebrosus* relative to the shelf-slope water front off the northeastern United States. (17 pages)

84/IX/110 N907 DAWE, E. G., R. K. O'DOR, P. H. ODENSE, and G. V. HURLEY. Development of an ageing technique for the short-finned squid (*Illex illecebrosus*). (24 pages)

84/IX/111 N908 ROWELL, T. W., R. W. TRITES, and E. G. DAWE. Larval and juvenile distribution of the short-finned squid (*Illex illecebrosus*) in relation to the Gulf Stream frontal zone in the Blake Plateau and Cape Hatteras area. (37 pages)

84/IX/112 N909 DAWE, E. G. Variation in length-weight relationships, condition, and feeding spectrum of short-finned squid (*Illex illecebrosus*) at Holyrood, Newfoundland. (13 pages)

84/IX/113 N910 ROWELL, T. W., J. H. YOUNG, J. C. POULARD, and J. P. ROBIN. Changes in the distribution and biological characteristics in the Scotian Shelf population of *Illex illecebrosus* over the 1980-1983 period. (38 pages)

84/IX/114 N911 MAURER, R. O., and R. E. BOWMAN. Feeding and food consumption of long-finned squid (*Loligo pealei*) and short-finned squid (*Illex illecebrosus*) in Subareas 5 and 6 of the Northwest Atlantic. (20 pages)

84/IX/115 N912 FROERMAN, Yu. M., and T. S. DUBININA. Distribution and peculiarities of allometric growth of larval *Illex* in the Northwest Atlantic. (25 pages)

84/IX/116 N913 FROERMAN, Yu. M. Life cycle and mechanism of abundance fluctuations in *Illex illecebrosus* (summary only). (7 pages)

84/IX/117 N914 VINOGRADOV, V. I. On feeding of two squid species in the Northwest Atlantic. (12 pages)

84/IX/118 N915 MATTLIN, R. H., R. E. SCHEIBLING, and E. C. FÖRCH. Distribution, abundance and size structure of arrow squid (*Nototodarus* sp.) off New Zealand. (14 pages)

84/IX/119 N916 NIGMATULLIN, Ch. M., R. M. SABIROV, and Yu. M. FROERMAN. Reproductive biology and scale of maturity stages of the reproductive system of male squid (*Illex illecebrosus*) (Abstract only). (3 pages)

84/IX/120 N917 BURUKOVSKY, R. N., Yu. M. FROERMAN, and Ch. M. NIGMATULLIN. Reproductive biology and scale of maturity stage of reproductive system for female squid (*Illex illecebrosus*) (Abstract only). (4 pages)

84/IX/121 N918 VOSS, G. L., and T. F. BRAKONIECHI. A review of the squid resources of the Southeast Fisheries Region of the United States. (16 pages)

84/IX/122 N921 BISHOP, C. A. Estimates of age at maturity for cod in Subdivision 3Ps. (3 pages)

84/IX/123 N922 HATANAKA, H., A. M. T. LANGE, and T. AMARATUNGA. Geographical and vertical distribution of larval stage short-finned squid (*Illex illecebrosus*) in the Northwest Atlantic. (16 pages)

84/IX/124 N933 VECCHIONE, M., and C. F. E. ROPER. Summary of planktonic cephalopods, including *Illex illecebrosus*, from *Kaiyo-Maru* Cruise 82-01, with recommendations for future sampling. (7 pages)

84/IX/125 N934 WEBBER, D. M., and R. K. O'DOR. The respiratory mechanism and swimming performance of the squid, *Illex illecebrosus*. (15 pages)

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84/I/1	N779	NAFO. Provisional report of Scientific Council, Special Meeting, January 1984. (17 pages) + Corrigenda (1 page)
84/VI/2	N781	NAFO. Report of joint NAFO/ICES Study Group on biological relationships of the West Greenland and Irminger Sea redfish stocks, Copenhagen, 21 February 1984. (3 pages)
84/VI/3	N782	GALLAGHER, E. EEC request for scientific advice on management in 1985 of certain stocks in NAFO Subareas 0 and 1. (1 page)
84/VI/4	N783	PARSONS, L. S. Canadian request for scientific advice on management in 1985 of certain stocks in Subareas 0 to 4. (1 page)
84/VI/5	N792	NAFO SECRETARIAT. Tagging activities reported for the Northwest Atlantic in 1983 and additional information for earlier years. (5 pages)
84/VI/6	N800	NAFO SECRETARIAT. Historical catches of selected species by stock area and country for the period 1973-82. (38 pages)
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84/VI/9	N810	NAFO SECRETARIAT. Report to the CWP on NAFO statistical program, data-processing and publications, 1982-84. (6 pages)
84/VI/10	N803	LARRANETA, M. G. Spanish research report, 1983. (2 pages)
84/VI/11	N804	NAFO SECRETARIAT. Solicited comments on proposal for second Ageing Workshop on shrimp. (4 pages)
84/VI/12	N805	NAFO SECRETARIAT. Notes on statistical activities and related publications, 1983/84. (3 pages)
84/VI/13	N813	CWP SECRETARY. Report of the *ad hoc* Inter-agency Consultation on Atlantic Fishery Statistics, 8-9 October 1983, Gothenburg, Sweden. (10 pages)
84/VI/14	N814	GODINHO, M. L. Portuguese research report, 1983. (4 pages)
84/VI/15	N815	COADY, L. W., J. S. SCOTT, and L. CLEARY. Canadian research report, 1983. (15 pages) + Addendum (6 pages)
84/VI/16	N831	SMIDT, E. Denmark (Greenland) research report for 1983. (17 pages)
84/VI/17	N837	CHUMAKOV, A. K., V. A. BOROVKOV, and A. S. NOSKOV. USSR research report for 1983. (41 pages)
84/VI/18	N844	GROSSLEIN, M. D., and E. D. ANDERSON. United States research report for 1983. (8 pages)
84/VI/19	N848	KAWAHARA, S. Japanese research report for 1983. (3 pages)
84/VI/20	N873	ROWELL, T. W. Provisional listing of papers expected to be presented at the Special Session on Squid, 5-7 September 1984. (5 pages)
84/VI/21	N879	POULARD, J. C. France research report for 1983. (6 pages)
84/VI/22	N884	NAFO SECRETARIAT. Provisional nominal catches in the Northwest Atlantic, 1983. (49 pages)
84/VI/23	N885	NAFO. Provisional report of Scientific Council, Dartmouth, Canada, 6-21 June 1984. (94 pages)
84/IX/24	N892	ERNST, P. German Democratic Republic research report for 1983. (11 pages)

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84/IX/25	N919	PACIORKOWSKI, A. J. Polish research report, 1983. (12 pages)
84/IX/26	N927	PARSONS, L. S., and E. GALLAGHER. Joint Canada-EEC request for advice on harp and hooded seals. (2 pages)
84/IX/27	N928	DOMINGUEZ, R. Cuban research report, 1983. (2 pages)
84/IX/28	N929	NAFO. Report of the Scientific Council, Dartmouth and Halifax, Canada, 5-14 September 1984. (29 pages)

IV. LIST OF PARTICIPANTS IN SCIENTIFIC COUNCIL MEETINGS, 1984

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Akenhead, S. A.	Northwest Atlantic Fisheries Centre, P.O. Box 5667, St. John's, Nfld.		B	
Anderson, J. T.	" " " " " "		B	
Atkinson, D. B.	" " " " " "		B	
Baird, J. W.	" " " " " "		B	
Bishop, C. A.	" " " " " "		B	C
Bowering, W. R.	" " " " " "		B	
Brodie, W. B.	" " " " " "		B	
Carscadden, J. E.	" " " " " "	A	B	C
*Dawe, E. G.	" " " " " "			C
Lear, W. H.	" " " " " "		B	
Lilly, G. R.	" " " " " "		B	C
Miller, D.	" " " " " "		B	
Nakashima, B.	" " " " " "		B	
Parsons, D. G.	" " " " " "	A		
Pinhorn, A. T.	" " " " " "		B	C
Pitt, T. K.	" " " " " "		B	
Wells, R.	" " " " " "		B	C
Winters, G. H.	" " " " " "		B	
*Aldrich, F. A.	Biology Dept., Memorial University of Newfoundland, St. John's, Nfld.			C
*Boothroyd, F. A.	" " " " " "			C
*Johnson, F. E.	" " " " " "			C
*Morris, C. C.	" " " " " "			C
*Pearson, D. A.	" " " " " "			C
*Stephen, S. J.	" " " " " "			C
Doubleday, W. G.	CAFSAC Secretariat, Bedford Institute of Oceanography, Dartmouth, N.S.		B	C
Campara, S.	Marine Fish Division, Bedford Institute of Oceanography, Dartmouth, N.S.		B	
Halliday, R. G.	" " " " " "	A	B	C
Hurley, P.	" " " " " "		B	
Mahon, R.	" " " " " "		B	
McGlade, J. M.	" " " " " "		B	
O'Boyle, R. N.	" " " " " "		B	
Sinclair, A. F.	" " " " " "		B	
Waldron, D. E.	" " " " " "		B	C
Drinkwater, K.	Marine Ecology Lab., Bedford Institute of Oceanography, Dartmouth, N.S.		B	
Frank, K. T.	" " " " " "		B	
Trites, R. W.	" " " " " "		B	C
*Hurley, G. V.	Hurley Fisheries Consulting, P.O. Box 3049 Sta. East, Dartmouth, N.S.			C
*Black, G. A.	Invertebrates and Marine Plants Division, P.O. Box 550, Halifax, N.S.			C
Etter, M. L.	" " " " " "	A		
Rowell, T. W.	" " " " " "		B	C
*Young, J. H.	" " " " " "			C
*Balch, N.	Biology Department, Dalhousie University, Halifax, N.S.			C
*O'Dor, R. K.	" " " " "			C
*Manning, D.	" " " " "			C
*Scheibling, R. E.	" " " " "			C
*Webber, D. M.	" " " " "			C
Koslow, T.	Oceanography Department, Dalhousie University, Halifax, N.S.		B	
Loucks, R. H.	Loucks Oceanography Limited, 24 Clayton Park Drive, Halifax, N.S.		B	
Gavaris, S.	Marine Fish Division, Biological Station, St. Andrews, N.B.		B	
Iles, T. D.	" " " " "		B	
Neilson, J. D.	" " " " "		B	
Scott, J. S.	" " " " "		B	
Stephenson, D. L.	" " " " "		B	
Clay, D.	Fisheries Research Branch, Gulf Region, P.O. Box 5030, Moncton, N.B.		B	
Neilson, G. A.	" " " " " "		B	
Rubec, P.	" " " " " "		B	
Tremblay, D.	Fisheries Research Branch, Quebec Region, P.O. Box 15500, Quebec, P.Q.			C
Keeley, J. R.	Marine Environmental Data Service, 240 Sparks Street, Ottawa, Ont.		B	
Beckett, J. S.	Fisheries Research Directorate, 200 Kent Street, Ottawa, Ont.		B	

CUBA

Dominguez, R.	Flota Cubana de Pesca, Ave. Pesquera esq. Desamparados, Havana		B	C
Fabregas, E.	Ministerio de la Industria Pesquera, Ensenada de Potes y Atares, Havana			C

EUROPEAN ECONOMIC COMMUNITY (EEC)

		Meetings
Noé, R.	Commission of European Communities, 200 rue de la Loi, Brussels, Belgium	A B C
Cross, D.	EUROSTAT, B.P. 1907, Batiment J. Monnet, Luxembourg (Grand Duchy)	B
Maucorps, A.	ISTPM, B.P. 1049, F-44037 Nantes-Cedex, France	B
Forest, A.	ISTPM, B.P. 4240, St. Pierre and Miquelon, France	A
Poulard J. C.	" " " " "	B C
Carlsson, D. M.	Greenland Fisheries Institute, Tagensvej, 135, Copenhagen, Denmark	A
Hansen, H. H.	" " " " " "	B
Horsted, Sv. Aa.	" " " " " "	B C
Jensen, J. M.	" " " " " "	B
Kanneworff, P.	" " " " " "	A
Messtorff, J.	Sea Fisheries Institute, Bremerhaven, Federal Republic of Germany	B C
Piatkowski, U.	Polar Research Institute, Bremerhaven, Federal Republic of Germany	C
Schumacher, A.	Sea Fisheries Institute, Hamburg, Federal Republic of Germany	B

ICELAND

Eiriksson, H.	Marine Research Institute, P.O. Box 390, 121 Reykjavik	A
Hallgrimsson, I.	" " " " "	A

JAPAN

Hatanka, H.	Far Seas Fisheries Research Laboratory, 5-7-1 Orido, Shimizu 424	B C
Tsubata, H.	International Affairs Division, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo	C

NORWAY

*Breiby, A.	Institute of Fisheries, University of Tromsø, 9001 Tromsø	C
*Jobling, M.	" " " " "	C
*Sundet, J. H.	" " " " "	C
Smedstad, O. M.	Institute of Marine Research, P.O. Box 1870-72, N-5011 Bergen-Nordnes	A

POLAND

Paciorkowski, A. J.	Sea Fisheries Institute, 1 Al. Zjednoczenoa, 81-345 Gdynia	C

PORTUGAL

Borges, M. F.	Instituto Nacional de Investigacas das Pescas, Av. Brasillia, 1400 Lisbon	B
Coelho, M. L.	" " " " " "	C

SPAIN

Larrañeta, M.	Instituto Investigaciones Pesqueras, Muelle de Bouzas, Vigo-8	B C
Vazquez, A.	" " " " "	B

UNION OF SOVIET SOCIALIST REPUBLICS (USSR)

Kovalev, S.	PINRO, 6 Knipovich Street, Murmansk	B
Nigmatullin, Ch. M.	AtlantNIRO, 5 Dmitry Donskoy Street, Kaliningrad	C
Rikhter, V. A.	" " " "	B C
Riazantsev, Yu, B.	VNIRO, 17 V. Krasnoselskaya, Moscow B-140	C
Solodovniic, V.	Ministry of Fisheries of the USSR, 12 Rozhdestvensky Bould., Moscow K-31	B

OBSERVERS

		Meetings
Gomez-Sanchez, G.	Secretaria de Pesca, Avenida Alvaro Obregon 269-8, Mexico	C
Ingham, M. C.	National Marine Fisheries Service, Narragansett, Rhode Island, USA	B C
Grosslein, M. D.	National Marine Fisheries Service, Woods Hole, Massachusetts, USA	B
Lange, A. M. T.	" " " " " "	B C
Palmer, J. E.	" " " " " "	B

*Rathjen, W. F.	National Marine Fisheries Service, Gloucester, Massachusetts, USA	C
*Roper, C. F. E.	Invertebrate Zoology, Smithsonian Institute, Washington, D.C., USA	C
*Summers, W. C.	Western Washington University, Bellingham, Washington, USA	C
*Tweeds, S. M.	Cape May County Extension Service, Dennisville Rd., New Jersey, USA	C
*Voss, G. L.	University of Miami, 4600 Rikenbacker Causeway, Miami, Florida, USA	C

* Attended Special Session on Squids only.