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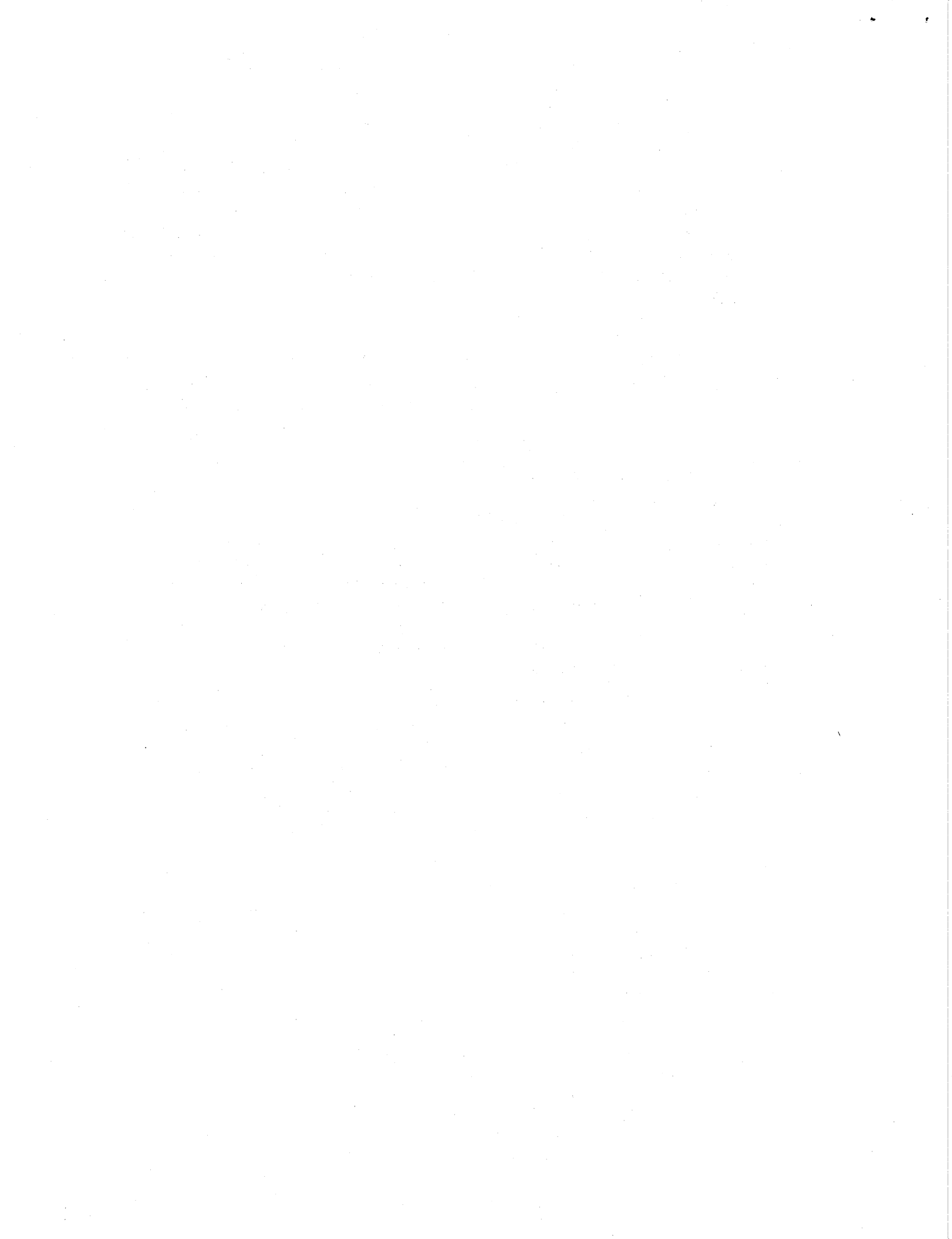
SPECIAL SCIENTIFIC COUNCIL MEETING - JANUARY 1983

Provisional Report of Scientific Council

Dartmouth, Canada, 19-24 January 1983

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PROVISIONAL REPORT OF SCIENTIFIC COUNCIL

Special Meeting on Shrimp, January 1983

Chairman: R. Wells

Rapporteur: V. M. Hodder

The Council met at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 19-24 January 1983 to provide advice for 1983 on conservation of the shrimp stocks in Subareas 0 and 1, as requested 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 (Appendix II and Annexes 1 and 2). Representatives attended from Canada, EEC (Denmark, France, and the Commission of the European Communities), Iceland and Norway (Appendix III).

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. Relevant research documents are listed in Appendix IV. Brief summaries of the stock assessments and other matters considered by the Council are given below.

I. STOCK ASSESSMENTS (APP. I)

1. Assessment of Shrimp Stock 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 and 1982 (NAFO Sci. Coun. Rep. 1981, page 109) but allowable catches totalling 35,000 tons was set for each of these two years by the coastal states involved. Provisional statistics for 1982 indicate an offshore catch of about 38,000 tons (Table 1), the major fishing grounds being in the southern part of Div. 1B and northern part of Div. 1C during the first half of the year, with a shift to the northern and western part of Store Hellefiske Bank in Div. 0A and 1B during the second half of the year.

Table 1. Total catches (metric tons) of shrimp in Subarea 0 and the offshore part of Subarea 1 in 1973-82, with the corresponding TACs for 1977-82.

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982 ¹
Catch	4,692	11,945	29,190	42,766	34,300	26,869	27,087	36,652	39,217	38,217
Advised TAC	-	-	-	-	36,000	40,000	29,500	29,500	29,500	29,500
Effective TAC	-	-	-	-	36,000	40,000	29,500	29,500	35,000	35,000

¹ Provisional data

All available biological information on length distribution and sexual components and all data on trends in catch rates, biomass estimates and stock composition were considered in advising on management of the fishery in 1983. It was noted that, after the decline in abundance observed during 1976-78, catch rates increased in 1980 and stabilized in 1981 and 1982. Data from the photographic survey indicated an increase in biomass in 1982 (more than 40% in relation to the revised estimate for 1981). This increase was interpreted as being due to growth of the abundant small shrimp observed during the photographic survey in 1981. However, the relative proportion of small shrimp decreased in 1982.

Although the fishable stock has remained stable since 1979, the Council noted the uncertainty about recruitment in 1983 and subsequent years, and agreed that there should be no change in the management regime of this fishery. The Council therefore advises that the overall TAC for the offshore grounds

in Subarea 1 and adjacent parts of Subarea 0 in 1983 should remain at the same level (29,500 tons) as advised previously for 1981 and 1982.

In order to improve the basis for assessing the stock in Subareas 0 and 1, the Council endorses the recommendations of STACFIS regarding further research requirements (see Appendix I).

2. Assessment of Shrimp Stock in Denmark Strait

The shrimp fishery in this area expanded rapidly in 1977 and 1980. The total catch on both sides of the midline between Greenland and Iceland increased rapidly to 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 4,600 tons in 1982. The 1982 fishery took place in the area of Strede and Dohrn Banks, as in earlier years, but in a more restricted zone, compared to 1981 and especially to 1980. There was no fishery on the Icelandic side of the midline in 1982, due to ice cover. Although the catch rates in May 1982 were higher than those in May 1981, the average catch rates for 1982 were lower than those for 1981.

Table 2. Nominal catches (metric tons) of shrimp in Denmark Strait for 1978-82, with corresponding TACs for 1981-82.

	1978	1979	1980	1981	1982 ¹
Catch	363	1,285	8,260	4,792	4,592
Advised TAC	-	-	-	-	4,200
Effective TAC	-	-	-	8,000	4,500

¹ Provisional data

The available data for the period from March to June 1982 indicated that catches were still composed of larger shrimp than in other exploited stocks but that the average size was slightly lower in 1982 than in 1981. Also, the data show that a significant proportion (30-50%) of the females do not spawn in each year.

In view of the sharp decline in spawning biomass implied from declining catch rates during 1980-82, and noting that this stock lives under extreme environmental conditions and may be very sensitive to over-exploitation, the Council urges that a cautious approach to exploitation should be maintained. Insufficient data were available on which to base a change in the TAC advised for 1982. The Council therefore advises that the overall TAC for 1983 should remain at the advised level for 1982 (4,200 tons).

In order to improve the basis for assessing this stock in Denmark Strait, the Council endorses the recommendations of STACFIS regarding future research requirements (see Appendix I).

II. FUTURE SCIENTIFIC MEETINGS

1. Scientific Council Meeting, June 1983

The Council confirmed that its next meeting will be held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 8-23 June 1983, to deal with the regular business, involving the work of the three standing committees (STACFIS, STACREC and STAC PUB) and associated subcommittees and *ad hoc* working groups.

2. Annual Meeting, September 1983

The Council noted that it was necessary to change the dates for its Annual Meeting in 1983 from those agreed at its September 1982 Meeting, in view of the subsequent change in timing of meetings of the General Council and Fisheries Commission during the 1983 Annual Meeting of NAFO. The Scientific Council will now commence its meeting on 7 September 1983, with three days (7-9 September) being allocated for the Special Session on "Trophic relationships in marine species relevant to fisheries management in the Northwest Atlantic". Other matters will be considered on 10 September and the closing session will take place on 16 September 1983. This meeting will be held in Leningrad, USSR.

III. ADJOURNMENT

The Chairman expressed his thanks to the Director of the Bedford Institute of Oceanography for the use of conference rooms, to the NAFO Secretariat for their usual efficiency in servicing this meeting, to the Chairman of STACFIS (J. P. Minet), and to all participants for their cooperation and contributions. The meeting adjourned at 1900 hours on 24 January 1983.



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

Chairman: J. P. Minet

Rapporteurs: Various

The Committee met at Dartmouth, Nova Scotia, Canada, during 19-24 January 1983 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) (App. II, Annexes 1 and 2). In addition, as requested by the EEC, the Committee reviewed the status of the shrimp stock off East Greenland (App. II, Annex 1). Scientists attended from Canada, EEC (Denmark, France, and the Commission of the European Community), 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. Fishery Trends

The nominal catch of shrimp in Subareas 0 and 1 increased from less than 10,000 tons prior to 1973 to 50,000 tons in 1976, decreased to about 35,000 tons in 1978 and 1979, and increased to a level of 47,000 tons in 1981 (Table 1). Preliminary statistics for 1982 indicate a total catch of about 43,000 tons in Subareas 0 and 1, of which 38,000 tons were taken on the offshore grounds. The inshore fishery at West Greenland was relatively stable at 7,000-8,000 tons yearly during 1972-81 (except 10,000 tons in 1974). Preliminary data indicate a decline in the inshore catch to 5,000 tons in 1982.

The offshore shrimp fishery has been regulated by total allowable catch (TAC) since 1977. In 1977 and 1978, the total offshore catches in the Davis Strait region were about 34,000 and 27,000 tons

Table 1. Nominal catches and TACs (metric tons) of shrimp (*Pandalus borealis*) in Subareas 0 and 1¹.

Area	Country	1974	1975	1976	1977	1978	1979	1980	1981	1982 ²
SA 0	Canada	-	-	-	-	-	-	59	1,590	873
	Denmark	-	-	-	68	86	67	-	48	1,082
	Faroes	-	-	-	239	-	115	-	1,686	700
	France	-	-	-	-	21	7	-	-	-
	Greenland	-	-	-	-	-	149	815	85	-
	Norway	-	-	65	150	15	791	-	-	-
	Spain	-	-	327	-	-	-	-	-	-
	Total	-	-	392	457	122	1,129	874	3,409	2,655
SA1	Canada	-	-	-	-	-	245	590	-	873
	Denmark	308	1,142	2,717	5,842	3,382	1,327	872	996	1,935
	Faroes	2,023	5,300	11,179	12,612	8,070	6,867	3,554	1,234	1,229
	France	-	-	803	924	805	353	247	535	677
	F.R. Germany	-	-	-	31	-	-	-	-	-
	Greenland (a) ³	10,064	8,700	7,300	7,800	7,600	7,500	7,500	7,500	5,000 ⁴
	Greenland (b) ³	180	1,089	2,478	7,081	5,531	12,527	27,501	31,988	30,000 ⁴
	Japan	-	-	146	-	-	-	-	-	-
	Norway	5,917	8,678	11,658	7,353	8,959	4,639	3,014	1,055	848
	Spain	-	6,948	6,925	-	-	-	-	-	-
	USSR	3,517	6,033	6,468	-	-	-	-	-	-
		Total	22,009	37,890	49,674	41,643	34,347	33,458	43,278	43,308
	Offshore	11,945	29,190	42,374	33,843	26,747	25,958	35,778	35,808	35,562
0+1 Offshore Catch		11,945	29,190	42,766	34,300	26,869	27,087	36,652	39,217	38,217
0+1 advised offshore TAC		-	-	-	36,000	40,000	29,500	29,500	29,500	29,500
0+1 effective offshore TAC		-	-	-	36,000	40,000	29,500	29,500	35,000 ⁵	35,000 ⁵

¹ Data for 1974-78 pertain to ICNAF Statistical Area 0 and Subarea 1, and for 1979-81 to the new NAFO Subareas 0 and 1.

² Provisional data.

³ a = inshore, b = offshore catches.

⁴ Estimated catches (Greenland (b) figures include catches of two Danish trawlers fishing on Greenland allocations).

⁵ TAC of 30,000 tons in Subarea 1 and 5,000 tons in Subarea 0.

against 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. In 1981 and 1982, Canada and EEC set separate TACs of 5,000 and 30,000 tons for Subareas 0 and 1 respectively, although the Scientific Council had advised that the TAC for Subarea 1 and the adjacent parts of Subarea 0 should remain at the same level of the two preceding years (29,500 tons).

2. Distribution of Fishing Effort and Biomass (SCR Doc. 83/I/1, 2, 3, 5, 7, 8)

A pilot research trawl survey, with a limited number of trawling stations, was conducted by Denmark in Div. 1B in July-August 1982, but this cruise provided no information on the distribution of shrimp in the area. However, data were available on the distribution of fishing effort for the Greenland and French fisheries in Subarea 1 and the Canadian fishery in Subarea 0. Some information on the distribution of shrimp biomass was available from a Danish photographic survey in the region off West Greenland from 66°N to 71°N.

The distribution of fishing effort by Greenland vessels in 1982 did not exhibit the northward shift that was evident in 1980 and 1981. The fishery was severely hampered by ice conditions in the first 5 months of the year, during which the effort was concentrated in the southern part of Div. 1B and the northern part of Div. 1C, with some activity in January and May in the area north of 68°N and east of 55°W. From June to November, the Greenland vessels fished mainly west and north of Store Hellefiske Bank, with little or no fishing activity in Holsteinsborg Deep. Fishing north of 70°N, which occurred in 1980 and 1981, did not take place in 1982, except for a few hauls in October. The severe ice conditions in February-May 1982 thus caused the delayed achievement of the allowable catch and a change in the distributional pattern of the fishery throughout the year, compared to that in 1981. The special management area off Disko Bay was therefore fished more heavily and for a longer period in 1982 than in the preceding years.

Fishing effort by a French trawler in 1982 occurred between 67°N and 68°N in Div. 1B, and Canadian vessels fished in the adjacent part of Div. 0A generally between 58°W and 59°W, with no significant change in fishing patterns from the previous year. Fishing effort by Norwegian vessels in Div. 1D was higher in 1982 than in previous years, but the major part of the fishing activity likely took place in Div. 1B.

Data from the Danish photographic survey in Div. 1B indicated a southward displacement of shrimp abundance, which was possibly related to the observed decrease in bottom temperatures in 1982.

3. Biology (SCR Doc. 83/I/2, 3, 5, 8)

Information presented at the November 1981 Special Meeting indicated for the first time the presence of three modal groups of male shrimp (10-15 mm, 15-20 mm and 20-25 mm carapace length) and a group (25-30 mm) consisting of transitionals and females. In 1982, the 10-15 mm group was observed in Canadian length frequencies of discarded shrimp and in data from the Danish research survey, but the group was not evident in the French commercial data, in contrast to the previous year. The 15-20 mm group appeared in the Danish and Norwegian data for 1982, but it was less prominent in the Canadian and French data than in 1981. The 20-25 mm group appeared in data from all sources in 1982, but normality was not clearly apparent in all samples. The 25-30 mm modal group of transitionals and females showed no significant change from the previous year in terms of length distribution.

No differences were observed in the size range of each sexual component of shrimp in the samples. However, in the French data for July-August 1982, the ratio of females with spines to transitionals was lower than in 1981, indicating a possible delay in sexual evolution from transitional to female. A similar delay in the transition from male to female might be the reason for the bimodality observed in the 20-25 mm size range of the 1982 samples. This bimodality may be related to the lower bottom temperatures observed in 1982 but could also have resulted from mixing of different components of the stock characterized by different growth rates.

In July-September 1982, transitionals and females with spines contained head roe, whereas a large proportion of the females without spines showed no evidence of maturing. This could explain why the proportion of non-ovigerous females in November 1982 was lower than in 1981. It also could be related to lower temperatures recorded for the area in 1982. Lacking an adequate time series of data, it is difficult at this time to quantify future recruitment.

4. Catch and Effort (SCR Doc. 83/I/2, 3, 5, 8)

Catch and effort information available for the shrimp fishery in 1982 included Canadian data for Subarea 0 based on vessel logbook records and observer reports, and French, Greenland and Norwegian data for Subarea 1 based on logbook records. The Canadian observer data showed an increase in mean catch rate (July-September) of approximately 19% from the value for the same period in 1981. Data for the French vessel, which fished in the same area west of Store Hellefiske Bank (Div. 1B) as in 1981, showed a decrease in mean catch rate (July-August) of about 17%. Norwegian data for Div. 1B and 1D showed increasing catch rates during May to July 1982, with those for Div. 1D being for the first time higher

than those for Div. 1B. The mean catch rate for Div. 1B in July 1982 was 47% higher than the mean for July-August 1981.

Data for six trawlers (each 722 GRT) of the Royal Greenland Trade Department showed the same trend throughout 1982 as in previous years, with peak catch rates in Div. 1B in May (severe ice conditions hindered entrance to the fishing grounds early in 1982), declining catch rates from May to September and increasing rates in October and November. The mean monthly catch rates in Div. 1B were higher in 1982 than in 1981. In contrast to 1980 and 1981, there was virtually no fishery by these Greenland trawlers in Div. 1A in 1982.

Indices of mean catch rates for Greenland, Norwegian and French fisheries in Div. 1B (normalized to 1976) and for the Canadian fishery in Div. 0A (normalized to the average of the other indices for 1980) in the July-September period of 1976-82 are given in Table 2. Except for the French index in 1981, which seems abnormally high, all indices show the same general trend.

Table 2. CPUE indices for Greenland, Norwegian and French fisheries for shrimp in Div. 1B and the Canadian fishery in Div. 0A, 1976-82.

	1976	1977	1978	1979	1980	1981	1982
Greenland	1.00	0.74	0.67	0.51	0.63	0.59	0.74
Norway	1.00	0.84	0.60	0.47	0.60	0.43	0.63
France ¹	1.00	1.13	0.61	0.48	0.58	0.80	0.60
Canada	-	-	-	-	0.60 ²	0.66	0.78

¹ July only.

² Normalized to the average of the other three index values for 1980.

5. Discarding of Shrimp (SCR Doc. 83/I/2, 3, 5)

The observed level of discarding by Canadian vessels in Div. 0A was about 3% by weight in 1982 compared to about 4% in 1981. Most of the discarded shrimp were from the 21 mm modal length group in 1982 whereas they were from the 19 mm group in 1981. Observations in Div. 1B indicated that about 2% of the shrimp caught by the French vessel were discarded by the automatic sorting machine (no data on additional sorting by hand), and that discarding by the Norwegian trawler was 12.3%, the highest value observed since 1977. In the latter case, the discards were distributed between two size-groups (modal lengths of 17 and 21 mm), which were more prominent in the catches than usual.

6. By-catches in the Shrimp Fishery (SCR Doc. 83/I/2, 3, 5, 8)

Data available for seven Greenland trawlers indicated that the highest by-catch rates occurred in Div. 1B in May of both 1981 and 1982, the major component being redfish in 1981 and cod in 1982. In the latter case, the by-catches of cod were observed only in May and only in Div. 1B. Comparison with earlier years showed a sharp decline in by-catches from 23.1% by weight in 1978 to 0.7% in 1982. Except for the occurrence of cod in 1982, the dominant by-catch species has been redfish.

By-catches in the Canadian shrimp fishery in Div. 0A were dominated by redfish, but the proportions have continued to decline from the levels observed in 1980. Other species have usually represented less than 1% of the total catch (weight). Observations from one French trawler in Div. 1B indicated by-catches of redfish (1.5% of shrimp catch), Greenland halibut (<1%) and a few cod. Data for one Norwegian trawler in Div. 1B indicated increased by-catches of redfish compared to 1980 (no data for 1981), but these were still considerably lower than in 1976-79. A similar trend was observed for Greenland halibut, whereas by-catches of cod have remained very low.

7. Biomass Estimates (SCR Doc. 83/I/1)

Data from the bottom photographic surveys have been incorporated into a shrimp distribution model which was used to derive biomass estimates for the years 1977-82. The trend in biomass estimates for 1977-81 was in good agreement with that presented at the November 1981 Meeting (NAFO Sci. Coun. Rep. 1981, page 115). However, the Committee noted that utilization of 1982 data in the model resulted in a significant decrease in biomass estimates for earlier years, compared to the results presented at the November 1981 Meeting (e.g. a decrease in biomass estimate from 252,000 tons to 163,000 tons for 1981). The total biomass in the region from 66°00'N to 69°30'N was estimated at 230,000 tons for 1982, representing an increase of more than 40% in relation to the revised estimate for 1981. The large increase in biomass is most likely the result of growth of small shrimp, which were observed to have been abundant in the 1981 photographic survey data. However, the proportion of small shrimp was lower in 1982 than in 1981.

The distribution model, used since 1980, has been extended to include two additional parameters (longitude and bottom temperature). Consequently, the correlation coefficient increased significantly from 0.34 to 0.65, but an analysis of the sensitivity of the model to the input parameters is still needed. Because the model is very sensitive to the input values of temperature, the Committee considered it important to know how fluctuations in observed temperatures in the sampling area would influence the calculation of biomass estimates. STACFIS urged that a special study should be undertaken on how to best utilize hydrographic conditions in the model to provide the best estimates of biomass.

Although some improvement of the model has been achieved in terms of a higher correlation coefficient, it was noted that the variance associated with the photographic survey data remains fairly high and that cautious interpretation of the results should be maintained. The trend in biomass estimated from the model shows generally good correspondence with the trend in July-September catch rates of the large Greenland trawlers (Fig. 1). A more or less continuous decline in average weight of shrimp was noted in 1977-81 whereas there was a significant increase from 1981 to 1982.

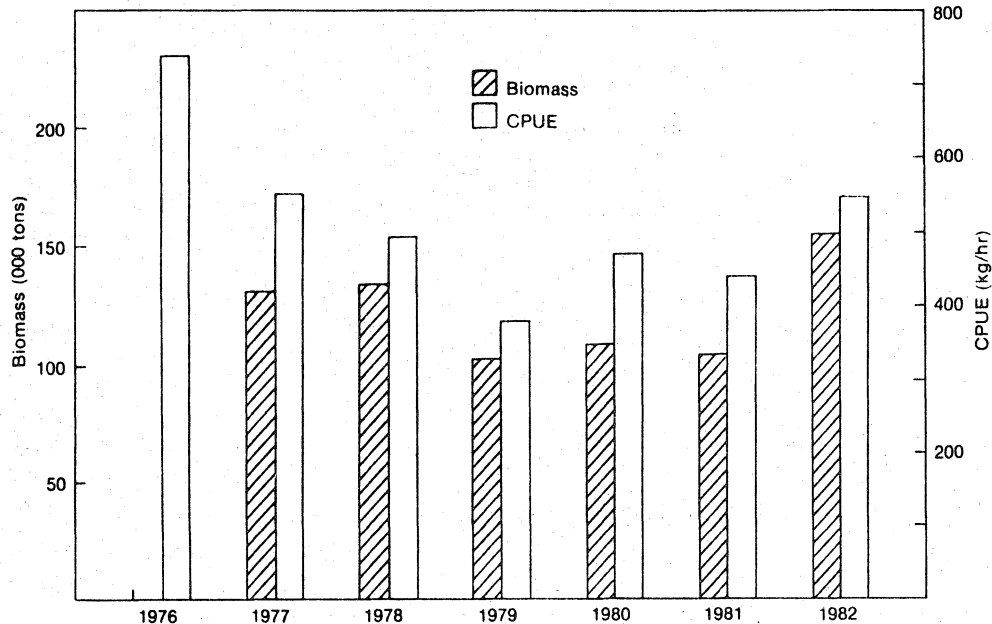


Fig. 1. Estimates of total biomass from photography and average CPUE from commercial trawlers (July-September) in the area of 66°00'-69°30'N, 59°-60°W, in depths from 100 to 600 m.

8. Management Advice

Catch rates from Canadian, Greenland and Norwegian fisheries in Div. 0A and 1B for the July-September period increased somewhat from 1981 to 1982. Although the catch rate for the French trawler was lower in 1982 than in 1981, it was generally agreed that the more extensive data supported the occurrence of an increase, which was likely due to recruitment and growth of the 20-25 mm modal size-group observed in 1981. Results from the photographic surveys and the CPUE indices (Fig. 1) indicate that the stock has fluctuated around a relatively stable level since 1978 (see also Table 2). The Committee noted, however, that the 1981 and 1982 catch rates may have been influenced by the introduction of new, more efficient trawls and thus not be directly comparable with the catch rates of earlier years.

The potential for recruitment to the fishery, based on data from the photographic surveys and from research and commercial length frequencies, indicate a decrease in the incidence of small shrimp (<20 mm) relative to the high level observed in 1981. These small shrimp were only partially recruited to the fishery in 1982 (possibly due to slower growth) but they should be fully recruited in 1983. It is not certain what effect this recruitment will have on the 1983 catch rates, but the lower abundance of small shrimp in 1982 may result in reduced catch rates in 1984 and 1985.

Although the stability of the fishable stock has continued since 1979, STACFIS noted the uncertainty about recruitment in 1983, with the possibility of reduced recruitment in subsequent years, and therefore advises that the overall 1983 TAC for the offshore grounds in Subarea 1 and the adjacent parts of Subarea 0 should remain at the level advised for 1979-82 (29,500 tons). STACFIS also agreed that

the practice of allowing only a small portion of the TAC for the offshore grounds 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.

The Committee expressed concern about the catches since 1980 (37,000-39,000 tons) relative to the advised TAC (Table 1). It appears that removals in the offshore fishery are approaching the maximum catch level (43,000 tons) attained in 1976 (Fig. 2), after which catch rates declined until 1979. This may be increasingly important if anticipated declines in recruitment do, indeed, occur.

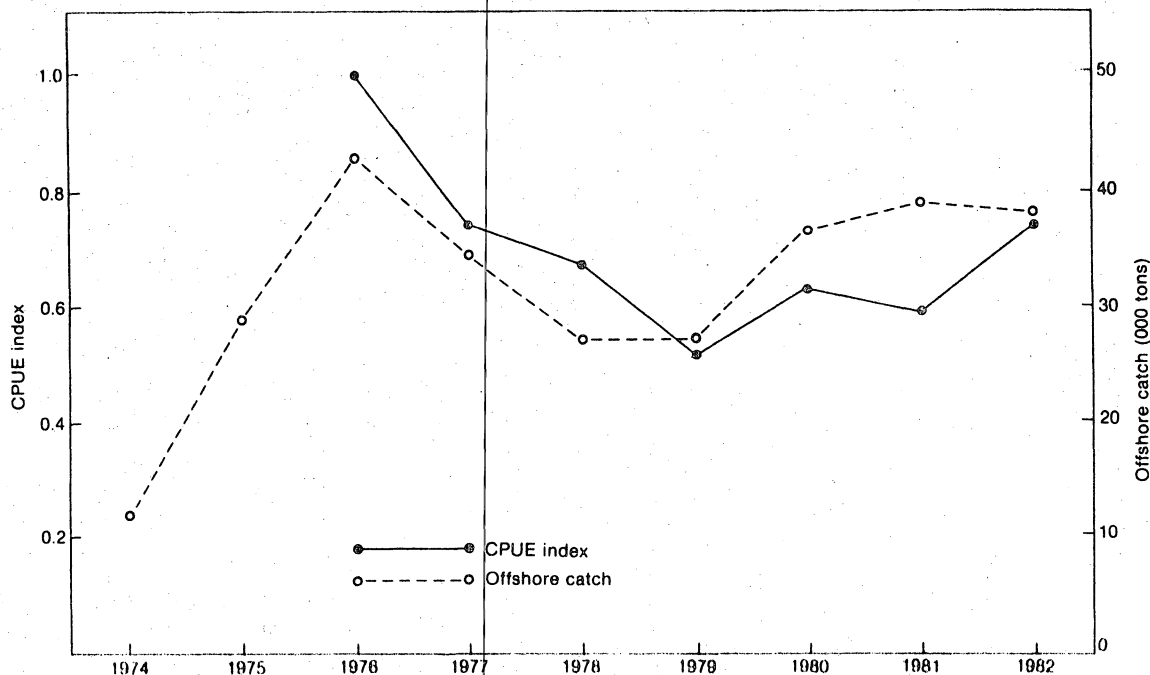


Fig. 2. CPUE index for Greenland trawlers in Div. 1B and total offshore catches in Subareas 0 and 1, 1976-82.

9. Future Research Requirements

As a result of recommendations from the November 1981 Meeting, some improvement was apparent in the quality of the 1982 data. Revision of the distribution model for the photographic data in 1982 greatly improved the confidence in the results. This survey also provided additional information on recruitment and temperature at various depths. A pilot trawl survey, using a stratified-random design, was conducted on the fishing grounds in Subarea 1, forming the basis for annual surveys. Efforts were made by countries participating in the shrimp fishery to continue their observer programs, to improve the quality of data that they collect and to ensure that catches are accurately reported and well-documented. Since the Greenland shrimp fishery accounts for 75-80% of the total shrimp catch, it is important that all biological sampling data be analyzed and presented. Further improvements are necessary in the quality of information on discarding of shrimp. STACFIS therefore

recommends

- i) that an indepth analysis of a time series of biological data from the Greenland fishery be initiated in 1983;
- ii) that the annual photographic survey be continued and efforts be made to redefine size categories for shrimp observed in the photographs;
- iii) that stratified-random trawl surveys be conducted annually, possibly through cooperative arrangements between participating countries;
- iv) that data indicating reproductive success, such as fecundity levels, proportion of non-maturing females, proportion of females spawning for the first time, incidence of non-viable eggs and larval abundance be routinely collected for future correlation with stock abundance indices and environmental records;

- v) that the observer program be continued and efforts increased to improve the quality of the data on discards; and
- vi) that countries participating in the shrimp fishery continue efforts to ensure that fishing vessel logbooks are completed and made available to authorities as soon as possible.

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

1. Fishery Trends

This stock, previously referred to as the East Greenland stock, is distributed in Denmark Strait on both sides of the line between Iceland and Greenland. The shrimp fishery began in 1978 by an Icelandic vessel on the eastern side of the midline (Table 3). 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 declined to 4,800 tons from both sides of the midline, 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. Provisional data indicate a catch of 4,600 tons in 1982.

Table 3. Nominal catches (metric tons) of shrimp (*Pandalus borealis*) reported from Denmark Strait, 1978-82.

Country	1978	1979	1980	1981 ¹	1982 ¹
Denmark	0	0	702	581	646
Faroese	0	0	4,233	713	537
France	0	0	50	353	414
Greenland	0	0	200	1,004	1,115
Iceland	363	485	614	125	0
Norway	0	800	2,461	2,016	1,880

Total	363	1,285	8,260	4,792	4,592
Advised TAC	-	-	-	-	4,200
Effective TAC ²	-	-	-	8,000	4,500

¹ Provisional data

² On the western side of the midline

2. Distribution of Fishing Effort and Biomass (SCR Doc. 83/1/4, 6, 9)

The shrimp fishery in Denmark Strait in 1982 took place in the area of Strede and Dohrn banks, as in earlier years, but in a more restricted area than in 1981 and especially in 1980. Mostly due to ice cover, there was no fishery on the Icelandic side of the midline in 1982. On the western side of the midline, the overall fishing period extended from February to June, when the total allowable catch was achieved. The main fishing period occurred from March to May.

Forty-two vessels participated in the fishery in 1982. Danish, French and Norwegian data indicated that the fishery was restricted along and west of the 30°W meridian during March to May, with a northward shift in June, as in earlier years. While highest catch rates were obtained just north of 66°N in 1980, there was a northward shift in 1981. In 1982, however, highest catch rates were obtained south of 66°N in April and May, with declining catch rates north of 66°N compared to 1980 and 1981.

The possible influence of ice cover on the distribution of the fishery was discussed. In April 1982, ice may have hindered access to the northern part of the area exploited in earlier years. However, the higher catch rates in the southern part of the area and information from the Danish fishery indicated that ice cover on the western side of the midline may not have significantly influenced the distribution of the fishery.

The significance of the absence of high peak catch rates in 1982 due to lower concentrations of berried female shrimp in contrast to previous years, was discussed. This absence of peaks may have been due either to a different distribution of the shrimp stock in 1982 compared to the years before, or to a marked reduction of the female spawning stock through exploitation.

3. Biology (SCR Doc. 83/1/4, 6, 9)

The biology of shrimp in Denmark Strait is not well known, mainly because sampling, limited to commercial vessels, has been possible only for a part of the year and because the sampling area has been

restricted in part by ice cover. Therefore, all information available for 1982 pertains to the short period from the end of March to the middle of June.

The size distribution of shrimp, based on French, Norwegian and Danish data, indicated that, as in 1981, most of the shrimp caught ranged in size from 24 to 36 mm carapace length, with a mode at 28.5 mm. However, the Danish and French observations showed a slight decrease in mean size in 1982 due to the lower abundance of large individuals. Length-weight relationships for ovigerous and non-ovigerous shrimp showed no major differences from results obtained for stocks in Davis Strait. Information on sexual components of catches from French and Danish data indicates that only adult shrimp were present on the fishing grounds. Males plus transitionals ranged in size from 19 to 31 mm and females from 25 to 36 mm. Sex reversal occurred at sizes of 25-31 mm. Most of the females taken during March-May were ovigerous and the French data indicated that hatching occurred in May-June, as in 1981. All transitionals and non-ovigerous females had ripening gonads during the spring, but only 30-50% of the ovigerous shrimp appeared to be maturing again. Thus, it is possible that a significant proportion of females do not spawn on a yearly basis and that they can grow to larger sizes than observed in the Davis Strait stock. This is in agreement with the three modal size-groups noted in the French length frequency samples.

Although large concentrations of berried and hatching females were present south of Dohrn Bank, it is not known if the stock is self-sustaining. The absence of juveniles and males of sizes less than 19-20 mm in the 1981 and 1982 length frequencies indicates that young shrimp are not present on the fishing grounds. If the stock is self-sustaining, it must be assumed that the young shrimp inhabit the area north of the fishing grounds, because there are no areas with suitable depth south of the fishing grounds. Hydrographic observations indicate a possible northward drift of shrimp larvae. However, the possibility of recruitment from larvae hatched in the Icelandic plateau must be considered.

4. Catch and Effort (SCR Doc. 83/I/4, 6, 9)

Monthly catch rates and corresponding effort, based on logbook data for the Danish, French, Greenland, Iceland and Norwegian fisheries in 1980-82, are listed in Table 4. There has been a gradual shortening of the fishery season, possibly due to management of the fishery. In 1980 and 1981, catch rates were highest during March-April, whereas in 1982 catch rates were highest in May. Although May catch rates were higher in 1982 than in 1981, those for March and April were substantially lower in 1982, and catch rates on the average have been decreasing.

Table 4. Representative catch rates (kg per hour trawling) and corresponding effort (hours trawling) for the shrimp fishery off East Greenland in 1980-82.

Year	Month	Denmark and Greenland		France		Iceland ¹		Norway	
		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
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	162	764	-	-	-	-	228	627
	Apr	192	1,570	216	331	-	-	171	2,562
	May	277	1,395	264	563	-	-	226	1,885
	Jun	-	-	185	238	-	-	-	-

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 is 1,480 hours.

5. Discarding of Shrimp (SCR Doc. 83/I/4, 6, 9)

Data on discarding of shrimp in Denmark Strait were available only for Norwegian and French vessels. Because of the large size of the shrimp, no discarding was observed in the French fishery, except damaged individuals. Discarding on Norwegian vessels was 3.7% of the total catch (weight) in 1982 compared to 11.5% in 1981. Thus, there seemed to have been less discarding in 1982 than in earlier years.

6. By-catches (SCR Doc. 83/I/4, 6, 9)

Data on by-catches of fish in the shrimp fishery were reported for French and Norwegian vessels. The total by-catch of fish taken in the shrimp fishery by French vessels was composed mainly of redfish (5 tons) and capelin (1-2 tons). In the Norwegian shrimp fishery, redfish dominated in the by-catches, although the mean number of cod per haul increased from 1 in 1981 to 23 in 1982. The mean number of fish per kg of shrimp caught decreased from 0.76 in 1981 to 0.16 in 1982.

7. Biomass Estimates

No estimate of the shrimp biomass in Denmark Strait could be made from the data available.

8. Advice on Management

No reliable estimates of the stock in Denmark Strait were available, but the Committee noted the following points: (a) the commercial catch rates, on the average, are decreasing without indications of levelling off, the decrease being primarily related to the current absence of peak catches in spring, which may reflect a sharp decline in the spawning biomass of females from 1980 to 1982; (b) a substantial part of the female component may not spawn each year (compared to other exploited stocks), which, combined with lower abundance, could result in relatively low recruitment; (c) about 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 (d) the stock may be living under extreme and unstable environmental conditions.

STACFIS expressed concern that this stock may be very sensitive to possible over-exploitation and therefore advises that the overall TAC for 1983 should not exceed the advised level for 1982 (4,200 tons). STACFIS further notes that, in light of a possible drastic reduction in the female component of the stock, the advised TAC might be considered too high.

9. Future Research

Although some improvement has been achieved in the knowledge of the stock of shrimp in Denmark Strait in 1982, particularly with regard to biological characteristics, the lack of information on a year-round basis was again strongly stressed by STACFIS. Information is specially needed on seasonal variation in distribution and abundance and on the life-cycle of shrimp in the area. The interaction of this stock with those of other areas should also be investigated, with special regard to larval drift and migration patterns of adults. The lack of data on environmental factors affecting the area, such as the influence of pulsations of Polar and Atlantic waters over the shrimp grounds, was again emphasized. Such studies are specially important because the stock in this area seem to be living at or near the environmental limit of its natural habitat. Consideration should also be given to studying the displacement of this stock, because a considerable proportion of females do not appear to be available to the fishery during the whole year. Under such conditions, STACFIS can only reiterate the great concern expressed at the November 1981 Meeting, 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; and*
- iv) *that a study on environmental conditions be undertaken, including the current circulation in the area.*

III. ADJOURNMENT

There being no further business, the Chairman of STACFIS expressed his thanks to all participants, especially to the various rapporteurs, for their keen interest and cooperation during the course of the meeting. He also expressed his appreciation to the NAFO Secretariat for their usual efficient work in preparing documents and reports.

APPENDIX II. PROVISIONAL AGENDA FOR SPECIAL MEETING ON SHRIMP, JANUARY 1983

- I. Opening (Chairman: R. Wells)
 1. Appointment of rapporteur
 2. Adoption of agenda
 3. Plan of Work

- II. Fishery Science (STACFIS Chairman: J. P. Minet)
 1. Shrimp in Subareas 0 and 1 (Annexes 1 and 2)
 - a) Review of fishery trends
 - b) Distribution and biology
 - c) Catch and effort
 - d) By-catches in shrimp fishery
 - e) Discarding of shrimp
 - f) Biomass estimates
 - g) Total allowable catches
 - h) Future research needs
 2. Shrimp at East Greenland (Annex 1)

(Items (a) to (h) in 1 above)
 3. Other Matters

- III. Review of Future Meeting Arrangements
 1. Main Scientific Meeting, June 1983
 2. Annual Meeting, September 1983

- IV. Other Business

- V. Adjournment

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

1. The EEC requests the Scientific Council to provide advice for the following stocks, subject to the agreement of the other coastal state concerned in the case of joint stocks:
 - a) Stocks occurring both in the EEC and Canadian Fishery Zones: Greenland halibut, Roundnose grenadier, and Shrimp in Subareas 0 and 1.
 - b) Stocks occurring in the EEC Fishery Zone: Cod, Redfish and Catfish (Wolffish) in Subarea 1.

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

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

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

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

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

ANNEX 2. CANADIAN REQUEST FOR SCIENTIFIC ADVICE CONCERNING VARIOUS MATTERS

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

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

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

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

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

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

- i) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and management options evaluated in terms of their implications of fishable stock size in both the short and long term. In those cases where present spawning stock size is a matter of scientific concern in relation to the continuing productive potential of the stock, management options should be evaluated in relation to spawning stock size. As a general reference point, the implications of continuing to fish at $F_{0.1}$ in 1983 and subsequent years should be evaluated. The present stock size should be described in relation to those observed historically and to those expected at the $F_{0.1}$ level. Management options for arriving at the latter stock size on a shorter time scale should be developed. Opinions of the Scientific Council should be expressed in regard to stock sizes, catch rates, and TACs implied by these management strategies for 1983 and the long term.
- ii) For those stocks subject to general production-type assessments, the status of the stock should be reviewed and management options evaluated in the way described above to the extent possible. In this case, the general reference point should be the level of fishing effort (ΣF) which is two-thirds that calculated to be required to take the MSY catch in the long term.
- iii) For those resources on which only general biological and/or catch data are available, no standard criteria on which to base advice can be established. The evidence on stock status should, however, be weighted against a strategy of optimum yield management and maintenance of stock biomass at levels of about two-thirds that of the virgin stock.

Dr. A. W. May
Assistant Deputy Minister for Atlantic Fisheries
Department of Fisheries and Oceans
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APPENDIX III. LIST OF PARTICIPANTS - JANUARY 1983

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APPENDIX IV. LIST OF RESEARCH DOCUMENTS

<u>SCR No.</u>	<u>Ser. No.</u>	<u>Title</u>	<u>Author(s)</u>
83/I/1	N639	Biomass of shrimp (<i>Pandalus borealis</i>) in NAFO Subarea 1 in 1977-1983, estimated by means of bottom photography. (22 pages)	P. Kanneworff
83/I/2	N640	The Canadian fishery for shrimp (<i>Pandalus borealis</i>) in Division OA, 1982. (21 pages)	D. G. Parsons P. J. Veitch G. E. Tucker
83/I/3	N641	Catch, effort and biological characteristics of shrimp (<i>Pandalus borealis</i>) in the French fishery off West Greenland, 1982. (19 pages)	H. Dupouy B. Fontaine
83/I/4	N642	Catch, effort and biological characteristics of shrimp (<i>Pandalus borealis</i>) in the French fishery off East Greenland in 1982. (21 pages)	H. Dupouy P. Derible A. Biseau
83/I/5	N643	Norwegian investigations on shrimp, <i>Pandalus borealis</i> , off West Greenland in 1982. (8 pages)	T. Jakobsen S. Torheim
83/I/6	N644	Norwegian investigations of shrimp, <i>Pandalus borealis</i> , in East Greenland waters in 1982. (7 pages)	T. Jakobsen S. Torheim
83/I/7	N645	A trawl survey with R/V <i>Dana</i> on the offshore shrimp grounds in Div. 1B, July-August 1982. (5 pages)	Sv. Aa. Horsted
83/I/8	N646	Data on the shrimp fishery in NAFO Subareas 0 and 1 in 1981 and 1982.	D. M. Carlsson
83/I/9	N647	Data on the shrimp fishery at East Greenland, 1980-82.	D. M. Carlsson

Northwest Atlantic



Fisheries Organization

Serial No. N648

NAFO SCS Doc. 83/I/1
(Corrigendum)

SPECIAL SCIENTIFIC COUNCIL MEETING - JANUARY 1983

Provisional Report of Scientific Council

Dartmouth, Canada, 19-24 January 1983

CORRIGENDUM

Page 5. Replace paragraph at top of page by the following:

"2. Annual Meeting, September 1983

The Council will meet during 14-23 September 1983, with 3 days (14-16 September) being allocated for the Special Session on "Trophic relationships in marine species relevant to fisheries management in the Northwest Atlantic". Other matters will be considered on 19 September and the closing session will take place on 23 September 1983. This meeting will be held at Leningrad, USSR."

- Page 7.
- (a) In the first paragraph under fishery trends, the catches noted at the end of line 3 (43,000 tons) and in line 4 (38,000 tons) should be changed to "42,000 tons" and "37,300 tons" respectively.
 - (b) In the "SA 1" section of Table 1 under 1982, delete "873" and replace with "-"; change "40,562" to "39,689"; and change "35,562" to "34,689".
 - (c) In the row "0+1 Offshore Catch" under 1982, change "38,217" to "37,344".

