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SPECIAL MEETING OF SCIENTIFIC COUNCIL - NOVEMBER 1981

Report of special Meeting of Scientific Council

Dartmouth, Canada, 23-26 November 1981

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REPORT OF SPECIAL MEETING OF SCIENTIFIC COUNCIL

Dartmouth, Canada, 23-26 November 1981

Chairman: R Wells

Rapporteur: V. M. Hodder

The Scientific Council met at NAFO Headquarters, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 23-26 November 1981 to provide advice for 1982 on the conservation of the harp and hooded seal stocks in the Northwest Atlantic and the shrimp stocks in Subarea 0 and 1, as requested jointly by Canada and the European Economic Community (EEC) (Appendix II). In addition, at the request of the EEC with the agreement of the executive Committee of the Council, a review of the status of the shrimp stock and fishery off East Greenland was included in the agenda for this meeting. The meeting of the Council was preceded on 20-21 November 1981 by the Workshop on Ageing Shrimp, with J. Frechette as Convener, to finalize work which was initiated in May 1981 (SCS Doc. 81/VI/14). Representatives attended from Canada, EEC, Iceland and Norway, and observers were present from the United States of America (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. The list of research and summary documents is given 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 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, of which 27,000 and 25,000 tons respectively were taken in these years. The same TAC was advised for 1981 (NAFO Sci. Coun. Rep. 1979-80, page 148), but a total of 35,000 tons was set by the coastal states involved. Preliminary statistics for January-October 1981 indicate an offshore catch of about 30,000 tons (Table 1), the major fishing grounds being on the northern part of Store Hellefiske Bank (Div. OA and 1B) and in Holsteinsborg Deep between 66° and 67°N.

Table 1. Total catches (metric tons) of shrimp in Subarea 0 and offshore parts of Subarea 1 and corresponding TACs, 1973-81.

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Catch	4,692	11,945	29,190	42,766	34,300	26,869	27,087	25,406	30,332 ¹
TAC	-	-	-	-	36,000	40,000	29,500	29,500	35,000

¹ Preliminary data, January-October

All available biological information on length distributions by sex and maturity stages and all data on trends in catch rates, biomass estimates and stock composition were considered in advising on a TAC for 1982. It was noted that, after the decline in abundance observed during 1976-79, catch-per-unit-effort increased in 1980 and stabilized in 1981. Data from a photographic survey indicated an increase in biomass in 1981, primarily due to an increase in abundance of small shrimp. Length frequency data confirmed this observation by showing larger proportions of small shrimp in the catches than in previous years. The major part of this recruiting group has been estimated as age 2 shrimp in 1981, possibly indicating good recruitment to the spawning stock in 1983.

Recognizing the relative stability of the stock in recent years but with some uncertainty about the strength of recruiting year-classes, the Council advises that the overall TAC for the offshore grounds in Subarea 1 and adjacent parts of Subarea 0 in 1982 should not exceed 29,500 tons, the same level as advised previously for 1981. In order to improve the basis for assessing the stock in Subareas 0 and 1, the Council endorses the recommendations of STACFIS regarding future research requirements (see Appendix I).

2. Assessment of Shrimp off East Greenland

The shrimp fishery off East Greenland began in 1978, and vessels from Denmark, Faroe Islands, France, Greenland, Iceland and Norway fished in the area in 1980-1981. The total catch on both sides of the midline between Greenland and Iceland increased rapidly to 8,000 tons in 1980 (Table 2). Preliminary data indicate a catch of about 5,000 tons for January-October 1981. The fishery which occurred on Strede and Dohrn banks in 1980 was restricted mainly to Strede Bank in 1981 (along the 30°W meridian south of 67°N), possibly due to extensive ice cover observed from April to June 1981. After this

period the fishery shifted slightly northeastward closer to the midline. In 1980 and 1981, mean catch rates (both sides of the midline) peaked in March-April, declined during the summer to low values and increased slightly in the autumn. However, the peak catch rates in 1981 were slightly lower than in 1980.

Table 2. Total catches (metric tons) of shrimp off East Greenland

	1978	1979	1980	1981
Catch	363	1,285	8,260	4,917 ¹

¹ Preliminary data, January-October

The available data indicated that the fishery in the spring exploited large berried females which were larger than in other areas of the North Atlantic except for the Cumberland stock. By-catches in the shrimp fishery consisted mainly of capelin, small redfish, polar cod, sandeel and small Greenland halibut.

From calculations based on a general production model, it was agreed that 4,200 tons could be a plausible estimate of the maximum sustainable yield. In view of the decline in catch and the significant decrease in catch rates from 1980 to 1981, and noting that this stock lives under extreme environmental conditions and may be sensitive to over-exploitation, the Council urges that a cautious approach should be taken in exploiting this stock and advises that the overall TAC should not exceed 4,200 tons in 1982. In order to improve the basis for assessing this stock off East Greenland, the Council endorses the recommendations of STACFIS regarding future research requirements (see Appendix I).

3. Assessment of Seal Stocks

a) Harp seals

The total catch of 200,162 seals in the Gulf and Front areas in 1981 exceeded the TAC by about 30,000 animals, due to unexpected catches in southern Labrador resulting from unusually light ice conditions along the coast, which enabled small vessels from Newfoundland and southern Labrador to participate in the hunt for whitecoats.

Recaptures of seals marked in the Gulf and Front areas provided unbiased and therefore reliable estimates of pup production in 1978 and 1979 of 469,000 \pm 26,000 (mean \pm standard error) and 476,000 \pm 36,000 respectively.

These estimates were used with other data in a computer simulation to provide the best estimate of pup production (380,000-390,000) in 1967, the starting point of the model, and the best estimate of natural mortality (0.0950-0.0975) for the 1967-81 period. Projections of the simulation from 1981 to 1991 indicated that TAC increases of 10, 25 and 50% do not cause the population (2.04-2.15 million animals in 1981) to decline, but doubling of the TAC produces a gradual decline to 1.8 million or 1.4 million by 1991 depending on the value of natural mortality used in the first year (i.e. $M_0 = M$ or $M_0 = 3M$, where M is natural mortality of age 1+ animals.) Replacement yields for 1982 and 1983 were estimated at 285,000 and 301,000 ($M_0 = M$) and at 239,000 and 248,000 ($M_0 = 3M$) respectively. Replacement yields increase to maxima of 338,000 ($M_0 = M$) and 284,000 ($M_0 = 3M$) by 1986 when they effectively become the sustainable yields. The Council notes that insufficient time was available to study the model thoroughly at this meeting and advises that further critical review should be undertaken before the results are adopted as a basis for major revision of management schemes for 1982.

At the joint request of Canada and the EEC, a number of questions on the interaction between harp seals and commercially exploited fish populations were discussed. The general conclusion was that the available information was insufficient to answer the questions adequately.

b) Hooded seals

The total catch of 13,686 seals in the Front and Gulf areas in 1981 was slightly less than the TAC of 15,000 animals. Preliminary analyses of historical data on production and mortality were considered, but, due to uncertainty about recent levels of pup production and stock size, the Council agreed that there was no firm basis for changing the present management regime.

c) Future research

The Council strongly endorses the recommendation of STACFIS concerning future research requirements for harp and hooded seals in order to improve the basis for assessing the stocks.

II. FUTURE SCIENTIFIC MEETINGS

1. Regular Meeting, June 1982

The Council confirmed that its next meeting would be held at the Holiday Inn, Dartmouth, Nova Scotia, Canada, during 2-18 June 1982. The first 4 days will be allocated for a special session on squid biology and distribution, with Mr. T. W. Rowell as Convener. Meetings of the standing committees (STACFIS, STACREC and STACPUB, and associated subcommittees and working groups) will take place during 7-17 June 1982 to deal with the regular business of the Council.

2. Annual Meeting, September 1982

The Council confirmed that its Annual Meeting will be held at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada, during 8-13 September 1982, immediately preceding meetings of the General Council and the Fisheries Commission on 14-17 September 1982. Noting the success of the September 1981 Meeting in attracting valuable contributions on environmental conditions during 1970-79 and on remote-sensing applications to fishery science, the Scientific Council agreed that an appropriate theme for the September 1982 Meeting would be "stock discrimination", with emphasis on marine fishes and squid of the Northwest Atlantic, but not excluding contributions on species in other regions if emphasis is on methodology. The Council requested the Executive Committee to arrange for a convener as soon as possible so that an agenda and information about the special session can be circulated early in 1982.

3. Ad hoc Working Group on Herring Tagging, January 1982

The Council noted that this Working Group, established at the September 1981 Meeting (SCS Doc. 81/IX/27), will meet at Quebec City, Quebec, Canada, during 12-14 January 1982, with W. T. Stobo as Convener.

III. APPROVAL OF REPORTS

1. Provisional Report of the September 1981 Meeting

The Council reviewed and formally approved with minor amendment the report of its Meeting at Dartmouth, Nova Scotia, Canada, 8-18 September 1981 (SCS Doc. 81/IX/27).

2. Report of this November 1981 Meeting

The Council noted that its report of the present meeting is scheduled for inclusion in the next issue of "Scientific Council Reports" to be published in December 1981, and agreed to formally adopt the report, subject to minor editorial amendment, where necessary, by the rapporteur.

IV. OTHER MATTERS

1. Coordination of Research on Flemish Cap

The Council reviewed its comments at the September 1981 Meeting regarding coordination of research activities on Flemish Cap in 1982 (SCS Doc. 81/IX/27; pages 4 and 15). It was agreed that the STACFIS recommendation from that meeting should be modified to ensure that discussions are initiated as soon as possible by correspondence with potential participants so that maximum coordination of 1982 surveys can be achieved. Consequently, the Council requests the Convener of the Working Group, J. T. Anderson, to initiate correspondence on this matter with USSR scientists at PINRO (Polar Research Institute of Marine Fisheries and Oceanography, Murmansk) to arrange for coordination of research in the Flemish Cap area in 1982.

2. Workshop on Hooded Seals

The Council welcomed the proposal by Norway to hold at Bergen in 1983 an international workshop on hooded seals and urges that appropriate support for this undertaking be given by interested Contracting Parties of NAFO.

3. Inadequate Time for Assessments

The Council noted that the time allotted for this meeting was insufficient to deal with all aspects of the assessments of the shrimp and seal stocks, and agreed that 5 working days are required if a similar meeting is held in November 1982.

V. 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 the Convener of the Working Group on Seals (A. W. Mansfield), and to all participants for their cooperation and contributions. The meeting adjourned at 1630 hours on 26 November 1981.

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

Special Meeting on Shrimp and Seals, November 1981

Chairman: J. P. Minet

Rapporteurs: Various

The Committee met at Dartmouth, Nova Scotia, Canada, during 23-26 November 1981 to review the status of the shrimp stocks in Subareas 0 and 1 and the harp and hooded seal stock in the Northwest Atlantic, as referred to it by the Scientific Council based on joint requests of Canada and the European Economic Community (EEC). In addition, as requested by the EEC, the Committee reviewed the status of shrimp stocks off East Greenland. Scientists attended from Canada, EEC, Iceland, Norway and USA.

In considering the agenda of the Scientific Council, STACFIS agreed that the assessments of shrimp and seals be carried out by two groups which would meet concurrently. Consequently, Dr. A. W. Mansfield agreed to convene the *ad hoc* Working Group on Seals and the Chairman of STACFIS convened the Working Group on Shrimp. These groups met during 23-25 November 1981, and their reports as approved by STACFIS on 26 November are given in Sections I and II below.

I. ASSESSMENT OF SHRIMP STOCKS

1. Shrimp in Subareas 0 and 1

a) 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 and declined to 32,000 tons in 1980 (Table 1). The offshore shrimp fishery has been regulated by total allowable catch (TAC) since 1977. In 1977 and 1978, total offshore catches in Subareas 0 and 1 were about 34,000 and 27,000 tons against TACs of 36,000 and 40,000 tons respectively. In 1979 and 1980, the offshore fishery was regulated by a TAC of 29,500 tons, of which about 27,000 and 25,000 tons respectively were taken. In 1981, Canada and the 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 29,500 tons. Preliminary statistics for January-October 1981 indicate a total offshore catch of about 30,000 tons from Subareas 0 and 1. The inshore fishery at West Greenland has remained relatively stable at 7,500-8,000 tons except in 1974 when 10,000 tons were taken.

b) Distribution (SCR Doc. 81/XI/146, 147, 151, 155)

No research vessel trawl surveys were conducted in Subareas 0 and 1 in 1981, but the photographic survey in Subarea 1 was continued. Information was also available on the distribution of fishing effort for the Greenland and French fisheries in Subarea 1 and the Canadian fishery in Subarea 0. The distribution of fishing effort for Greenland vessels was generally the same in 1981 as in 1980, exhibiting the same northward shift as in 1980 compared with earlier years, but some differences were evident between the two years. In February-March 1980, effort was concentrated north of Store Hellefiske Bank (between 68° and 69°N), whereas in the same period of 1981 the fishery was concentrated in the Holsteinsborg Deep (between 66° and 67°N), apparently due to ice conditions, but catch rates in 1981 were higher than in 1980. During June-September 1981, Greenland vessels fished mainly to the west of Store Hellefiske Bank (in Subarea 1) between 67° and 69°N, whereas in 1980 more effort occurred in areas north of 70°N. Fishing effort by French vessels in 1981 was concentrated in Div. 1B between 67° and 68°N. Canadian vessels fished in the adjoining part of Div. 0A generally between 58° and 59°W.

Data from the Danish photographic survey in Subarea 1, based on 2,802 photographs, indicated highest concentrations of shrimp at about 300 m, as in previous years, although there was slight indication of a shift in abundance toward shallower depths.

c) Biology (SCR Doc. 81/XI/146, 147, 151, 155)

For the first time since 1978, three modal groups of male shrimp (10-15 mm, 15-20 mm and 20-25 mm) were clearly apparent in the length frequencies from French commercial catches. The third group may also include some transitionals (20-27 mm) and first spawning females (22-28 mm), although these two stages may belong to a fourth modal group. Well-developed head roe observed in all transitionals and females might be an indication that, after transition, all females take part in the reproductive cycle. In 1980, females became ovigerous primarily during September. The length frequencies from the catches by the different fleets were similar in structure. The occurrence of a mode between 15 and 20 mm in Canadian, French and Danish length frequencies, increased numbers of small shrimp from the photographic surveys, and Canadian length composition of discards provide evidence of possible strong recruitment to the fishery in 1982 and 1983.

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

Area	Country	1973	1974	1975	1976	1977	1978	1979	1980	1981 ²
SA 0	CAN	-	-	-	-	-	-	-	59	1565
	FAROEES	-	-	-	-	239	-	115	-	* ³
	DEN-G	-	-	-	-	-	-	149	815	-
	DEN-M	-	-	-	-	68	86	67	-	* ³
	FRA-M	-	-	-	-	-	21	7	-	-
	NOR	-	-	-	65	150	15	791	-	* ³
	SPA	-	-	-	327	-	-	-	-	-
	TOTAL	-	-	-	392	457	122	1129	874	3886
SA 1	CAN	-	-	-	-	-	-	245	590	-
	FAROEES	1371	2023	5300	11179	12612	8070	6867	3554	689
	DEN-G(a) ⁴	7950	10064	8700	7300	7800	7600	7500	7500	7500
	(b)	185	180	1089	2478	7081	5531	12527	16767	23156
	DEN-M	196	308	1142	2717	5842	3382	1327	872	976
	FRA-M	-	-	-	803	924	805	353	247	556
	FRG	-	-	-	-	31	-	-	-	-
	JAP	-	-	-	146	-	-	-	-	-
	NOR	2940	5917	8678	11658	7353	8959	4639	2502	1069
	SPA	-	-	6948	6925	-	-	-	-	-
	USSR	-	3517	6033	6468	-	-	-	-	-
	TOTAL	12642	22009	37890	49674	41643	34347	33458	32032	33946
	OFFSHORE	4692	11945	29190	42374	33843	26747	25958	24532	26446
	TAC (0+1 offshore)					36000	40000	29500	29500	35000 ⁵

¹ Statistics for 1973-1978 pertain to ICNAF Statistical Area 0 and Subarea 1, and for 1979 and onwards to the new NAFO Subarea 0 and 1.

² Preliminary to the end of October.

³ Total of 2,321 tons by Faroes, Denmark(M) and Norway.

⁴ a = inshore, b = offshore catches.

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

d) Catch and effort (SCR Doc. 81/XI/146, 147, 151, 157)

Catch and effort data, based on haul-by-haul logbook records, were available from the Canadian fishery in Subarea 0 and the French, Greenland and Norwegian fisheries in Subarea 1. The Canadian data for the July-September period indicated stabilization of catch rates in Subarea 0 in recent years. Data for a French vessel fishing in a small area west of Store Hellefiske Bank (Div. 1B) showed an increase of about 23% in mean catch rate in July 1981 relative to the same period in 1980. No conclusion could be drawn from the Norwegian data, as smaller vessels participated in the 1981 fishery and the catch rates were not directly comparable with those of previous years.

Data for 6 trawlers (722 GRT) of the Royal Greenland Trade Department showed, as in earlier years, high monthly mean catch rates during March-May, followed by a decrease in catch rates during June-September 1981. The peak spring catch rates were higher than in any year since 1977, due possibly to favorable ice conditions which provided better access to spring concentrations of berried female shrimp in 1981 than in previous years. As was the case in 1980, the Greenland shrimp fishery extended into Div. 1A as far north as 71°N. The mean catch rate of these Greenland trawlers in July-September was considered in previous assessments to be the best stock abundance index available. Following a gradual decline in this mean catch rate during 1976-79, there was an insignificant decrease from 1980 to 1981, indicating stabilization of the catch rate at approximately 450 kg of shrimp per hour trawled. Based on all of the available information, STACFIS agreed that there has been no significant change in the status of the shrimp stock on the offshore grounds in Subareas 0 and 1.

e) Discarding of shrimp (SCR Doc. 81/XI/146, 147)

The only information on shrimp discards in Subarea 1 was an estimate of 6% by weight of the shrimp caught by the French vessel in Div. 1B during 1981. Canadian data for Subarea 0 indicated that the discarding rate increased from 2.4% in June to 7.4% in September 1981, the June and July rates being lower and the September rate higher than those for 1980. The higher rate in September 1981 may be due to increased recruitment of small shrimp to the fishery.

f) By-catches in the shrimp fishery (SCR Doc. 81/XI/146, 151)

As in previous years, redfish (mainly *Sebastes mentella*) was the major by-catch in the shrimp fishery. Canadian data for Subarea 0 during June-September indicated lower by-catches of redfish in 1981 than in 1980, the ranges of monthly values being 3-15% and 2-33% respectively. Excluding incidental catches of Greenland shark, other species (mainly Greenland halibut, American plaice and wolffishes) constituted a maximum of 1% of the total catch. In Subarea 1, there has been a steady decline in by-catches of redfish, particularly in Div. 1B.

g) Biomass estimates (SCR Doc. 81/XI/155)

The only biomass estimate for 1981 was derived from photographic survey data based on a mathematical model introduced at the November 1980 Meeting (SCR Doc. 80/XI/169). New estimates for 1977-80, utilizing all available survey data, were in good agreement with those presented in 1980. The total biomass in the area between 66°00'N and 69°30'N was estimated at 252,000 tons for 1981. This represented a major increase from 177,000 tons indicated for 1980, but special analysis indicated that a large part of the increase was due to greater abundance of small shrimp, although a small increase was indicated for medium-sized shrimp. If the biomass calculations had been based on a density index (number per square meter) instead of a weight index (grams per square meter), the increase in biomass from 1980 to 1981 would have been more pronounced.

It was noted that the variance associated with the photographic survey data remains high and that cautious interpretation of the estimates should be maintained. The trend in biomass estimates for 1977-80 is generally similar to the trend in seasonal catch rates of Greenland trawlers, but the significant increase in biomass from 1980 to 1981 is not reflected in the catch rates. Although a more or less continuous decline in the mean size of shrimp was observed during 1977-81 at a check station sampled in all years in the central area of commercial fishing, the biomass calculations for all years involved were based on the same average individual weight of shrimp. Consequently, the biomass for 1980 may be slightly overestimated and that for 1981 overestimated to a larger degree, due to the increasing abundance of small shrimp.

The photographic sampling data may indicate good recruitment to the stock, possibly in 1983, as a major portion of the recruiting group is estimated to consist of age 2 shrimp. As was the case in previous years, the greater proportion of small shrimp was found at stations in the area north-west of Store Hellefiske Bank.

h) Total allowable catch

Catch rates from the Canadian, French, Norwegian and Greenland fisheries showed only slight increases or decreases between 1980 and 1981 for similar areas and seasons except for the increased spring catch rates of Greenland vessels. Considering all of the available evidence, the Committee concluded that the fishable stock has remained relatively stable during 1979-81. An abundance index, based on weighted catch rates of a comparable group of Greenland trawlers for the July-September period, was previously interpreted to indicate a reduction of approximately 50% in spawning stock biomass from a high (virgin) level in 1975-76 (NAFO Sci. Coun. Rep. 1979-80, page 157). This reduction corresponds to the prediction of the model on which the assessment of shrimp stock was first based (ICNAF Redbook 1977, page 15). The catch rate for 1981 is close to the predicted level, as indicated in the following table:

Year	1976	1977	1978	1979	1980	1981
Relative CPUE	1.00	0.73	0.67	0.50	0.64	0.59

A reduction in spawning stock of this magnitude from the unexploited (virgin) level indicates that the stock biomass should be maintained at about two-thirds of the virgin stock level. As the joint Canada-EEC request was not received prior to the meeting, there was insufficient time to consider the other requested option, i.e. maintenance of the biomass at one-half of the virgin stock level.

Data from the photographic survey indicated as increase in biomass in 1981, primarily due to

increased abundance of small shrimp. Because many of these shrimp are not fully recruited to the fishery, such an increase would not be apparent from the commercial catch rates. However, commercial length frequency data supported the photographic survey data by showing larger proportions of smaller sizes of shrimp in the 1981 catches than in previous years. A quantitative estimate of recruitment could not be obtained, but some improvement over the average level should be obvious in 1982. Recognizing the relative stability of the fishable stock in recent years but taking into account the uncertainty about the strength of recruiting year-classes until at least 1982, STACFIS advises that the overall TAC for the offshore grounds in Subarea 1 and the adjacent parts of Subarea 0 in 1982 should remain at the same level advised for 1979-81 (29,500 tons). It was 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.

i) Future research

Several essential requirements were identified by STACFIS relating to potential improvement of the shrimp stock in Subareas 0 and 1. In view of the status of current assessment techniques for shrimp, the results of photographic and research trawl surveys remain an important part of the data base. Analysis of all biological samples, mainly length compositions by sex and maturity stages, was considered an essential requirement. Also considered was the need to improve the quality of data on discards and catches reported as fresh weight through continuing observer programs and the importance of properly maintaining logbook records on fishing vessels. STACFIS therefore

recommends

- i) that annual photographic surveys be continued and stratified-random trawl surveys be conducted annually, possibly through cooperative arrangements between participating countries;
- ii) that effort be increased to analyze all biological samples, especially those available from the Greenland fishery;
- iii) that the observer program be continued with emphasis on improving the quality of data on discards and ensuring that catches are reported as fresh weight rather than processed weight; and
- iv) that countries participating in the shrimp fishery take steps to ensure that fishing vessel logbooks are completed.

2. Shrimp at East Greenland

a) Fishery trends

The shrimp fishery in this area was begun in 1978 by an Icelandic vessel on the Icelandic side of the midline between Greenland and Iceland (Table 2). The catch increased to 1,300 tons in 1979, when Norwegian trawlers participated in the fishery, and exceeded 8,000 tons in 1980, following the additional involvement of Danish, Faroese, French and Greenlandic vessels. Preliminary data for January-October 1981 indicate a catch of about 5,000 tons of shrimp on both sides of the midline, considerably below the level of 8,000 tons aimed at by the EEC for the area west of the midline.

Table 2. Nominal catches (metric tons) of shrimp (*Pandalus borealis*) at East Greenland, 1978-81.

Country	1978	1979	1980	1981 ¹
Denmark	-	-	702	581
Faroese	-	-	4,233	713
France	-	-	50	353
Greenland	-	-	200	1,004
Iceland	363	485	614	125
Norway	-	800	2,461	2,141
Total	363	1,285	8,260	4,917

¹ Preliminary data for January-October

b) Distribution (SCR Doc. 81/XI/157, 158, 165, 167)

The shrimp fishery off East Greenland in 1981 took place in the Strede and Dohrn Bank area but was more restricted than in 1980. On the western side of the midline, fishing occurred mainly during April-June. Danish, French and Norwegian data indicated that the fishery was restricted to the area along the 30°W meridian south of 67°N during April and May, possibly due to extensive ice cover. A northeastern shift in the fishery closer to the midline was observed in June. French data indicated that trawling took place in depths of 250-480 m during April-May. On the Icelandic side of the midline, the fishery was delayed until late May due to the unusual southward extension of ice cover. No data were available to explain the geographical distribution of shrimp, particularly the smaller size-groups.

c) Biology (SCR Doc. 81/XI/157, 158, 165, 167)

The biology of shrimp off East Greenland is not well known, mainly because sampling is not possible in the winter due to ice cover, thus limiting the accumulation of biological knowledge on the stock over all phases of the life cycle. Nevertheless, some typical characteristics can be noted.

The shrimp are characterized by their large size (mean carapace length 24-34 mm), being larger than in any other area of the North Atlantic except the Cumberland stock. Sex reversal occurs at large sizes, but nothing definite is yet known about the growth and age of the shrimp due to the complete lack of small individuals in the samples. Although the females are ovigerous in late summer (spawning starting in July), there are indications that some of the females are not fertilized. It has been noted that the egg-bearing period is very long, but nothing definite about the length of the period can be stated due to the absence of winter samples. It is possible that the East Greenland stock is supported partly by its own larvae and partly by shrimp larvae drifting into the area from Icelandic waters. The stock may also be at its northern biological limit and thus be very sensitive to environmental changes.

d) Catch and effort (SCR Doc. 81/XI/157, 158, 165, 167)

Monthly catch rates, based on logbook data for the Danish, French, Greenland, Icelandic and Norwegian fisheries in 1980 and 1981, are given in Table 3. In both years, the catch rates were highest in March-April, declined to very low values during the summer and increased slightly in the autumn. The peak catch rates during March-April were significantly lower in 1981 than in 1980. Although ice conditions in the area during early 1981 may have hindered full access to the shrimp resource and thereby influenced the catch rates, it was agreed that the differences in catch rates reflected heavy impact of the fishery on the resource.

Table 3. Catch rates (kg per hour trawling) for the shrimp fishery off East Greenland in 1980 and 1981.

Year	Month	Denmark and Greenland	France	Iceland ¹	Norway
1980	Mar	-	-	-	904
	Apr	660	-	-	704
	May	420	-	125	378
	Jun	140	-	90	98
	Jul	70	62 ²	104	-
	Aug	70	-	123	95
	Sep	180	-	96	145
	Oct	110	-	-	99
	Nov	145	-	-	160
1981	Mar	-	-	-	322
	Apr	480	433	-	291
	May	260	261	-	146
	Jun	120 ²	144	99	113
	Jul	-	-	78	-
	Aug	-	-	39	39 ²
	Sep	-	-	-	42 ²

¹ Data from Icelandic side of midline between Greenland and Iceland; all other data from the Greenland side of the midline.

² Based on very small catches.

e) Discarding of shrimp (SCR Doc. 81/XI/157, 158)

French data showed a discard rate of less than 1% by automatic sorting with the possibility of some additional discarding by hand. Norwegian data indicated a discard rate of 15%, but this estimate was based on information from only one vessel and extrapolation to the entire Norwegian fleet was considered questionable. However, since the samples were taken during the peak fishing period, it probably approximately reflects the discarding practice of the Norwegian fleet. Discarding of shrimp is not known to occur in the Icelandic fishery.

f) By-catches in the shrimp fishery (SCR Doc. 81/XI/157, 158, 165)

Information on by-catches of fish in the shrimp fishery by Greenland, French, Icelandic and Norwegian vessels indicated that capelin and small redfish were the most common species. Significant quantities of polar cod, sandeel and small Greenland halibut were sometimes taken but the amounts varied between countries. Icelandic data for October 1980 (ICES C. M. 1981/K:7) indicated by-catches (number per hour trawling) of 71 polar cod (10-22 cm), 55 redfish (10-27 cm), 52 capelin (10-19 cm) and 15 Greenland halibut (12-88 cm). Norwegian data for April-May 1981 showed by-catches (number per hour trawling) of 124 redfish (8-32 cm) and 64 Greenland halibut (16-59 cm).

g) Biomass estimates

No estimate of the shrimp biomass off East Greenland could be made from the data available.

h) Total allowable catch

It was not possible to obtain a reliable estimate of the actual stock size of shrimp off East Greenland in order to provide an estimate of the sustainable yield. However, preliminary calculations, based on a general production model, indicated that 4,200 tons could be a plausible estimate.

Considering that the monthly catch rates in 1981 were significantly lower than in 1980 even though a part of the decrease might have been due to more severe ice conditions in 1981, that the total catch of 5,000 tons during January-October 1981 was only 60% of the proposed level on the Greenland side of the midline, that the stock may be living under extreme environmental conditions and therefore be very sensitive to possible overexploitation, and that the only available estimate of maximum sustainable yield was crudely derived from a general production model, STACFIS advises that the overall TAC for 1982 should not exceed 4,200 tons.

i) Future research

Research requirements for the West Greenland area apply equally well to the stock between East Greenland and Iceland. Of special importance is sampling on a year-round basis in the whole area of distribution whenever ice conditions permit fishing to take place. The interaction of this stock with those of other areas should be investigated with special regard to larval drift. There is a lack of knowledge about environmental factors affecting the area, such as the influence of pulsations of the Irminger Current over the shrimp grounds. Environmental studies are specially important because the shrimp in this area seem to be living at the northern limit of its distribution. Consideration should be given to a tagging study, as the stock consists mainly of large shrimp and a considerable portion of the females do not appear to be available to the fishery during the last part of the year. STACFIS therefore

recommends

- i) *that a sampling program be carried out to monitor the composition of the stock in the whole area of distribution on a year-round basis;*
- ii) *that plankton surveys be carried out to observe the drift of shrimp larvae;*
- iii) *that a study of environmental conditions be undertaken, including the current system in the area; and*
- iv) *that a tagging experiment be carried out to determine the migration patterns of various size group of shrimp.*

3. Other studies on shrimp

a) Information on the Gulf of Maine stock (SCR Doc. 81/XI/148)

STACFIS welcomed the presentation of a paper on recent trends in the USA shrimp fishery in the

Gulf of Maine. It was noted that nominal catches had increased to peak levels (11,000-13,000 tons) in the late 1960's and early 1970's and then declined precipitously to only 400 tons in 1977. The catch remained at approximately this level during 1979-80 but increased to 1,000 tons in 1981. Data from research vessel surveys indicated that the biomass had declined by 80-90% during the 1970's. Little if any recovery has been indicated by commercial indices of abundance and data from research vessel surveys by the State of Maine, but some improvement since 1977 is evidenced from Northeast Fisheries Center surveys. Temperature appears to have been an important factor in determining historical trends in abundance for this stock, although in recent years the relative impacts of temperature and exploitation on recruitment have been difficult to quantify. Management became intensive during the 1970's with declining abundance, culminating in closure of the fishery during 1978, but a winter-spring fishery has been allowed in subsequent years.

The Committee considered that the Gulf of Maine situation could provide useful biological data for interpretation of life history aspects and environmental impacts on recruitment. It was also noted that the Gulf of Maine fishery constituted an example of an unrestricted winter fishery on ovigerous females and could therefore provide the basis for future inferences on stock-recruitment relationships.

b) Workshop on age determination of shrimp

STACFIS noted that the Shrimp Ageing Workshop which met at Quebec City, Quebec, Canada, during 11-14 May 1981 to consider various techniques for estimating the age composition of shrimp from biological sampling data, had reconvened (with Mr. J. Fréchette as Convener) at NAFO Headquarters during 20-21 November 1981 to finalize discussions and complete its report. The report of the Workshop will be presented at the regular meeting of STACFIS in June 1982.

II. ASSESSMENT OF SEAL STOCKS

1. Harp seals

a) Review of fishery (SCS Doc. 81/XI/28)

Provisional Canadian and Norwegian statistics for the "Gulf" and "Front" areas in 1981 indicate a total catch of 200,162 harp seals, of which 176,328 were young of the year. Due to the unusually small amount of ice along the Labrador coast in 1981, coastal residents and a fleet of small (longliner-type) vessels were able to exploit the young seals in the area. This resulted in the catch exceeding the TAC by approximately 30,000 animals. No information was provided on harp seal catches in the Canadian Arctic and at West Greenland in 1981. Denmark provided final figures for West Greenland catches in 1977 and updated estimates for 1978-80. These data indicated that the annual total catch for these arctic regions in 1977-80 was probably in the order of 12,000-14,000 harp seals.

b) Research in 1981 (SCR Doc. 81/XI/149, 152, 153, 154, 158, 160, 161, 162, 163, 164, 166)

Canada reported on estimates of pup production from mark-recapture experiments (SCR Doc. 81/XI/153), on mean age at sexual maturity and age specific pregnancy rates (SCR Doc. 81/XI/152), on a reanalysis of population dynamics (SCR Doc. 81/XI/166), on the interaction of harp seals and their food organisms (SCR Doc. 81/XI/154), on changes in blood properties of fasting and feeding harp seal pups (SCR Doc. 81/XI/158), on energetics of nursing (SCR Doc. 81/XI/160), on changes in energy stores during neonatal development (SCR Doc. 81/XI/161), on changes in composition and energy content of harp seal milk (SCR Doc. 81/XI/162), on post-weaning growth (SCR Doc. 81/XI/163), and on energy utilization during the post-weaning period (SCR Doc. 81/XI/164). Denmark reported on recaptures at West Greenland up to 1981 of harp seals tagged and branded in the Newfoundland area (SCR Doc. 81/XI/149) and presented age frequencies of samples from northwest Greenland in 1978 and 1979 compared with those of previous years.

c) Population assessment

i) Pregnancy rate (SCR Doc. 81/XI/152)

There was significant change in mean age at maturity and age-specific pregnancy rates for 1981 from those of recent years. The available data were inadequate to determine if pregnancy rates are lower in the old females.

ii) Pup production (SCR Doc. 81/XI/153)

Data from the 1977-80 mark-recapture experiments were reanalyzed using new information on tag recoveries in 1981. Tagging was carried out in both the Front and Gulf areas in 1978-1980, and it was thus possible to test the hypothesis that the number of recoveries from

each area was proportional to the number originally tagged. The observed recoveries were compared with expected frequencies by a χ^2 goodness-of-fit test. The results indicated that the 1978 and 1979 marked cohorts produced unbiased estimates of pup production but that the 1980 data deviated significantly from the expected frequencies. Because tagging was carried out only in the Gulf in 1977 on a small number of seals, it was not possible to test the assumption of random sampling or uniform distribution of recovered tags, and consequently the 1977 estimate of production was considered unreliable. Estimated production in 1978, 1979 and 1980 was $469,000 \pm 26,000$ (mean \pm standard error), $476,000 \pm 36,000$ and $434,000 \pm 52,000$ pups respectively, the 1978 and 1979 estimates being considered the most reliable. The estimates from the mark-recapture experiments were combined to give a mean estimate of pup production for the 1977-80 period of 410,000 with nominal standard error of 46,000. This estimate was combined with estimates from survival indices and a simulation model to give the best available point estimate of pup production of 375,000 in 1980.

iii) Natural mortality, stock size and replacement yield (SCR Doc. 81/XI/152, 166)

A method was presented that used the probability distributions of the observed ratios between survival of the 1967 and 1968 cohorts and the 1971 and 1972 cohorts, together with the new mark-recapture estimates of pup production in 1978 and 1979, to obtain the most likely values for pup production (380,000-390,000) in 1967, the starting point of the model, and for instantaneous natural mortality (0.0950-0.0975) in the 1967-81 period. In view of the uncertainty about age-specific mortality rates, two simulations were undertaken. In the first case, the same natural mortality rate applied to all age-groups, resulting in most likely estimates for 1981 of $M = 0.0975$ and population size of 2.15 million age 1+ seals. In the second case, natural mortality in the first year was assumed to be 3 times that of age 1+ animals (i.e. $M_0 = 3M$), resulting in estimates for 1981 of $M = 0.095$ and population size of 2.04 million age 1+ seals.

Projections were made from 1981 to 1991, utilizing present age-specific hunting selectivities and age-specific pregnancy rates. Projections over this period were considered necessary to allow for possible changes in the age structure and to permit the cohorts entering under the assumed management regimes to reach an age where their contribution to pup production, and hence population size, could be assessed. Increases in the TAC of 10%, 25% and 50% do not cause the simulated population to decline, but a doubling of the TAC produces a gradual decline to 1.8 million animals in 1991 with $M_0 = M$ and to 1.4 million animals with $M_0 = 3M$. Replacement yields for 1982 and 1983 were estimated at 285,000 and 301,000 animals respectively for $M_0 = M$ and 239,000 and 248,000 animals respectively for $M_0 = 3M$. Replacement yields increase to maxima of 338,000 ($M_0 = M$) and 284,000 ($M_0 = 3M$) by about 1986 when they can be regarded as sustainable yields. However, these projections are uncertain due to possible changes in pregnancy rate and density-dependent effects. In view of the complexity of the new analysis and the lack of time to study it thoroughly at this meeting, STACFIS agreed that further critical review should be undertaken before the results are adopted as the basis for major revision of management schemes for 1982.

d) Interaction between harp seals and commercially exploited fish populations (SCR Doc. 81/XI/154)

The Committee considered the questions noted in the joint Canada-EEC request for advice on seals as follows:

- i) *What quantities of commercially exploited fish and invertebrates are estimated to be consumed annually by Northwest Atlantic harp seals? What is the size, age and species-stock composition of this consumed food?*

There is as yet little information to produce reasonable estimates of the quantities of food items eaten because of variability in species composition of the food by season, location, age of seals, and biased sampling (i.e. during whelping and moulting periods when seals do not feed regularly). Analysis of existing data should be completed by next year, and studies on energetics of harp seals, now in progress, will give better estimates of metabolic rates and therefore food demand.

- ii) *What direct or indirect (e.g. through competition for food) effects would increasing or decreasing the Northwest Atlantic harp seal population to 25% above or below its current abundance be expected to have on exploited fish and invertebrate stocks and yields from them?*

The effects are unknown for the reasons given in the answer to (i).

- iii) *To what extent, where and when are Northwest Atlantic harp seals accidentally killed in commercial fisheries for other marine animals?*

Accidental deaths, attributable to commercial fisheries are normally very few. Although harp seals have been captured in small numbers as by-catch in salmon drift-nets off West Greenland, this fishery has greatly diminished. Shrimp trawlers occasionally take seals off West Greenland, and the rare seals summering around Newfoundland may be caught by fishing gear. In 1981, with abnormally early melting of ice off eastern Newfoundland leading to an unusually early start of the cod gillnet fishery, about 1,000 beaters and bedlamers were taken as by-catch, this figure being much above normal.

- iv) *To what extent, when and where do Northwest Atlantic harp seals compete directly with fishermen by taking commercially exploited fish species near, in or from fishing gear?*

The information available indicates that such competition is rare.

- v) *To what extent does such competition damage gear or fish or disturb the functioning of the gear?*

Much damage is known to occur occasionally to gillnets in the cod fishery of northern Norway, but there is no evidence of such damage in the Northwest Atlantic.

- vi) *Is there evidence that harp seals indirectly affect exploited fish and invertebrate populations through propagation of disease or parasites?*

There is no special knowledge of the potential effects of harp seal parasites and diseases on exploited fish populations. However, harp seals are regarded as relatively unimportant hosts of the codworm, *Porrocaecum decipiens*, either because they summer outside its geographical range where *Contracaecum* and the herring worm *Anisakis* also predominate, or because infestation rates are low in contrast to those for grey seals, *Halichoerus grypus*, and harbor seals, *Phoca vitulina*.

e) Future research

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

recommends

- i) *that further biological samples of moulting harp seals and beaters be taken at the Front;*
- ii) *that sampling of harp seals be continued in the Gulf of St. Lawrence and at northeast Newfoundland in winter for studies of age composition and reproduction;*
- iii) *that studies on the energetics and feeding of harp seals, including milk transfer from mother to pup, be continued for the Gulf and Front areas and initiated for the Arctic;*
- iv) *that Norway and Denmark participate in a joint study with Canada on the accuracy of age determination of harp seals from teeth; and*
- v) *that catch statistics of harp seals be improved for the northern Gulf of St. Lawrence and the Arctic regions.*

2. Hooded seals

a) Review of fishery (SCS Doc. 81/XI/27)

Provisional Canadian and Norwegian statistics for 1981 indicate a total catch of 13,686 hooded seals. Denmark provided revised statistics for the catch of hooded seals at West Greenland in 1977 and preliminary figures for 1978-80, indicating an average catch of about 3,500 seals at West Greenland and a total of 5,000-6,000 if catches at East Greenland are included.

b) Research in 1981 (SCR Doc. 81/XI/150)

Denmark provided an updated analysis of catches and biological studies on hooded seals in Greenland during 1970-80, including age frequencies for northwest Greenland up to 1980. Canada reported that 183 hooded seal pups were tagged in the Gulf in 1981 with 19 local recoveries, and that age samples of female hooded seals taken at the Front in 1979-81 had been analyzed.

c) Population assessment

The Committee considered the results of some preliminary analyses by Canada of historical data relating to production and mortality parameters of hooded seals in the Northwest Atlantic. Es-

timates of natural mortality for adult females ranged from 0.10 to 0.13 and annual pup production during the late 1960's was estimated from survival indices to have been about 40,000. However, because of uncertainty about recent pup production and stock size, STACFIS agreed that there was no firm basis for changing its previous advice and therefore advises that the present management regime should be continued.

d) Future research

- i) STACFIS noted the proposal by Norway to host at the Institute of Marine Research, Bergen, in 1983 an international workshop on hooded seal biology, distribution and stocks, and agreed that such a meeting would provide an opportunity for scientists to present much hitherto unpublished data. STACFIS accordingly

recommends

that the Scientific Council should provide appropriate endorsement of the Norwegian proposal to host an international workshop on hooded seals in 1983.

- ii) In view of the uncertainty about stock size levels of hooded seals since the late 1960's and the absence of a recent analytical assessment, STACFIS

recommends

that an effort be made to estimate current pup production and stock size of hooded seals.

III. ADJOURNMENT

There being no further business, the Chairman expressed his thanks to all participants, especially to the Convener of the Working Group on Seals and to the various rapporteurs, for their keen interest and cooperation during the course of the meeting, and to the Secretariat staff for their efficiency in the preparation of documents and reports.

APPENDIX II. AGENDA FOR NOVEMBER 1981 MEETING OF SCIENTIFIC COUNCIL

1. Opening (Chairman: R. Wells)

- a) Appointment of rapporteur
- b) Adoption of agenda
- c) Plan of work

2. Fishery Science (Chairman: J. P. Minet)

a) Review of harp and hooded seals (Annex 1) (Convener: A. W. Mansfield)

- i) Review of fishery
- ii) Research in 1981
- iii) Stock relationships
- iv) Population assessment
 - Vital rates
 - Pup production
 - Stock size
 - Sustainable yield
- v) Interactions between harp seal and fish populations
- vi) Future research needs

b) Review of shrimp stocks in Subareas 0 and 1, and at East Greenland¹ (Annexes 2 and 3) (Convener: J. P. Minet)

- i) Review of fishery trends
- ii) Distribution and biology
- iii) Catch and effort
- iv) By-catches in shrimp fishery
- v) Biomass estimates
- vi) Total allowable catches
- vii) Future research needs

c) Other matters

3. Adoption of Reports

- a) Provisional report of September 1981 Meeting of Scientific Council
- b) Report of Scientific Council (this meeting), including report of STACFIS

4. Review of Future Meeting Arrangements

- a) Regular Meeting (2-18 June 1982)
- b) Annual Meeting (8-17 September 1982)

5. Other Matters

- a) Proposed international workshop on hooded seals
- b) Report of Shrimp Ageing Workshop

6. Adjournment

¹ Assessment of East Greenland shrimp stock included on the Agenda at the request of EEC (Annex 3) and with the concurrence of the Scientific Council.

ANNEX 1. JOINT CANADIAN/EEC REQUEST FOR ADVICE ON THE SCIENTIFIC BASIS
FOR MANAGEMENT OF SEAL FISHERIES

At the request of Canada, the Scientific Council at a special meeting in November 1980 provided advice on the scientific basis for management in 1981 of stocks of harp seals and hooded seals within national fishery limits in NAFO Subareas 0, 1, 2, 3 and 4. The Canadian Government and the EEC consider it desirable that the Scientific Council similarly provide advice on the scientific basis for seal management over two hunting seasons, i.e. for 1982 and 1983.

For stocks of both species it is requested that the Council comment on the following aspects:

1. Current stock size and pup production and recent trends in these parameters.
2. Current replacement yield and sustainable yield at present stock size and in the long term, under varying options of age compositions in the catch, including that recently occurring.
3. Trends in population size based upon the present quota levels and quota levels which vary from these levels by + or - 10%, 25% or 50% for all removals except those by traditional hunting in the Canadian Arctic and at Greenland.

It is requested that the Council specifically note the effects, if any, of unusual ice conditions in 1981 and the manner in which such effects have been incorporated into the estimates and comments on the above aspects. Further, it is requested that the Council document and review available information relevant to interactions between Northwest Atlantic harp seals and commercially exploited fish populations and fisheries, and to provide scientific advice on the following questions insofar as available data permit:

- a) What quantities of commercially exploited fish and invertebrates are estimated to be consumed annually by Northwest Atlantic harp seals? What is size, age and species-stock composition of this consumed food?
- b) What direct or indirect (e.g. through competition for food) effects would increasing or decreasing the Northwest Atlantic harp seal population to 25% above or below its current abundance be expected to have on exploited fish and invertebrate stocks and yields from them?
- c) To what extent, where and when are Northwest Atlantic harp seals accidentally killed in commercial fisheries for other marine animals?
- d) To what extent, when and where do Northwest Atlantic harp seals compete directly with fishermen by taking commercially exploited fish species near, in, or from fishing gear?
- e) To what extent does such competition damage gear or fish or disturb the functioning of the gear?
- f) Is there evidence that harp seals indirectly affect exploited fish and invertebrate populations through propagation of disease or parasites?

It is suggested that the Council meet and report during the autumn of 1981 with dates to be established through appropriate consultation.

Mr M. Marcussen
Head of Division
Directorate General for Fisheries
Commission of the European Communities
Brussels, Belgium

Dr A. W. May
Assistant Deputy Minister for Atlantic
Fisheries
Department of Fisheries and Oceans
Ottawa, Ontario, Canada

(Extract from NAFO Circular Letter 81/65, dated 9 October 1981)

ANNEX 2. CANADIAN AND EEC REQUEST FOR ADVICE ON THE SCIENTIFIC BASIS FOR MANAGEMENT
IN 1982 OF THE SHRIMP STOCKS IN NAFO SUBAREAS 0 AND 1

Canada and the EEC request the Scientific Council to assess the status of shrimp stocks in NAFO Sub-areas 0 and 1 and to advise both on the short term and long term consequences of 1982 catches of 25,000, 30,000, 35,000, 40,000 and 45,000 tons and the TACs required to maintain the stock biomass at levels of about two-thirds and one-half that of the virgin stock.

Mr M. Marcussen
Head of Division
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(The original individual requests by Canada and EEC for assessment of the shrimp stocks were listed in Annex 2 of NAFO Circular Letter 81/65, dated 9 October 1981. The above joint request was received on 25 November 1981 after the Scientific Council had nearly completed its work.)

ANNEX 3. EEC REQUEST FOR ADVICE ON THE SCIENTIFIC BASIS FOR MANAGEMENT
IN 1982 OF THE SHRIMP STOCK OFF EAST GREENLAND

The shrimp stock at East Greenland should be assessed by the NAFO assessment working group, in agreement with ICES Resolution 1980/2:6-19. The consequences of TACs of 6,000, 8,000 and 10,000 tons in 1982 on the state of this stock for 1983 should be tentatively explored.

Mr. M. Marcussen, Head of Division
Directorate General for Fisheries
Commission of the European Communities
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(Extract from original EEC request for advice on the shrimp stocks, NAFO Circular Letter 81/29, dated 28 April 1981.)

APPENDIX III. LIST OF PARTICIPANTS

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APPENDIX IV. LIST OF MEETING DOCUMENTS

A. RESEARCH DOCUMENTS (SCR)

SCR Doc. 81/II/1 to 81/II/15 were issued at the February 1981 Meeting, SCR Doc. 81/VI/16 to 81/VI/84 were issued at the June 1981 Meeting, and SCR Doc. 81/IX/85 to 81/IX/145 were issued at the September 1981 Meeting of the Scientific Council.

SCR Doc.	Serial	
81/XI/146	N455	<u>PARSONS, D. G., P. J. VEITCH, and G. E. TUCKER.</u> Data on the shrimp (<i>Pandalus borealis</i>) fishery in Division OA, 1981 (20 pages)
81/XI/147	N456	<u>DUPOUY, H., J. P. MINET, and P. DERIBLE.</u> Catch, effort and biological characteristics of shrimp (<i>Pandalus borealis</i>) in the French fishery off West Greenland, 1981 (15 pages)
81/XI/148	N457	<u>CLARK, S. H.</u> Recent trends in the Gulf of Maine northern shrimp fishery (23 pages)
81/XI/149	N454	<u>LARSEN, F.</u> Report on harp seal recoveries in Greenland, 1980-81 (4 pages)
81/XI/150	N462	<u>KAPEL, F. O.</u> Studies of hooded seals in Greenland, 1970-1980 (18 pages)
81/XI/151	N458	<u>CARLSSON, D. M.</u> Data on the shrimp fishery in NAFO Subareas 0+1 in 1980 and 1981 (36 pages)
81/XI/152	N459	<u>BOWEN, W. D., and D. E. SERGEANT.</u> Mean age at sexual maturity and age-specific pregnancy rates of Northwest Atlantic harp seals in 1980 and 1981 (5 pages)
81/XI/153	N460	<u>BOWEN, W. D., and D. E. SERGEANT.</u> Further investigations of harp seal pup production between 1977 and 1980 from mark-recapture (6 pages)
81/XI/154	N461	<u>BOWEN, W. D.</u> Harp seals and their foods: how do they interact? (8 pages)
81/XI/155	N463	<u>KANNEWORFF, P.</u> Biomass of shrimp (<i>Pandalus borealis</i>) in NAFO Subarea 1 in 1977-81, estimated by means of bottom photography (19 pages)
81/XI/156	N464	<u>JAKOBSEN, T., and S. TORHEIM.</u> The Norwegian fishery for shrimp, <i>Pandalus borealis</i> , off West Greenland in 1981 (4 pages)
81/XI/157	N465	<u>DUPOUY, H., J. P. MINET, and P. DERIBLE.</u> Catch, effort and biological characteristics of shrimp (<i>Pandalus borealis</i>) in the French fishery off East Greenland in 1981 (13 pages)
81/XI/158	N466	<u>JAKOBSEN, T., and S. TORHEIM.</u> Norwegian investigations on shrimp, <i>Pandalus borealis</i> , in East Greenland waters in 1981 (9 pages)
81/XI/159	N467	<u>WORTHY, G. A. J., and D. M. LAVIGNE.</u> Changes in blood properties of fasting and feeding harp seal pups, <i>Phoca groenlandica</i> , after weaning (19 pages)
81/XI/160	N468	<u>STEWART, R. E. A., and D. M. LAVIGNE.</u> Energetics of nursing in the harp seal <i>Phoca groenlandica</i> : energy transfer and female condition (30 pages)
81/XI/161	N469	<u>WORTHY, G. A. J.</u> Changes in energy stores during neonatal development in the harp seals, <i>Phoca groenlandica</i> (9 pages)
81/XI/162	N470	<u>LAVIGNE, D. M., R. E. A. STEWART, and F. FLETCHER.</u> Changes in composition and energy content of harp seal milk during lactation (15 pages)
81/XI/163	N471	<u>WORTHY, G. A. J., D. M. LAVIGNE, and W. D. BOWEN.</u> Post-weaning growth of the harp seal, <i>Phoca groenlandica</i> (37 pages)
81/XI/164	N472	<u>WORTHY, G. A. J., and D. M. LAVIGNE.</u> Energy utilization of harp seals, <i>Phoca groenlandica</i> , during the post-weaning period (11 pages)
81/XI/165	N473	<u>CARLSSON, D.</u> Data on shrimp fishery at East Greenland in 1980 and 1981 (14 pages)

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81/XI/166	N474	<u>ROFF, D. A., and W. D. BOWEN.</u> Population dynamics of harp seals, 1967-1991 (31 pages)
81/XI/167	N475	<u>HALLGRIMSSON, I.</u> Preliminary information on the Icelandic shrimp (<i>P. borealis</i>) fishery in the Denmark Strait in 1981 (2 pages)

B. SUMMARY DOCUMENTS (SCS)

SCS Doc. 81/II/1 to 81/II/2 were issued at the February 1981 Meeting, SCS Doc. 81/VI/3 to 81/VI/20 were issued at the June 1981 Meeting, and SCS Doc. 81/IX/21 to 81/IX/27 were issued at the September 1981 Meeting of the Scientific Council.

SCS Doc. Serial

81/XI/28	N476	<u>NAFO SECRETARIAT.</u> Provisional sealing statistics for the Northwest Atlantic, 1981 (2 pages)
81/XI/29	N477	<u>NAFO.</u> Report of Special Meeting of Scientific Council, Dartmouth, Canada, 23-26 November 1981 (24 pages)