Northwest Atlantic Fisheries Organization

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SCIENTIFIC COUNCIL MEETING - NOVEMBER 1994

Report of Scientific Council, 18-21 November 1994 Meeting

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REPORT OF SCIENTIFIC COUNCIL

Scientific Council Meeting, 18-21 November 1994

Chairman: W. R. Bowering Rapporteur: T. Amaratunga

I. PLENARY SESSIONS

The Scientific Council met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada, during 18-21 November 1994. Representatives attended from Canada, Denmark (in respect of the Faroe Islands and Greenland) and Iceland. The Chairman, H. Lassen (EU-Denmark) had conveyed his regrets not being able to attend and Vice-Chairman, W. R. Bowering (Canada), had been invited to chair this meeting. The Assistant Executive Secretary was in attendance.

The opening session was called to order on 18 November 1994 at 1000 hr.

The Chairman, W. R. Bowering, welcomed representatives to this Special Meeting of the Scientific Council to conduct assessments on shrimp in Subareas 0 and 1, and Denmark Strait. The Assistant Executive Secretary was appointed rapporteur.

In considering the Agenda, the Chairman noted that at its meeting in September 1994, the Council had recommended that a single publication on papers dealing with shrimp on the Flemish Cap be considered at this meeting, and proposed that this matter be considered under "Other Matters". The Provisional Agenda was **adopted** with this item inserted appropriately (Appendix II).

The Council noted that STACFIS would undertake the assessments of the stocks, while the prognoses and the advice would be undertaken by the Council. The Chairman also highlighted the Scientific Council decision of September 1994, that the assessment reports must in their texts clearly cite the particular documents used during the assessments, in addition to presenting a list of all the documents in the subject heading.

The meeting was adjourned at 1015 hr.

The concluding session was convened at 1600 hr on 21 November 1994, noting that the shrimp assessment reports had been prepared by STACFIS. The Council then addressed the requests of the Coastal States considering the results of the assessments and provided advice and recommendations. The meeting was adjourned at 1615 hr.

Brief summaries of the STACFIS Report and other matters considered by the Scientific Council are given below in Sections II-IV. The Agenda, List of Research (SCR) and Summary (SCS) Documents and the List of Participants of this meeting are given in Appendix II, III and IV, respectively.

II. FISHERY SCIENCE (see STACFIS report, App. I)

1. Stock Assessments

a) Shrimp in Subareas 0 and 1

i) Advice and Recommendations

Shrimp in Subarea 1 and adjacent areas of Div. 0A. At its meeting in November 1993 the Scientific Council recommended, based on the similarity in stock composition (i.e. the occurrence of similar modes in length distributions, prominence of the 1985 year-class in all areas, and recruitment of the same year-classes in all areas), that shrimp in Div. 0A and in Subarea 1 both north and south of 71°N and in inshore areas be assessed as a single stock.

At the present meeting STACFIS reviewed the available information on catch, catch rates, biomass estimates, and commercial and survey length distributions in the three areas. It was concluded that due to the lack of catch rates and catch composition data in the inshore areas, it was most appropriate to review data from each of the three areas separately for the current assessment, as follows:

Subarea 1 offshore, north of 71°N. Catches in this area declined rapidly to a low level following a few years in which catches exceeded 10 000 tons. Biomass estimates are now at the lowest level observed in the time series. Regardless of whether the reduction is due to environmental factors and/or fishing pressure the Scientific Council concluded, that due to the current depressed status of this component no increase in the total TAC should be based on the inclusion of this area. Nevertheless, any catches in 1995 from this area should be counted against the TAC for the total stock area.

Subarea 1 inshore. Catches in this area were relatively stable during 1990-92 but have declined in 1993-94 due to a shift in effort to offshore areas. This could be attributed to more attractive catch rates offshore, as inshore biomass estimates have been relatively stable during 1991-94, while offshore surveys have shown a considerable increase in abundance in nearby areas in recent years. In the absence of commercial fishery data needed to assess the status of this component, the Scientific Council concluded that the average of recent catches (1990-93) is the best available estimate of production. The Scientific Council hence **advised** that this stock component contribute 10 000 tons to the TAC for the total stock area in 1995.

Subarea 1 offshore south of 71°N and adjacent areas in Div. 0A. Total catches in this area had increased steadily up to 1992 and exceeded the advised TAC by more than 35% in 1992 and 1993. Standardized catch-rate indices from Div. 0A and Subarea 1 all show the same decline from 1993 to 1994, to the lowest value in the time series, after a period of stability maintained by the strong 1985 year-class. Biomass estimates from surveys have been relatively stable since 1988, largely maintained by the 1985 year-class. Comparison of year-class strength shows that subsequent year-classes recruiting to the fishery are substantially weaker, and it is these year-classes which will determine the success of the 1995 fishery. In the light of the above, the Scientific Council **advised** that the 1995 catch for this stock component be reduced to the currently advised TAC of 50 000 tons.

Total stock area (Div. 0A and Subarea 1). Based on considerations from the three areas discussed above, the Scientific Council **advised** that the total allowable catch for the entire stock area be set to 60 000 tons in 1995.

b) **Shrimp in Denmark Strait**

i) **Advice and Recommendations**. In consideration of the continued low level of shrimp stock abundance in Denmark Strait and the uncertainty in the interpretation of the abundance indices, the Scientific Council in 1993 advised a TAC of 5 000 tons for 1994. It further advised that this level would have to be maintained for several years in order to be effective in rebuilding the stock.

The current assessment reviewed by STACFIS concluded that there appeared to be some improvement in the stock abundance between 1993 and 1994 based upon analyses of commercial catch-rate data and research vessel survey results. There was some concern expressed, nevertheless, that the proportion of female shrimp in the stock, which is the main contributor to the commercial catch, remains relatively low. The Scientific Council, therefore **advised** that the TAC of 5 000 tons recommended for 1994 remain for 1995 to allow for continued improvement in stock size. This catch level is intended to include any catch in the new fishing areas.

SUMMARY SHEET - Shrimp in Subareas 0 and 1

Source of Information: SCR Doc. 94/75, 89, 93, 94, 95.

Year	1987	1988	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]
Offshore SA 0+1 (south of 71°N)								
Recommended TAC	36	36	44	50	50	50	50	50
Agreed TAC[2]	40.1	40.1	45.2	45.2	46.2	44.2	40.6[3]	42.3[3]
Actual landings[7,8]	46.1	43.4	49.9	58.2	63.1	68.8	68.2	52.4[6]
Offshore SA 1 (north of 71°N)								
Recommended TAC	-	-	-	-	-	-	-	-
Agreed TAC	11.6	11.5	8	6.8[4]	6.8[4]	6.4[4]	8.3[5]	8.3[5]
Actual landings	10.7	6.7	2.5	2.1	1.1	2.6	0.6	0.4[6]
SA 0+1 total (including inshore SA 1)								
Actual landings[7,8]	63.7	60.3	65.7	70.7	75.3	84.9	74.6	66.9[6]

Weights in '000 tons

[1] Provisional landings.
[2] Not including catches of vessels <75 GRT.
[3] SA 1 offshore, south of 68°N + Div. 0A.
[4] Including the area from 69°30'N to 71°N, west of 58°W.
[5] SA 1 offshore, north of 68°N.
[6] Preliminary statistics available as of November 1994.
[7] Includes information in addition to official statistics.
[8] Revised data for 1990-93.

Catches: For the area where the TAC had been applied, catches have increased steadily up to 1992 and exceeded the advised TAC by more than 35% in 1992 and 1993.

Data and Assessment: Catch rates, research survey indices and biological sampling data.

Fishing Mortality: No information available.

Recruitment: Recruitment of 1988 and 1990 year-classes indicated but are weaker than the 1985 year-class.

State of Stock: Catch-rate indices indicated declining abundance; research survey indices indicated that the stock is stable since 1988.

Forecast for 1995: Not available.

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =	No information available.	
F_{93} =		
F_{max} =		

Recommendations: TAC for 1995 be set at 60 000 tons for Div. 0A and Subarea 1 including areas north of 71°N and inshore areas.

Special Comments: Area covered by TAC for 1995 now includes all of SA 1 and Div. 0B compared to previous years.

SUMMARY SHEET - Shrimp in Denmark Strait

Source of Information: SCR Doc. 94/90, 91, 92, 96, 97.

Year	1987	1988	1989	1990	1991	1992[1]	1993[1]	1994[1]
Recommended TAC	-	-	10	10	10	8	5	5
Agreed TAC[1]	7.7[2]	8.7[2]	9.0[2]	14.1	14.5	13.0	9.6	9.6
Reported catches	12.2	12.6	10.7	10.3	8.7[3]	7.5[3]	7.8[3]	8.1[3]
Sp. stock biomass								
Recruitment	No information available.							
Mean F								

[1] On Greenland side of midline only.
[2] Not including Greenland fishery north of 66°30'N.
[3] Provisional.

Weights in '000 tons

Catches: In 1993, a fishery started in new areas south of the traditional area, where 1 300 and 3 700 tons were caught in 1993 and 1994, respectively.

Data and Assessment: General biological data, catch and effort data from the fishery, unstandardized catch-rate series of the years 1980-94 and standardized catch-rate series for the years 1987-94. Research vessel survey data for 1989, 1990, 1992 and 1994.

Fishing Mortality: Not known.

Recruitment: Not known.

State of Stock: Although the indices suggest an increase in abundance, the stock is still considered to be at a much lower level than it was during the first half of the 1980s.

Forecast for 1995:

Option Basis	Predicted catch (1995)	Predicted SSB (1.1.1996)
$F_{0.1}$ =	No information available.	
F_{93} =		
F_{max} =		

Recommendations: The Scientific Council advised that the TAC of 5 000 tons recommended for 1994 remain for 1995 to allow for continued improvement in stock size. This catch level is intended to also include any catches in the new fishing areas.

Special Comments:

III. OTHER MATTERS

1. **Publication of Papers on Flemish Cap Shrimp**

The Council at its meeting in September 1994 recommended that consideration be given to publication of papers dealing with shrimp on Flemish Cap. The Designated Expert, D. G. Parsons (Canada), who was requested to address this matter, informed the Council that he had consulted potential contributors and was in a position to formulate a compilation. The Council agreed to consider a draft of the proposed single publication during its meeting in September 1995.

IV. ADOPTION OF REPORTS

The Council noted that STACFIS had **adopted** its report with the understanding that some editorial insertions would be made to reflect discussions at its concluding session. The Council accordingly **adopted** the STACFIS report, and then the Scientific Council Report recognizing that the Chairman along with STACFIS Chairman and the Assistant Executive Secretary will undertake the editorial work.

V. ADJOURNMENT

There being no further business, the Chairman thanked the participants, the Chairman of STACFIS and the Secretariat for their able assistance in the conduct of the meeting.

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

Chairman: W. B. Brodie Rapporteur: Various

The Committee met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada during November 18-21 November 1994 to review the status of the shrimp stocks in Subareas 0 and 1, and Denmark Strait referred to it by the Scientific Council. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland) and Iceland.

I. STOCK ASSESSMENTS

1. **Shrimp in Subareas 0 and 1** (SCR Doc. 94/75, 89, 93, 94, 95)

a) **Introduction**

In accordance with the recommendation of Scientific Council in November 1993,the entire shrimp stock in Div. 0A and Subarea 1, both north and south of 71°N and inshore,is assessed as one single population.

Overall catches in the entire stock area increased until 1986, were stable from 1986 to 1988, then increased until 1992 followed by a decrease in 1993. Preliminary statistics indicate that catches in 1994 will be above the 1993 level.

The nominal catch of shrimp in the offshore areas of Subarea 1 south of 71°N and the adjacent part of Subarea 0 (Div. 0A) increased from less than 1 000 tons before 1972 to almost 43 000 tons in 1976, fluctuated thereafter, stabilized around a level of 44 000 tons during 1985-88, and then increased to 68 000 tons in 1993. Preliminary statistics available for 1994 (January-October) showed total catches of about 52 400 tons (compared to 46 400 tons in the same months in 1993). The fishery has been regulated by TAC since 1977 (Table 1; Fig. 1).

Table 1. Shrimp in Div. 0A and Subarea 1: nominal catches and TAC (tons).

	1984	1985	1986	1987	1988	1989	1990	1991[1]	1992[1]	1993[1]	1994[1]
Div. 0A Total[7]	2 142	3 069	2 995	6 095	5 881	7 235	6 177	6 788	7 493	5 491	3 920
SA 1 Offshore											
North of 71°N[8]	-	4 349	11 045	10 700	6 660	2 522	2 121	1 077	2 647	641	378[6]
South of 71°N	33 741	39 547	41 589	40 020	37 559	42 676	52 020	56 264	61 324	62 680	48 505[6]
SA 1 inshore[8]	7 500	7 500	7 500	6 921	10 233	13 224	10 333	11 177	13 412	5 741	4 081[6]
SA 1 Total	41 241	51 396	60 134	57 641	54 452	58 422	64 474	68 518	77 383	69 062	52 964[6]
SA 0+1 Total	43 383	54 465	63 129	63 736	60 333	65 657	70 651	75 306	84 876	74 553	56 884[6]
0+1 offshore catch[2]	35 883	42 616	44 584	46 115	43 440	49 911	58 197	63 052	68 817	68 171	52 425[6]
0+1 advised TAC[2]	29 500	36 000	36 000	36 000	36 000	44 000	50 000	50 000	50 000	50 000	50 000
0+1 effective TAC[2,3,4]	34 925	42 120	40 420	40 120	40 120	45 245	45 245	46 225	44 200	40 600[5]	42 300[5]

[1] Provisional data.
[2] Offshore south of 71°N.
[3] Including TAC in Div. 0A: 1983-84 - 5 000 tons, 1985-88 - 6 120 tons, 1989-90 - 7 520 tons, 1991-92 - 8 500 tons.
[4] Not including catches from vessels <75 GRT.
[5] SA 1 offshore south of 68°N + Div. 0A.
[6] Preliminary statistics available as of November 1994.
[7] Includes information in addition to official statistics.
[8] Revised data for 1990-93.

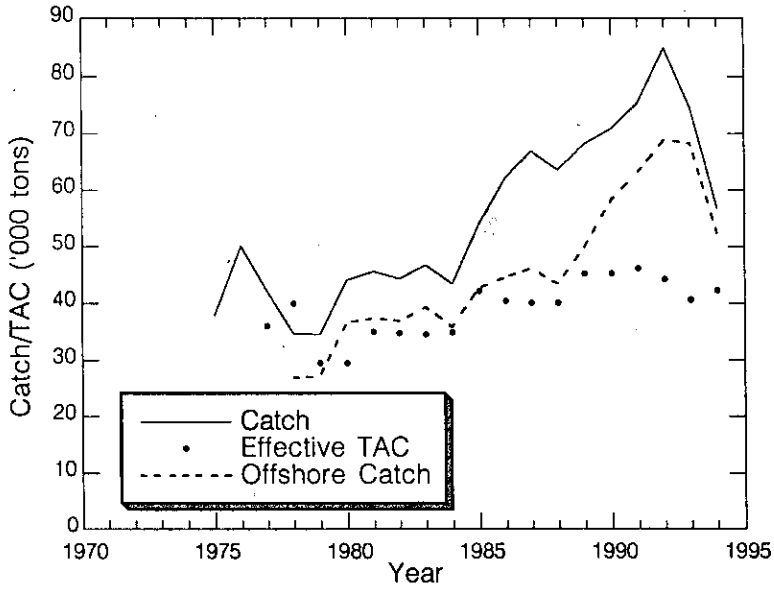

Fig. 1. Shrimp in Subareas 0 and 1: catches and TACs.

During the history of this fishery, the fishing grounds in Div. 1B have been the most important. Since 1987, however, there have been increasing catches in Divisions south of 1B.

The fishery in Div. 0A usually takes place from July to November. In Subarea 1 the fishery occurs in all months of the year, however, early in the year it is often confined to the southern Divisions due to ice coverage in Div. 1A and 1B. In 1994 there was less than normal ice coverage, and the northern Divisions could be accessed earlier than in previous years.

An offshore fishery north of 71°N, outside the fishing areas in Subareas 0 and 1 for which TACs have previously been advised, began in 1985 and yielded about 4 300 tons that year. In 1986 and 1987 catches increased to about 11 000 tons, decreased steadily to about 1 000 tons in 1991, increased to 2 647 tons in 1992 and decreased again in 1993 and 1994 to the lowest figures since the fishery started. This fishery normally occurs from June to November.

Effort by large trawlers in Subarea 1 was lower in 1993 and 1994 compared to earlier years because a significant part of the fleet participated in the shrimp fishery on the Flemish Cap (Div. 3M).

The West Greenland inshore shrimp fishery was relatively stable from 1972 to 1987 with estimated catches of 7 000-8 000 tons annually (except for 10 000 tons in 1974). Catches in recent years have increased to over 13 000 tons in 1992, but decreased in 1993 to less than 6 000 tons due to a shift from inshore to offshore areas of the small vessel fishery (SCR Doc. 94/89). Preliminary data for 1994 (January-September) indicate catches at a slightly higher level than in the same period in 1993.

b) **Input Data**

i) **Commercial fishery**

Fishing effort and CPUE (Fig. 2). Catch and effort data from the shrimp fishery in 1994 were available from fishing records from Canadian vessels in Div. 0A (SCR Doc. 94/75) and from Greenland logbooks for Subarea 1 (SCR Doc. 94/93).

An overall increase in effort by large vessels was observed from 1987 to 1991, followed by a decrease in 1992 and 1993, and remained stable in 1994.

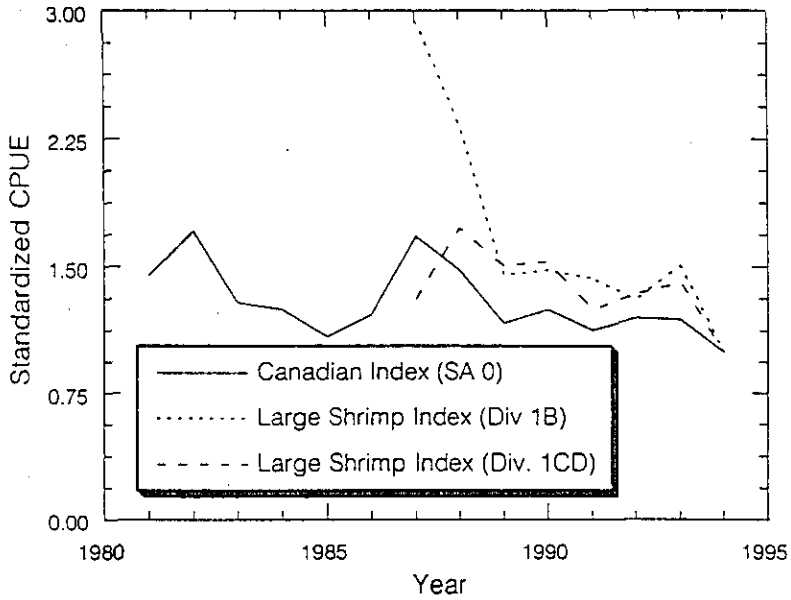

Fig. 2. Shrimp in Subareas 0 and 1: standardized CPUE indices from Div. 0A, Div. 1B and 1CD compared to nominal offshore catches (excluding catches north of 71°N in Subarea 1). Effective TACs in 1993 and 1994 for Greenland south of 68°N.

Unstandardized yearly catch rates were calculated using Canadian fishery data from Div. 0A from 1979 to 1994. Because of seasonality in the catch rates and changes in the fleet over time, the data from 1981 to 1994 were analyzed using a multiplicative model to produce standardized yearly catch rates (SCR Doc. 94/75, Table 5). The series showed two periods of stable catch rates (1983-86 and 1989-93), separated by a higher level in 1987-88, and a significant decrease from 1993 to 1994.

From 1987 onward, logbook data from 33 Greenland trawlers, which record the shrimp catch by size category in the logbook, were used in a multiplicative model to establish a CPUE index for large shrimp >8.5 g (mainly females), for which unreported discards were supposedly at a low level (SCR Doc. 94/93, Table 6, Fig. 9). The index in Div. 1B showed a decrease from 1987 to 1989 followed by stability from 1989 to 1992, an increase in 1993, and a significant decrease in 1994. The index in Div. 1CD increased from 1987 to 1988, decreased to 1991, and increased slightly to 1993 followed by a significant decrease in 1994.

Length and age composition. Length frequency distributions obtained by observers were available from the commercial fishery in Div. 0A from 1981 to 1994 and in Subarea 1 from 1990 to 1994 (SCR Doc. 94/93, Table 7). The relative importance of the 1985 year-class was evident in 1990 as it recruited to the fishery, and in 1991-1993, when it clearly dominated the catches. In 1994 this year-class still accounted for a substantial part of the catches, but it was not possible identify the actual abundance in the group of females.

In 1994, there were proportionally more shrimp below 19 mm CL than in 1993. Three male groups at 18, 20 and 22 mm were identifiable in samples from most areas and seasons. Samples were, however, dominated by males at 22 mm CL (the 1988 year-class), and females at 25-27 mm CL. These two size groups made up more than 75% of the total catches in Div. 0A (SCR Doc. 94/75, Table 7).

Shrimp discards. In Div. 0A, the percentages of shrimp discard estimated by observers declined in recent years from a high of 6.5% in 1991 to 2.5% in 1993 and 1.3% in 1994, the lowest level achieved during the 1981 to 1994 period (SCR Doc. 94/75, Table 11). The further decrease in 1994 is consistent with the domination of catches by year-classes produced before 1989, but also might reflect favourable markets for all sizes of shrimp in 1994.

It is believed that discarding has decreased in Subarea 1 after the introduction of an observer system in 1992.

ii) **Research survey data**

Abundance estimates. Trawl surveys have been conducted from 1988 in offshore and from 1991 in inshore (SCR Doc. 94/94, 95) Subarea 1 and adjacent parts of Division 0A. The trawlable biomass estimates are as follows:

Biomass ('000 t)	1988	1989	1990	1991	1992	1993	1994
Offshore, south of 71°N	159	184	166	115	165	217	175
Offshore, north of 71°N	13	8	9	4	14	8	3
Inshore (Div. 1A)	-	-	-	48	45	32	41
Total	-	-	-	167	224	257	219

The estimated numbers of shrimp in the total areas surveyed are shown in the following table by sex and year:

No. of shrimp (billions)	1988	1989	1990	1991	1992	1993	1994
Offshore:							
Males (age < 7)	18.1	31.9	21.9	12.2	20.9	31.8	25.0
Females (age 7+)	7.7	6.0	8.0	4.4	5.5	7.9	6.4
Total offshore	25.9	37.8	29.8	16.6	26.5	39.7	31.4
Inshore:							
Males (age < 7)	-	-	-	5.5	5.6	3.2	4.9
Females (age 7+)	-	-	-	2.0	1.6	1.5	1.6
Total inshore	-	-	-	7.4	7.1	4.7	6.6
Total	-	-	-	24.0	33.6	44.4	38.0

Offshore: In July-September 1994, the stratified-random trawl survey was carried out in the main area of shrimp distribution in Div. 1A to 1E and the adjacent part of Div. 0A. The survey was carried out for the first time as a two-phase survey applying more stations into strata with high densities (SCR Doc. 94/95), reducing the 95% confidence interval in 1994 from 68 to 31%.

Total biomass estimate from the 1994 survey was somewhat lower than in 1993, the highest in the survey series, but at the same level as in 1988, 1990, and 1992. In 1993 and 1994, however, the biomass was concentrated in the areas north of Store Hellefiskebanke adjacent to Disko Bay. In 1994 the biomass was more concentrated in depths between 300 and 400 m than in earlier years.

Analysis of the research length frequency data (SCR Doc. 94/95, Fig. 6; SCR Doc. 93/70; 132) showed the predominance of the 1985 year-class in 1989, 1990 and 1991 throughout the offshore area. Recruitment of year-classes of the late-1980s was indicated in 1992, 1993 and 1994 but appeared to be much weaker than the 1985 year-class (see text table below).

In 1994, partial recruitment of younger year-classes (1990, 1991 and 1992) was also indicated but the relative strength of these year-classes could not yet be estimated.

Percents-at-age for male shrimp from the Greenland research survey data are given in the following table and show the strength of the 1985 year-class relative to other cohorts:

Age	1988	1989	1990	1991	1992	1993	1994
1						1.6	1.0
2	2.3	1.4	3.8	1.3	3.4	6.8	5.3
3	4.7	14.5	4.8	5.2	11.8	10.7	9.6
4	19.0	50.1	14.4	14.1	15.1	22.5	26.4
5	39.2	21.9	53.4	18.1	27.1	32.1	27.9
6	34.8	12.1	23.6	61.3	42.7	26.3	29.8
Total	100	100	100	100	100	100	100

Inshore: In August 1994 a stratified-random trawl survey was conducted in the inshore areas in Disko Bay and Vaigat (Div. 1A) (SCR Doc. 94/94). Biomass was estimated at 41 000 tons, an increase compared to the estimate of 32 000 tons in 1993, but lower than the estimates around 46 000 tons in 1991 and 1992, with 95% confidence intervals around 30 to 50%.

The overall size compositions of shrimp from the inshore surveys were similar to those for the offshore in relation to the occurrence of modes. The relative proportion of males and females in the survey in 1994 was similar to that observed in 1993. The overall size distribution still showed the presence of a wide range of male year-classes.

c) **Assessment Results**

In Subarea 1 south of 71°N and the adjacent areas of Div. 0A for which STACFIS has been advising a TAC since 1977, nominal catches have steadily increased (except for 1993) and been above advised levels in many years. Catches exceeded the TAC by about 15% in 1989 and 1990, increasing to more than 35% in 1992 and 1993. In Subarea 1 north of 71°N, no TAC has been set, but STACFIS advices a cautious approach to this resource as catches in this area have declined rapidly to a low level following a few years of substantial catches. In the inshore areas in Subarea 1 for which no TACs have been advised, catches had been relatively stable until 1987, increased thereafter, but decreased after 1992 due to a shift in effort to offshore areas.

Standardized catch-rate indices from Div. 0A, 1B and 1CD all showed a significant decrease from 1993 to 1994, to the lowest level observed.

Survey results showed relative stability in biomass, except for Subarea 1 north of 71°N, where it fluctuated and in 1994 reached the lowest level observed.

The decline of the catch-rate indices has been in accordance with decreased abundance of females in survey results. The strong 1985 year-class entered the fishery in 1990 and maintained catch rates in the following years but has now essentially passed through the fishery. Catches in 1994 have been comprised primarily of year-classes 1985-1988, but the relative contribution of each cannot be precisely estimated. The 1994 fishery has not been as successful as anticipated, and the recruitment may have been overestimated in 1993. Recruitment is generally difficult to estimate except for very large year-classes such as the 1985 year-class.

Catch rates in 1995 will be largely dependent upon the full recruitment of the 1988 year-class. This year-class is estimated to be substantially smaller than the 1985 year-class.

2. Shrimp in Denmark Strait (SCR Doc. 94/90, 91, 92, 96, 97)

a) Introduction

The fishery in Denmark Strait started in 1978 and has taken place primarily in the area of Strede Bank and Dohrn Bank as well as on the slopes of Storfjord Deep. The available fishing grounds at any given time depends heavily on the ice conditions. The traditional area extends from approximately 65°N to 67°30'N and between 26°W and 34°W. In 1993, a new fishery started in new areas between 60°30'N and 65°N and west of 35°W. Catches in the traditional area increased rapidly to 1980 and remained stable to 1983, increased gradually to 1988 (12 500 tons) and then decreased again to 1993 (Fig. 3). In 1994 the catch was 8 100 tons in the whole area. Catches from the new area were 1 300 and 3 700 tons in 1993 and 1994, respectively.

Recent catches and TACs (tons) are as follows:

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Catch north of 65°N											
eastern side	742	1 794	1 150	1 330	1 424	1 326	281	465[1]	1 750[1]	2 553[1]	1 417[1]
western side	5 989	6 316	9 814	10 848	11 125	9 416	9 994	8 200[1]	5 786[1]	4 003[1]	3 040[1]
Catch south of 65°N											
western side	-	-	-	-	-	-	-	-	-	1 285[1]	3 671[1]
Total	6 731	8 110	10 964	12 178	12 549	10 742	10 275	8 665[1]	7 536[1]	7 841[1]	8 128[1]
Advised TAC	4 200	5 000	-	-	-	10 000	10 000	10 000	8 000	5 000	5 000
Effective TAC western side	5 245	6 090	7 525[2]	7 725[2]	8 725[2]	9 025[2]	14 100	14 500	13 000	9 563	9 563

[1] Provisional.
[2] Not including Greenland fishery north of 66°30'N.

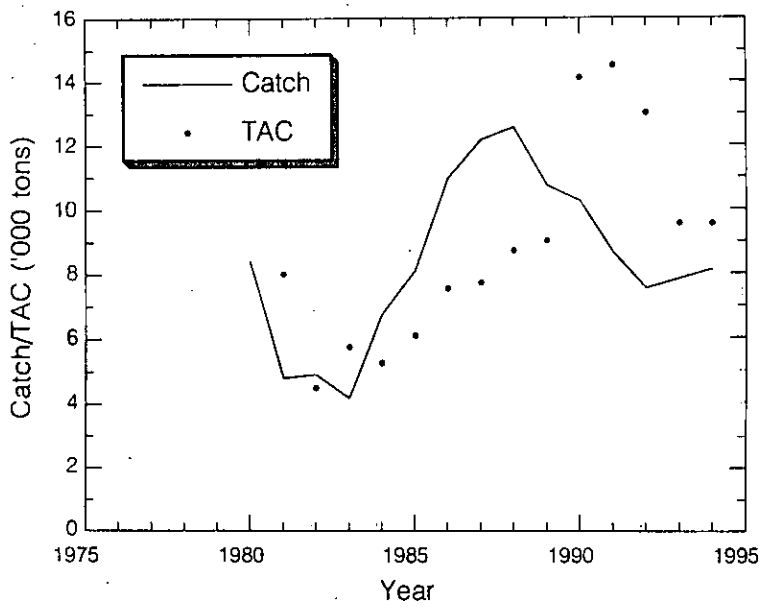

Fig. 3. Shrimp in Denmark Strait: catches and TACs.

b) **Input Data**

i) **Commercial fishery data**

Fishing effort and CPUE. Catch and effort data from logbooks were available from Greenland, Norway, Iceland and EEC-France since 1980, and from Denmark and Faroe Islands since 1986. Although shrimp from the new areas mentioned above are thought to belong to the same stock as those in the traditional area, the catch rates and effort data as shown in the Figures pertain only to the traditional area north of 65°N.

Effort patterns of the three most important fleets (Greenland, Norway and Iceland) were variable in the traditional area. Since 1990 the effort has decreased in both spring (January-June) and autumn (July-December). The Norwegian effort during the spring fishery was variable between 1986 and 1990, but increased substantially in 1991 and 1992, while effort in the autumn fishery increased to 1989, declining thereafter. The overall pattern over the years was quite variable for the Icelandic fishery, switching from an autumn fishery in the 1980s to a spring fishery in the 1990s.

Total unstandardized effort values showed the same pattern as catches. Between 1980 and 1989, effort increased from about 35 000 hours to more than 100 000 hours, declining thereafter to about 72 000 hours in 1993 and further to about 30 000 hours in 1994. The decline in effort was mostly due to the fleet fishing in the new areas. The fishery from July-December became more important at the end of the 1980s, accounting for approximately 50% of the total annual effort, whereas in the 1990s the spring effort has been the most important.

Unstandardized catch-rate series (Fig. 4) fluctuated from 1983 to 1987 followed by a substantial decline to 1989 (SCR Doc. 94/96, Fig. 4 and SCR Doc. 94/92, Table 13). Values for 1990-92 were similar to the low 1989 value at about 50% of the level seen in the early- to mid-1980s. In 1994 there was however a considerable rise in the catch rate.

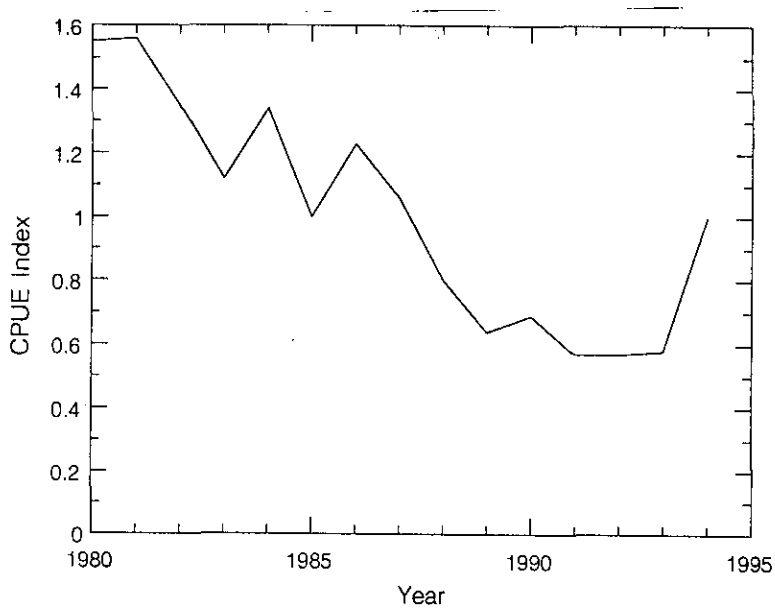

Fig. 4. Shrimp in Denmark Strait: Unstandardized catch rates.

Standardized catch-rate series were calculated (Fig. 5) for Greenland for large shrimp and all shrimp. The results for both showed a continuous decline from 1987 to 1992, stability between 1992 and 1993 and a considerable increase in 1994 (SCR Doc. 94/ 91, Fig. 6).

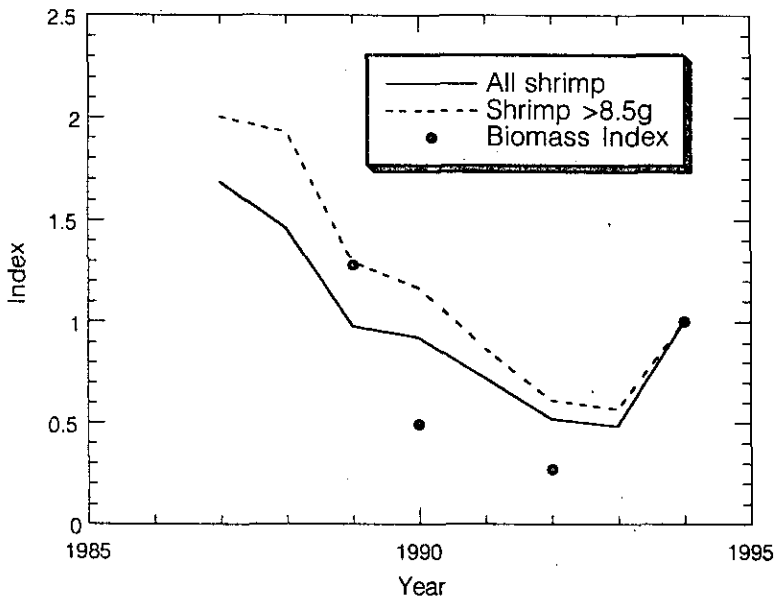

Fig. 5. Shrimp in Denmark Strait: standardized catch rates. Biomass indices from research surveys are shown as points.

Biological data. The Icelandic samples taken in the autumn of 1987 and 1988 showed that the catches in the limited area east of the midline were comprised mainly of female shrimp with a distinct mode at 30-31 mm CL. The 1990 autumn samples showed the increased importance of the male component (about 50% compared to 32 and 26% in 1987 and 1988). The 1991, 1992 and 1993 samples taken in spring showed that male shrimp dominated in all three years. In 1994 the samples taken in spring showed about 50% occurrence of males (SCR Doc. 94/96, Fig. 6). However the more extensive data from the Greenlandic fishery showed that the males comprised only 27% in February (SCR Doc. 94/91, Table 14 and Fig.9).

The occurrence of a component of female shrimp with a mode at 25-26 mm in the 1990 Icelandic samples suggested that sex change occurred earlier than in previous years. The 1991 and 1992 samples showed the occurrence of these small females but there was no noticeable component as seen in the 1990 data. The occurrence of a component of female shrimp with a mode at 25-26 mm as noted in the 1990 samples was again present in 1994 but was not very distinct (SCR Doc. 94/96, Fig 6).

The Greenlandic observer samples (SCR Doc. 94/91, Table 14 and Fig. 9) from the fishery in 1994 in the new areas showed that the occurrence of males ranged from 29% in February to 58% in April. These proportions of males resemble the conditions of the population in the traditional north area in the 1980s.

ii) **Research survey data**

A trawl survey was conducted by Greenland in the Denmark Strait in September-October 1994, based on a new sampling method for this area using a spline technique. The biomass index in 1994 (SCR Doc. 94/90) was much higher than the indices for 1990 and 1992, but lower than the 1989 estimate (Fig. 5).

Greenland survey samples from 1989, 1990, 1992 and 1994 showed an increase in the proportion of males over the period which is consistent with a trend from the 1985 to 1989 Norwegian surveys. The samples also showed a decrease in occurrence of both the largest males and the females between 1989 and the following years.

	Percent males									
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Norway	43.8	41.4	53.5	58.5	58.0					
Greenland					63.1	62.5	-	78.3	-	74.5

c) **Assessment Results**

Unstandardized catch rates showed a declining trend from 1987 to 1991, a stabilization between 1991 and 1993 and a rise in 1994. The standardized catch rates of the Greenlandic fleet showed also a decline from 1987 to 1992 and a stabilization between 1992 an 1993 followed by about the same increase in catch rate in 1994 as that for all fleets combined. An increase between 1993 and 1994 was also evident in the trawl survey index. Although these indices suggest an increase in abundance, the stock is still considered to be at a lower level than it was during the first half of the 1980s.

Although there were catches taken outside the traditional fishing area in 1993-94, STACFIS concluded that there was no evidence to suggest that they were not part of the same stock. STACFIS noted that the TAC should apply to catches in the whole area, including the new fishery areas.

3. **Other Business**

There being no other business, the Chairman thanked the participants for their work, and the Secretariat for its assistance during the meeting. The meeting adjourned at 1600 hr on 21 November.

APPENDIX II. AGENDA FOR SCIENTIFIC COUNCIL MEETING, 18-21 NOVEMBER 1994

I. Opening (Chairman: H. Lassen*)

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

II. Fishery Science (STACFIS Chairman: W. B. Brodie)

1. Stock assessments (see Annexes 1 and 2)

   - Northern shrimp (Subareas 0 and 1)
   - Northern shrimp (in Denmark Strait and off East Greenland)
   - [**Note**: For Northern shrimp in Subareas 0 and 1, the assessment and TAC advice should include, if possible, the areas north of 71°N in Subarea 1 as well as the inshore region of Subarea 1.]

2. Other business

III. Other Matters

1. Publication of papers on Flemish Cap Shrimp.

IV. Adoption of Reports

V. Adjournment

* Due to the unavailability of H. Lassen (EU-Denmark), Vice-Chairman W. R. Bowering (Canada) was invited to chair this meeting.

ANNEX 1

CANADIAN REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT IN 1995 OF CERTAIN STOCKS IN SUBAREAS 0 TO 4

1. Canada requests that the Scientific Council, at its meeting in advance of the 1994 Annual Meeting, provide advice on the scientific basis for the management of the following fish and invertebrate stocks in 1995:

Greenland halibut (Subarea 2 and Div. 3K and 3L)
Roundnose grenadier (Subareas 2 and 3)
Silver hake (Div. 4V, 4W and 4X)

It is also suggested that, subject to the concurrence of Denmark (Greenland), the Scientific Council, prior to the 1994 Annual Meeting of NAFO, provide advice on the scientific basis for management in 1995 of the following stocks:

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

The Scientific Council has noted previously there was no biological basis for making two separate assessments for the Greenland halibut throughout Subareas 0-3. The Council is therefore asked, subject to concurrence of Denmark (Greenland) as regards Subarea 1, to provide an overall assessment of the total stock throughout its range and comment on its management, including any expansion of the responses to the questions asked in June 1993.

With respect to shrimp, it is recognised that the Council may, at its discretion, delay providing advice until later in the year, taking into account data availability, predictive capability, and the logistics of additional meetings.

2. Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for those stocks listed above:

a) For those stocks subject to analytical dynamic-pool type assessments, the status of the stock should be reviewed and implications of continuing to fish at $F_{0.1}$ in 1995 and subsequent years should be evaluated. The present stock size should be described in relation to those observed historically and those to be expected at the $F_{0.1}$ level 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 considered to rebuild the spawning stock. All results should be expressed in terms of stock sizes, catch rates and TACs implied for 1995 and the long term.

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

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

3. The Scientific Council is requested to review the status of the cod stock in Divisions 2J+3KL and to provide estimates of the current size of the total and spawning biomass, together with a description of recent trends. The Council is asked further to provide estimates of the immediate and long-term outlook for the abundance of this stock, including both total and spawning biomass.

4. With respect to scientific advice on seals, Canada has no specific request at this time. As I noted in my letter to Dr. Chepel dated February 24, 1994, we will have important inputs to the Scientific Council's symposium on "Seals in the Ecosystem" scheduled for September 1995.

B. Rawson
Deputy Minister
Department of Fisheries and Oceans
Ottawa, Canada

ANNEX 2

DENMARK (GREENLAND) REQUEST FOR SCIENTIFIC ADVICE ON MANAGEMENT OF CERTAIN STOCKS IN 1995

1. Denmark, on behalf of Greenland, requests the Scientific Council of NAFO in advance of the 1994 Annual Meeting, provide advice on the scientific basis for management of the following stocks in Subarea 1 in 1995 and as many years forward as data allow:

   i) Redfish (by species, if possible)
   ii) Any other stock of invertebrates and finfish of commercial interest, for which data allow a status report

   It is also suggested that, subject to the concurrence of Canada, advice be given for the following stocks overlapping Subareas 0 and 1:

   i) Greenland halibut
   ii) Roundnose grenadier
   iii) Northern shrimp (*Pandalus borealis*)

   Further, in cooperation with ICES, the Scientific Council is requested to advise on the scientific basis for management of the following stock in the Denmark Strait and off East Greenland:

   i) Northern shrimp (*Pandalus borealis*)

2. In the analyses on which management advice will be based, the following should be included:

   In its 1993 report, the Scientific Council has noted that the offshore component of **Greenland halibut**, in Subareas 0 and 1 was distributed equally between these Subareas, and further that the biomass of the inshore component in Subarea 1 was unknown. The Council is therefore asked to provide information on the following questions asked in June 1993.

   a) Analysis of existing information on stock delimitation in Subareas 0, 1, 2 and 3.

   b) Allocation of TACs to appropriate Subareas (within Subareas 0 and 1).

   c) Allocation of the TAC for Subarea 1 into inshore and offshore areas.

   For **Northern shrimp in Subareas 0 and 1** the biological and practical implications of combining all areas of stock distribution for stock assessment purposes should be considered. Specifically, the Council is asked to provide a TAC for areas not included in the 1994 advice (i.e. Subarea 1 north of 71°N and Subarea 1 inshore).

3. The Scientific Council should feel free to report on such other invertebrates and finfish stocks in Subarea 1 and on such other scientifically based management options for the above-mentioned Subarea 1 stocks, as it feels applicable.

Henrik Leth
Aalisarnermut Piniarnermut
Nunalerinermullu Pisortaqarfik
Direktoratet for Fangst, Fiskeri og Landbrug

APPENDIX III. LIST OF RESEARCH AND SUMMARY DOCUMENTS

RESEARCH DOCUMENTS (SCR)

SCR No.	Ser. No.	Author(s) and Title
94/88	N2475	PARSONS, D. G., and P. J. VEITCH. The Canadian fishery for northern shrimp (*Pandalus borealis*) in Davis Strait, 1979-1994.
94/89	N2476	ANDERSEN, M. The small vessel shrimp fishery in West Greenland.
94/90	N2477	ANDERSEN, M., D. M. CARLSSON, and P. KANNEWORFF. Trawl surveys for shrimp (*Pandalus borealis*) in Denmark Strait, 1994.
94/91	N2478	SIEGSTAD, H., and D. M. CARLSSON. The commercial shrimp fishery in Denmark Strait in 1993 and January-October 1994.
94/92	N2479	SKÚLADÓTTIR, U. The catch statistics of the shrimp fishery (*Pandalus borealis*) in the Denmark Strait in the years 1980-1994.
94/93	N2480	SIEGSTAD, H., and D. M. CARLSSON. The shrimp fishery in NAFO Subarea 1 in 1993 and January-October 1994.
94/94	N2481	ANDERSEN, M., D. M. CARLSSON, and P. KANNEWORFF. Stratified-random trawl survey for shrimp (*Pandalus borealis*) in Disko Bay, West Greenland, 1994.
94/95	N2482	ANDERSEN, M., D. M. CARLSSON, and P. KANNEWORFF. Offshore trawl survey for shrimp (*Pandalus borealis*) in NAFO Subareas 0 and 1 in 1994.
94/96	N2483	SKÚLADÓTTIR, U., M. ANDERSEN, D. M. CARLSSON, P. KANNEWORFF, and SIEGSTAD. Preliminary assessment of shrimp in the Denmark Strait.
94/97	N2486	SKÚLADÓTTIR, U. The Icelandic shrimp fishery (*Pandalus borealis*) in the Denmark Strait in 1992-1994, and a preliminary estimation of age.

SUMMARY DOCUMENTS (SCS)

SCS No.	Ser. No.	Author(s) and Title
94/23	N2484	NAFO. Report of Scientific Council, 18-21 November 1994.

APPENDIX IV. LIST OF PARTICIPANTS

CANADA

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DENMARK (In respect of Faroe Islands and Greenland)

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