PART C

Scientific Council Special Meeting, 15-18 November 1996

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Participants of Special Meeting, 15-18 November 1996

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REPORT OF SCIENTIFIC COUNCIL

Special Meeting, 15-18 November 1996

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

I. PLENARY SESSIONS

The Scientific Council met at NAFO Headquarters, Dartmouth, Nova Scotia, Canada, during 15-18 November 1996. Representatives attended from Canada, Denmark (in respect of Faroe Islands and Greenland) and Iceland. The Executive Secretary and Assistant Executive Secretary were in attendance.

The opening session was called to order on 15 November 1996 at 1100 hr.

The Chairman, W. R. Bowering (Canada), welcomed representatives to this Special Meeting of the Scientific Council to conduct assessments on shrimp in Subareas 0 and 1, and Denmark Strait. A special appreciation was extended to W. B. Brodie (Canada) who kindly undertook the task of chairing the STACFIS sessions of this meeting, after his tenure of STACFIS chairmanship had ended in September 1996. The Assistant Executive Secretary was appointed rapporteur. The Provisional Agenda was **adopted** (see Agenda III, Part D, this volume).

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 session was adjourned at 1110 hr.

The concluding sessions were convened on 18 November 1996, noting that the shrimp assessment reports had been prepared by STACFIS. The Council then addressed the requests of the Coastal States and considering the results of the assessments provided advice and recommendations. The meeting was adjourned at 1708 hr.

Summary reports of the assessments 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 Part D, this volume.

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

The Council noted that matters referred to STACFIS relating to assessments of shrimp in Subareas 0 and 1 and Shrimp in Denmark Strait were addressed. The complete reports are given in Appendix I.

III. FORMULATION OF ADVICE

The Council reviewed the STACFIS assessments of shrimp in Subareas 0 and 1, and Denmark Strait and the agreed summaries are as follows:

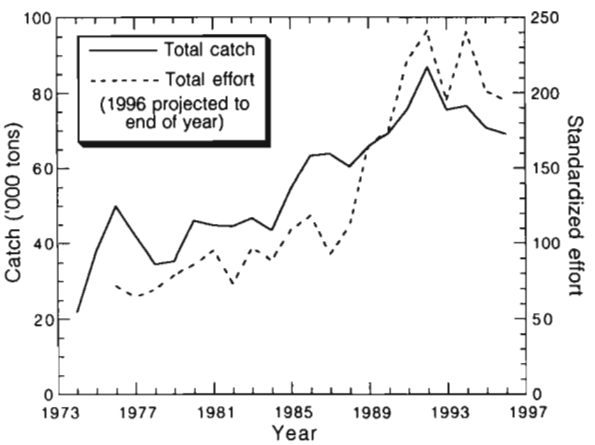
Shrimp in Subareas 0 and 1

Background: A small scale inshore fishery began in SA 1 during the 1930s. Since 1969 an offshore fishery has developed and the shrimp fishery is now the largest in Davis Strait.

Fishery and catches: The fishery is conducted mainly by Greenland and Canada. Recent catches from the stock are as follows:

	('000 tons)	
Year	Inshore	Offshore
1990	13.6	55.7
1991	16.3	59.6
1992	20.6	66.2
1993[1]	17.8	57.8
1994[1]	18.1	58.5
1995[1]	16.4	54.3
1996[1](to Oct)	10.5	44.6

[1] Provisional.

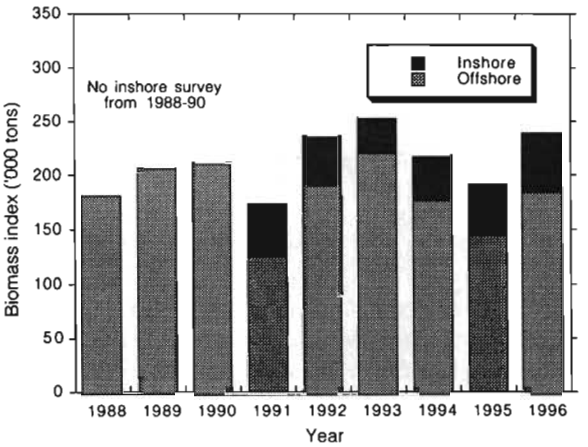


Data: Catch, effort and biological sampling data were available from the offshore fishery, and catch and effort data from the inshore fleet. Time series of biomass indices and stock composition data were available from research surveys from both offshore and inshore areas.

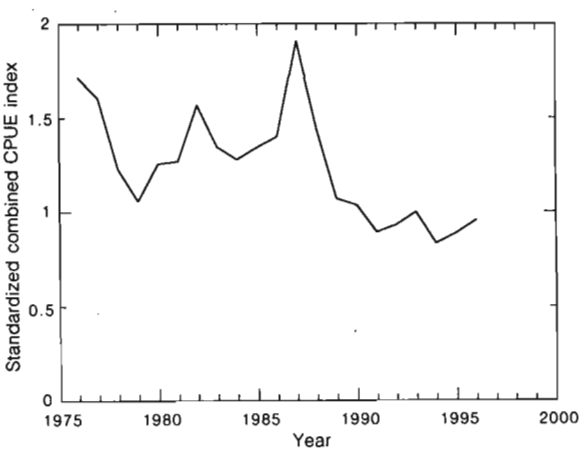
Assessment: No analytical assessment is available and fishing mortality is unknown. Evaluation of the status of the stock is based on interpretation of commercial fishery data (catch, effort and standardized catch rates), time series of research biomass indices and stock composition data.

CPUE: A single combined index covering the whole area in the period 1976-96 indicates two levels of stock abundance. From 1977 to 1988 the indices fluctuated at a level higher than the 1989-96 period.

Recruitment: Survey length distributions indicate a relatively strong 1990 year-class and the presence of several year-classes of smaller shrimp. The 1993 year-class seems very abundant. The 1990 year-class will likely maintain the catch rates in 1997, as it recruits to the female component of the stock. If the 1993 year-class is as strong as indicated, the catches will contain high proportions of small shrimp in 1997.



Biomass: Survey biomass indices indicate a relatively stable stock size from 1988 to 1996.



State of the Stock: Stock seems to be relatively stable, but at a lower level than in the 1970s to late-1980s. The presence of several year-classes recruiting to the fishable stock further suggests that there is no concern for recruitment in the short or medium term.

Recommendations: TACs advised for both 1995 and 1996 were 60 000 tons. The current assessment does not show any significant change in the status of the stock, which could justify modifying the advice.

Special Comments: The Scientific Council noted in its November 1995 report that an increase in TAC (to 67 000 tons) based on an upward revision of the average inshore catch was not warranted. The previously advised TAC of 60 000 tons is lower than the recent catches and may allow the stock size to increase to the higher level observed in the 1980s. However, a catch of 67 000 tons is also lower than recent catches and may be sustainable given the relative stability of the stock for the 1990s. An increase in the TAC to 67 000 tons would likely decrease the probability that the stock will increase from the current lower level, but Scientific Council is unable to quantify this probability.

Sources of Information: SCR Doc. 96/106, 109, 110, 111, 112, 113, 114, 115.

Shrimp in Denmark Strait

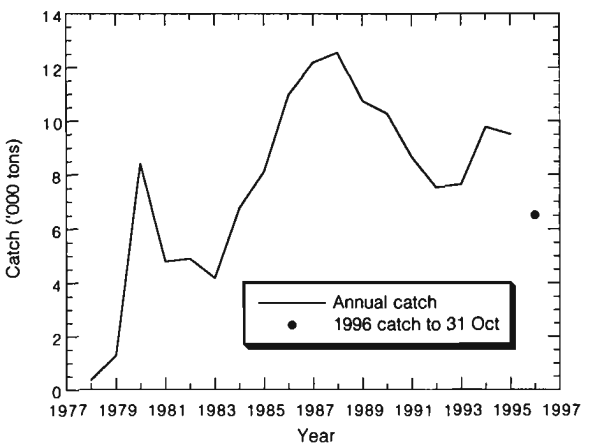
Background: The fishery for shrimp in limited areas of the Denmark Strait began in 1978. The fishery started exploiting new areas after 1992.

Fishery and Catches: This soon became a multi-national fishery with recent catches and TACs as follows:

	('000 tons)		
Year	Catch	TAC Recommended	TAC[1] Effective
1992	7.5	8	13.0
1993[2]	7.6	5	9.6
1994[2]	9.8	5	9.6
1995[2]	9.5	5	9.6
1996[2] (to Oct)	6.5	5	9.6

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

Effort has declined substantially since the late-1980s.



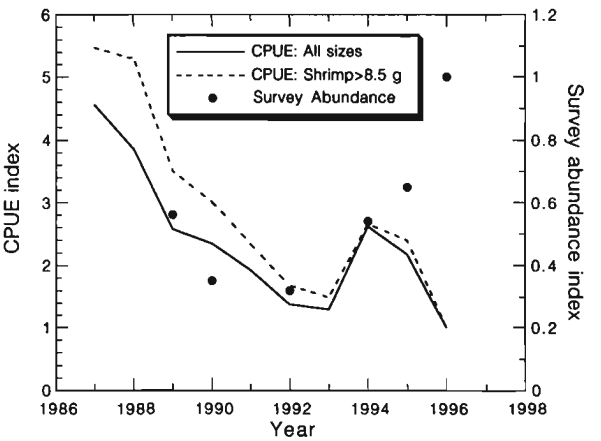
Data: Catch, effort and biological sampling data were available from the trawlers of several nations. Two time series of survey biomass indices were available, one from Norway for the years 1985 to 1989 and another from Greenland for the years 1989 to 1996, with associated biological samples.

Assessment: No analytical assessment is available and fishing mortality is unknown. Evaluation of the status of the stock is based on interpretation of commercial fishery data, the time series of survey biomass indices and biological data from both sources.

CPUE: Standardized CPUE indices in the traditional northern area have declined from peak values in 1987 to minimum values in 1992-93, subsequently increasing in 1994, remaining stable in 1995 and declining in 1996. However the unstandardized index for northern and southern areas combined increased from 1993 to 1994 and stabilized thereafter.

Recruitment: There are no immediate concerns for recruitment since the number of males in the surveys has increased substantially in recent years.

Abundance: The abundance index from the Greenlandic survey from the northern area declined from 1989 to 1992, and increased thereafter. The 1996 value is the highest in the series but is based on incomplete coverage.



State of the Stock: Although changes in fishing patterns make assessing stock status difficult, it seems that the stock has recently improved, but remains below the level of the early- to mid-1980s.

Recommendations: For 1997 there is no biological basis for advising any change to the TAC from the 1996 value of 5 000 tons.

Special Comment. Scientific Council noted that catch levels have substantially exceeded advised TACs in recent years. Although these recent catch levels have not resulted in stock decline, reducing catches to the advised TAC level would improve chances of stock rebuilding.

Sources of Information: SCR Doc. 96/107, 108, 116, 117, 118).

IV. OTHER MATTERS

The Council noted that the Working Group on Shrimp in Div. 3M will meet immediately after this meeting of the Scientific Council, with the Designated Expert, D. G. Parsons (Canada), as Chairman. The Working Group will present its report in the form of an SCS Document for consideration by the Council in 1997.

V. ADOPTION OF REPORTS

The Council met briefly at 1700 hr on 18 November 1996 and **adopted** the STACFIS Report. The report is given in Appendix I. The Council then **adopted** its own report.

VI. ADJOURNMENT

There being no further business, the Chairman thanked the participants, especially the Designated Experts, the Chairman of STACFIS, W. B. Brodie (Canada), who kindly offered to undertake the task of chairing this STACFIS meeting and the Secretariat for the 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 15-18 November 1996, to review the status of the shrimp stocks in Subareas 0 and 1, and Denmark Strait, as 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. 96/106, 109, 110, 111, 112, 113, 114, 115)

a) **Introduction**

In accordance with the recommendation by STACFIS in November 1993, the entire shrimp stock in Div. 0A, and Subarea 1 both north and south of 71°N, as well as inshore, is assessed as a single population. Overall catches in the entire stock area increased until 1992, then decreased from 1993 to 1995 (Fig. 1). Catches in 1996 are projected to be slightly below the 1995 level, because measures have been taken by Greenland authorities to reduce the catch by 5% per year starting in 1995.

It has been recognized that shrimp catches include a small component of the species *P. montagui*. In 1995 and 1996, separate quotas were set by Greenland for catches of *P. montagui*. These catches amounted to 374 tons and 432 tons, respectively, and were not included in the nominal catches for *P. borealis*.

Recent nominal catches and TAC (tons) for shrimp in Div. 0A and Subarea 1 are as follows:

	1986	1987	1988	1989	1990	1991	1992	1993[1]	1994[1]	1995[1]	1996[1,2]
Div. 0A Total	2 995	6 095	5 881	7 235	6 177	6 788	7 493	5 491	4 766	2 361	2 100
SA 1 Offshore	52 634	50 720	44 159	45 198	49 478	52 834	58 664	52 280	53 693	51 900	42 466
SA 1 Inshore	7 500	6 921	10 233	13 224	13 630	16 258	20 594	17 843	18 118	16 429	10 533
SA 1 Total	60 134	57 641	54 392	58 422	63 184	69 092	79 258	70 123	71 811	68 329	52 999
SA 0+1 Total	63 129	63 736	60 273	65 657	69 361	75 880	86 751	75 614	76 577	70 690	55 099
0+1 offshore catch	55 629	56 815	50 040	52 433	55 731	59 662	66 157	57 771	58 459	54 261	44 566
0+1 advised TAC[3]	36 000	36 000	36 000	44 000	50 000	50 000	50 000	50 000	50 000	60 000	60 000

[1] Provisional data.
[2] January-October.
[3] Until 1994 the advised TAC was only for offshore south of 71°N. After 1994, the advised TAC includes offshore north of 71°N and inshore.

The nominal catch of shrimp in the offshore areas of Subarea 1 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 54 000 tons during 1985-88, then increased to 66 000 tons in 1992 and decreased thereafter to 54 000 tons in 1995. Preliminary statistics for the offshore area in 1996 (January to October, Subarea 1) show total catches of about 44 000 tons (compared to 43 000 tons in the same months in 1995). The offshore fishery has been regulated by TAC since 1977.

During the history of this fishery, the fishing grounds in Div. 1B have been the most important. The fishery started expanding southward in 1989 and this expansion continued until 1993.

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 Div. 1B. The northwestern fishing grounds in Div. 1B and Div. 0A were fished less intensively in 1995 and 1996.

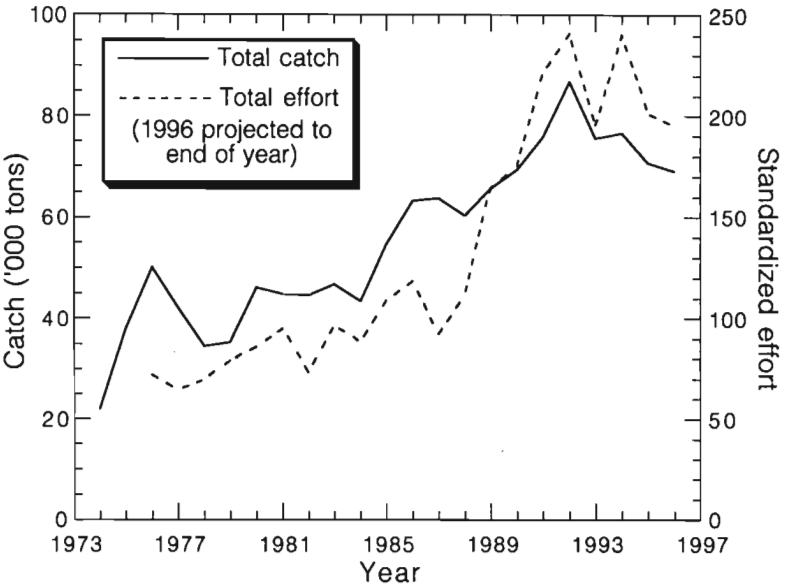


Fig. 1. Shrimp in Subareas 0 and 1: total catches and standardized effort.

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). A revision of the inshore catch statistics showed that catches in recent years have increased to over 20 500 tons in 1992, but decreased to 16 000 tons in 1995. Preliminary data for 1996 (January-October) indicate that catches are at the same level as for the same period in 1995.

b) **Input Data**

i) **Commercial fishery data**

Fishing effort and CPUE. Catch and effort data from the shrimp fishery in 1996 were available from fishing records from Canadian vessels in Div. 0A (SCR Doc. 96/106) and from Greenland logbooks for Subarea 1 (SCR Doc. 96/109, 111).

Five time series of standardized CPUE indices were available, including both the inshore and offshore areas, as well as the small vessel component. The five indices were: 1) Seven trawler index in Div. 1B (offshore) of total shrimp catches from 1976 to 1990, 2) Div. 1B trawler index (offshore) of large shrimp (count 120 per kg or less) from 1987 to 1996, 3) Div. 1CD trawler index (offshore) of large shrimp (count 120 per kg or less) from 1988 to 1996, 4) The Greenland small vessel (<80 GRT) index (inshore and near shore) of total shrimp catches from 1988 to 1996, 5) the Canadian Div. 0A trawler index (offshore) of total shrimp catches from 1981 to 1996. A single index was constructed by combining the five separate indices covering the period 1976-96 (SCR Doc. 96/109, 96/111). The last value of the index (1996) was calculated from the historic model.

During the 1976-88 period, the index fluctuated at a level substantially higher than the level during 1989-96. In the latter period the index fluctuated without trend (Fig. 2).

Up to 1986, the standardized effort showed a slight increasing trend. Effort more than doubled between 1987 and 1992, and then varied without a trend until 1995. The 1996 value (projected to the end of the year) is expected to be lower than the 1995 value (Fig. 1). Twin trawls introduced in 1995 on several Greenlandic trawlers have been accounted for in analyses of effort data.

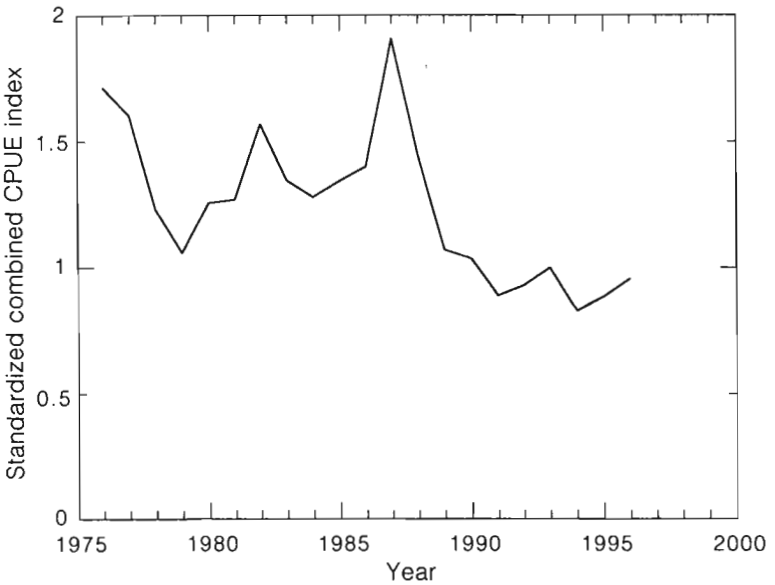


Fig. 2. Shrimp in Subareas 0 and 1: standardized combined CPUE index.

Length and age composition. Length frequency distributions obtained by observers were available from the commercial fishery in Div. 0A from 1981 to 1996 (SCR Doc. 96/106) and in Subarea 1 from 1991 to 1996 (SCR Doc. 96/109).

Standardized catch rates for males, which included several year-classes, increased from 1993 to 1996 while for females they fluctuated between 1991 and 1996. There are indications that the 1993 year-class is abundant. Data from Div. 0A show that the 1993 year-class is very strong relative to other year-classes at age 3 in this fishery.

Shrimp discards. In Div. 0A in 1995 and 1996, discarding was lower than in previous years.

ii) **Research survey data**

Biomass and abundance estimates. Trawl surveys have been conducted from 1988 in offshore areas (Subarea 1 + Div. 0A) and from 1991 in inshore Subarea 1 (SCR Doc. 96/112, 96/114). Re-analyses of survey results showed that *P. montagui* occurred in small quantities (around 100 tons per year) from 1988 to 1991 and increased from 1992 to 1995 from 1 100 tons to about 15 000 tons. In 1996 the estimated biomass of *P. montagui* decreased to 2 800 tons (SCR Doc. 96/113).

The estimates of trawlable biomass for *P. borealis* are as follows:

Biomass ('000 tons)	1988	1989	1990	1991	1992	1993	1994	1995	1996
Offshore (Subarea 1+Div. 0A)	182	207	212	125	192	222	178	145	186
Inshore (Div. 1A)	-	-	-	49	45	32	41	47	55
Total	-	-	-	174	237	254	219	192	241

Offshore: In July-September 1996, a 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 with a two-phase design, applying more stations in strata with high shrimp densities (SCR Doc. 96/114).

Biomass estimates from the survey in the period 1988-96 were variable around a mean level of 180 000 tons (Fig. 3).

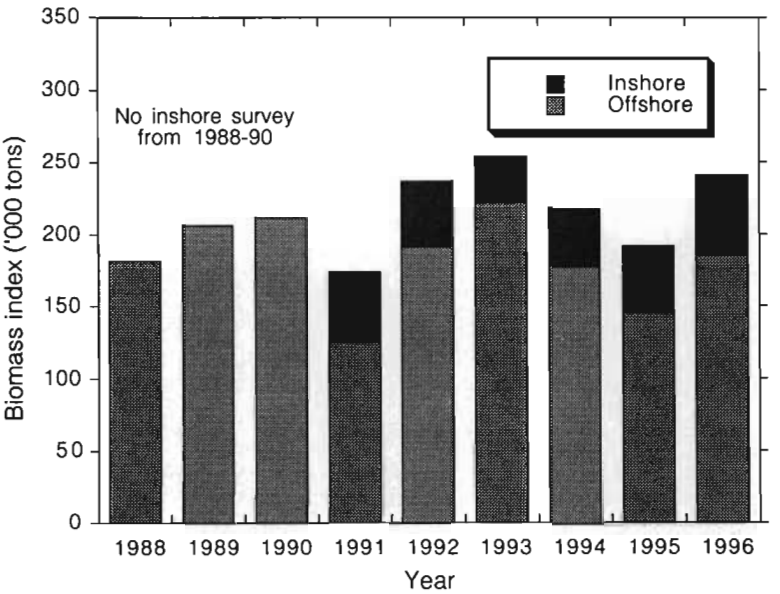


Fig. 3. Shrimp in Subareas 0+1: combined biomass estimates from inshore and offshore surveys.

Survey catches were dominated by males in 1996. Length distributions in 1996 indicated a relatively strong 1990 year-class and the 1991 and 1992 year-classes appeared to be about average. The 1993 year-class in 1996 is more abundant than previous year-classes observed at age 3 from 1993 to 1995.

Abundance-at-age (in billions) for shrimp from Greenland offshore research survey data is given in the following table:

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996
1						0.5	0.3	0.5	0.7
2	0.4	0.4	0.8	0.2	0.7	2.2	1.3	0.5	1.9
3	0.9	4.5	1.1	0.6	2.5	3.4	2.4	1.1	8.0
4	3.4	16.0	3.2	1.7	3.2	7.2	6.5	3.6	7.0
5	7.1	7.0	11.7	2.2	5.7	10.2	7.0	7.6	6.0
6	6.3	3.9	5.2	7.5	8.9	8.4	7.5	4.7	9.3
7+	7.7	6.0	8.0	4.4	5.5	7.9	6.4	5.1	5.6
Total	25.8	37.9	29.9	16.6	26.4	39.7	31.4	23.1	38.5

Inshore: In August 1996, a stratified-random trawl survey also using a two-phased approach was conducted by Greenland in the inshore areas in Disko Bay and Vaigat (Div. 1A) (SCR Doc. 96/112). The biomass estimates from the survey series in 1991-96 were variable around 45 000 tons with an increasing trend from 1993 to 1996 (Fig. 3).

The overall size composition of shrimp from the inshore survey in 1996 was similar to that of the offshore in relation to the occurrence of modes. In the 1996 survey males were most abundant in southwestern and central Disko Bay. Females were most abundant in central Disko Bay and northern Vaigat.

c) **Assessment Results**

Indices from the commercial fishery show that the abundance of shrimp in 1989-96 fluctuated without trend, but at a lower level than in 1976 to 1988. The decrease from 1987 to 1989 was coincident with a substantial increase in effort. The survey indices from 1988 to 1996 also indicate that the abundance has fluctuated without trend.

The combined inputs to the assessment indicate a stable stock size. The fishery in 1997 will depend on the relatively strong 1990 year-class and as it recruits to the female component it should maintain catch rates. The presence of several recruiting year-classes, further suggests that there is no concern about recruitment in the short or medium term.

If the 1993 year-class is as strong as indicated, the catch will contain a high proportion of small shrimp in 1997.

d) **Research Recommendations**

STACFIS was pleased to note that the recommendations from the 1995 November Meeting of the Scientific Council were fulfilled.

For shrimp in Div. 0A and Subarea 1, STACFIS **recommended** that *for consideration at the November 1997 Meeting of the Scientific Council, sampling of the commercial fishery be improved to cover all components of the fishery by area and month.*

2. **Shrimp in Denmark Strait** (SCR Doc. 96/107, 108, 116, 117, 118)

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 depend 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 fishery started in areas between 60°30'N and 65°N and west of 35°W. In 1996 the fishery was located mainly in the southern area, with some indication of activity in nearshore areas of East Greenland.

Catches in the northern (traditional) area increased rapidly to 1980, declined and remained stable from 1981 to 1983, increased gradually to 1988 (12 500 tons) and then decreased again to 1994, staying relatively constant from 1994 to 1996. Catches from the southern fishing area increased from 3 000 tons to 6 600 tons in 1994, then declined to 4 400 tons in 1996 (preliminary data). Catches for the whole area increased from 1993 to 1994-95 and then declined in 1996 (preliminary data) (Fig. 4).

Recent catches and TACs (tons) are as follows:

	1986	1987	1988	1989	1990	1991	1992	1993[1]	1994[1]	1995[1]	1996[1,2]
Catch north of 65°N											
eastern side	1 150	1 330	1 424	1 326	281	465	1 750	2 553	1 514	1 151	566
western side	9 814	10 848	11 125	9 416	9 994	8 192	5 764	3 950	3 358	4 052	1 582
Catch south of 65°N	-	-	-	-	-	-	-	2 995	6 641	5 461	4 380
Total	10 964	12 178	12 549	10 742	10 275	8 657	7 514	7 638	9 778	9 512	6 528
Advised TAC	-	-	-	10 000	10 000	10 000	8 000	5 000	5 000	5 000	5 000
Effective TAC western side	7 525[3]	7 725[3]	8 725[3]	9 025[3]	14 100	14 500	13 000	9 563	9 563	9 563	9 563

[1] Provisional catches.
[2] January-October.
[3] Not including Greenland fishery north of 66°30'N.

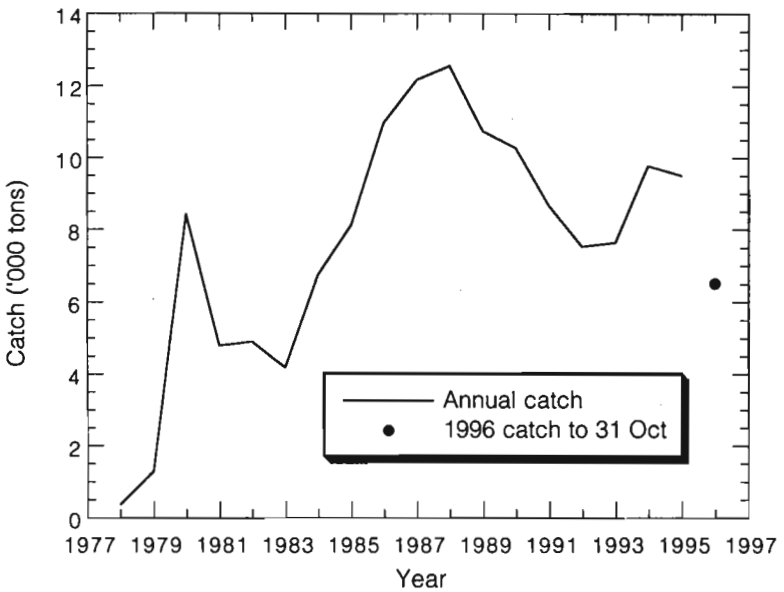


Fig. 4. Shrimp in Denmark Strait: catches.

b) **Input Data**

i) **Commercial fishery data**

Fishing effort and CPUE. Catch and effort data from logbooks were available from Greenland, Norway, Iceland, Faroe Islands and EU-Denmark since 1980, and from EU-France for the years 1980 to 1991. Because of uncertainty regarding the area fished by Norway in 1993 to 1995, Norwegian data have been excluded from some catch-effort analyses.

In the northern area, between 1980 and 1989, total unstandardized effort increased from about 35 000 hours to more than 100 000 hours, declining thereafter to about 16 000-24 000 hours in 1994-95. The fishery in the July-December period became more important at the end of the 1980s, accounting for approximately 50% of the total annual effort, whereas in the 1990s the effort in spring has been the most important. In the southern area, effort was between 36 000-40 000 hours in 1993-95. For the whole area, effort has declined from 80 000 hours in 1993 to 63 000 hours in 1995.

In the northern area (excluding Norway) unstandardized catch rates (Fig. 5) declined from 1980 to 1983, fluctuated from 1983 to 1987 then declined again to 1989 (SCR Doc. 96/107, 96/108). Values for 1990-93 were similar to the low 1989 value at about 50% of the level seen in the early- to mid-1980s. In 1994 there was a considerable rise in the catch rate but this subsequently declined in 1995 and 1996.

For north and south areas combined, the unstandardized catch rate rose from 1993 to 1994 and then remained relatively constant.

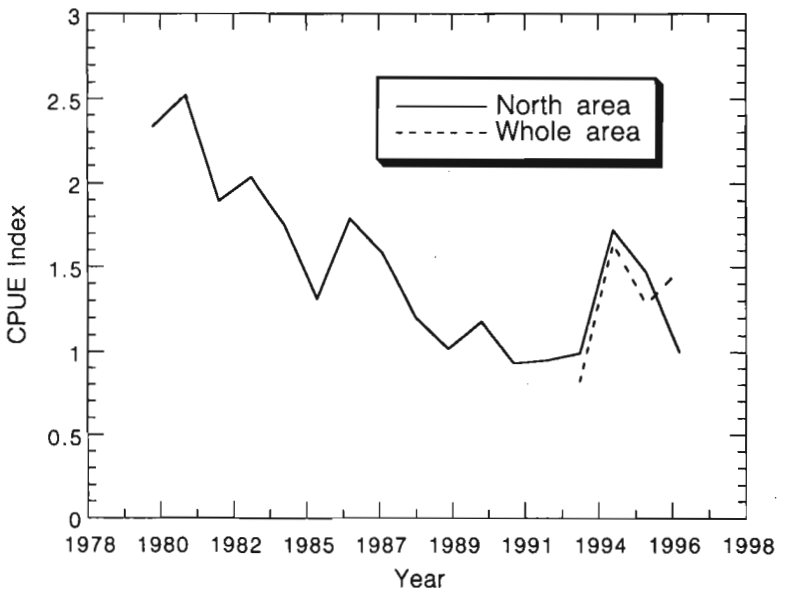


Fig. 5. Shrimp in Denmark Strait: unstandardized catch rates (scaled to the 1996 value in the northern area).

Standardized catch-rate series for Greenland vessels for large shrimp and all shrimp in the northern area (Fig. 6) showed a continuous decline from 1987 to 1993 and a considerable increase in 1994. The 1995 value was approximately the same as that for 1994 but in 1996 the index declined to the lowest value in the series (SCR Doc. 96/117).

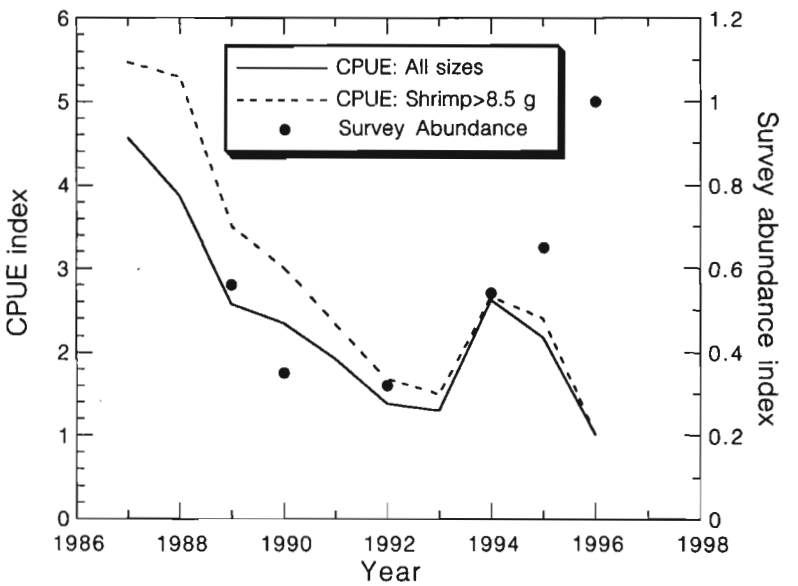


Fig. 6. Shrimp in Denmark Strait: standardized catch rate indices. Survey abundance index is shown as points. All indices are for the northern areas only and are relative to the 1996 value.

Biological data. Samples from the Icelandic and Greenlandic fisheries in the late-1980s were comprised mainly of females. Throughout the 1990s males have dominated the catches except in the Icelandic fishery of 1995 which may have been affected by sampling problems (SCR Doc. 96/118).

Commercial samples from both the Greenlandic and Icelandic fisheries indicate no concerns for recruitment for the next 1-3 years.

ii) **Research survey data**

A trawl survey was conducted by Greenland in the Denmark Strait in September 1996, based on a two-stage sampling method using a spline technique. Survey coverage was incomplete due to bad weather, and the results were not strictly comparable to earlier years.

The abundance index declined from 1989 to 1992, and increased from 1992 to 1996 (SCR Doc. 96/116). The 1996 value was about 50% higher than 1995 but this value should be treated with caution. Because variance estimates were not available, it was not known whether differences between years were statistically significant.

The Greenland survey showed an increase in the proportion of males from 1989 to 1992, which continued a trend from the Norwegian surveys of 1985 to 1989. In 1994 and 1995 the proportions of males were almost the same as in 1992, but a further increase was recorded in 1996:

	Percent males										
Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Norway	41.4	53.5	58.5	58.0							
Greenland				63.1	62.5	-	78.3	-	74.5	74.2	81.0

c) **Assessment Results**

The changes in fishing patterns (decline in catches in north area, increased in south area) make assessment of this stock difficult. The decline in catch rate in the north area is difficult to reconcile with the other indices. Catch rates are increasing in the southern area and are stable considering north and south areas combined. The 1996 survey indicates that abundance is being maintained in the northern area. Length frequencies indicate no immediate concern for recruitment. Despite the uncertainty of the present assessment, it seems that the stock has recently improved, however, it remains below the level of the early- to mid-1980s.

d) **Research Recommendations**

For shrimp in the Denmark Strait, STACFIS **recommended** that *the annual survey be expanded to cover the whole distribution of shrimp in this area.*

3. **Other Business**

There being no other business, the Chairman thanked the participants, and particularly the Designated Experts, for their work during the meeting. After thanking the Secretariat for their help, the meeting was adjourned.