

## **PART C**

### **Scientific Council Meeting, 6-10 November 1998**

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**Participants of Scientific Council Meeting, 6-10 November 1998, Copenhagen, Denmark**



Left to Right: D. M. Carlsson, P. Kanneworff, T. Amaratunga, H. Siegstad, U. Skúladóttir, C. Hvingel, R. Mayo, O. Folmer, L. Savard, H.-P. Cornus, D. C. A. Auby, D. G Parsons, M. C. S. Kingsley.



## REPORT OF SCIENTIFIC COUNCIL

6-10 November 1998

Chairman: H. P. Cornus

Rapporteur: T. Amaratunga

### I. PLENARY SESSIONS

The Scientific Council met at Greenland Home Rule Government, Denmark Office, Pilestræde 52, Copenhagen K, Denmark, during 6-10 November 1998. Representatives attended from Canada, Denmark (in respect of Greenland), Estonia, European Union, Iceland and United States of America. The Assistant Executive Secretary was in attendance.

The opening session was called to order on 6 November 1998 at 1020 hours.

The Chairman, H. P. Cornus (EU-Germany), welcomed representatives to this 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.

The Provisional Agenda was considered. It was noted that informal discussions among NAFO and ICES experts immediately after this Scientific Council Meeting will consider general problems in relation to the Precautionary Approach for shrimp stocks. The Council also agreed to consider the progress on the Pandalid Symposium of September 1999, and the time and venue of the November 1999 Meeting for shrimp assessments. The Agenda (see Agenda III in Part D, this volume), modified accordingly was **adopted**.

The Council noted that STACFIS would undertake the assessments of the stocks (see Appendix I) while the prognoses and advice would be undertaken by the Council.

The session was adjourned at 1120 hours.

The Council met as needed through 6-10 November 1998, and the concluding session was convened at 1000 hours on 10 November 1998. The Council addressed the requests of the Coastal States and considering the results of the assessments, provided advice and recommendations. The Council addressed 'Other Matters' in the agenda. The Council then considered and **adopted** the STACFIS report, and considered its own report and **adopted** the report of this meeting of 6-10 November 1998.

The meeting was adjourned at 1620 hours on 10 November 1998.

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

The **adopted** Report of Standing Committee on Fishery Science (STACFIS) is given at Appendix I. The Council's summary sheets and conclusions on shrimp in Subareas 0+1 and shrimp in Denmark Strait are presented in Section IIIa and b, respectively, of this report. **The recommendations with respect to stock advice appear therein.**

The **recommendations** made by STACFIS for the work of the Scientific Council as **endorsed** by the Council, are as follows:

At this meeting STACFIS **recommended** that, for shrimp in Subareas 0 and 1:

- *sampling of the commercial fishery be further improved to cover all components of the fishery by area and month,*
- *an analysis of the distribution of the shrimp stock in relation to environmental conditions be conducted,*
- *survey results for 1994-97 (both biomass estimates and size composition data) be standardized to make them comparable to results from the other years,*
- *survey strategy and design be further optimized, and a study on the impact of the duration of trawl hauls on biomass estimates be undertaken, and*
- *an analysis of the abundance and spatial distribution over time of all by-catch species in trawl surveys be undertaken.*

At this meeting STACFIS **recommended** that, for shrimp in Denmark Strait:

- *a survey be conducted, to provide fishery independent data of the stock throughout its range,*
- *all available oceanographic data regarding the area be compiled for further investigation of the warming in northern Denmark Strait beginning in 1993,*
- *commercial catch sampling of the fishery be improved to fully cover seasonal and spatial variation , so that size and sex composition of the catch can be accurately described,*
- *methods for presenting length-at-age and length-at-sex reversal be coordinated, and*
- *all available logbook data be analyzed for trends in CPUE (both standardized and unstandardized).*

### **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 (Pandalus borealis) 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 most important in Davis Strait.

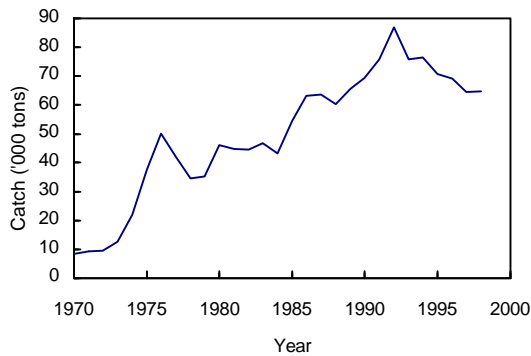
**Fishery and catches:** The fishery is conducted mainly by Greenland and Canada. Recent catches from the stock are as follows:

Year	Catch ('000 tons)			TAC ('000 tons)
	Inshore	Offshore	Total	Recommended
1991	16.3	59.6	75.9	50.0 <sup>1</sup>
1992	20.6	66.2	86.8	50.0 <sup>1</sup>
1993	17.9	57.8	75.7	50.0 <sup>1</sup>
1994 <sup>2</sup>	18.1	58.5	76.6	50.0 <sup>1</sup>
1995 <sup>2</sup>	16.4	54.3	70.7	60.0
1996 <sup>2</sup>	17.4	51.9	69.2	60.0
1997 <sup>2</sup>	13.5	51.0	64.5	60.0
1998 <sup>2,3</sup>				55.0

<sup>1</sup> Only offshore.

<sup>2</sup> Provisional.

<sup>3</sup> Projected total catch for 1998 is 65 000 tons.



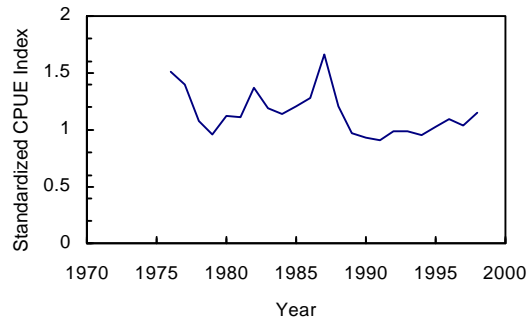
**Data:** Catch, effort and biological sampling data were available from the offshore fishery, and catch and effort data from the inshore fleet. Time series of biomass indices, and size and sex composition data were available from research surveys from both offshore and inshore areas.

**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 biological data.

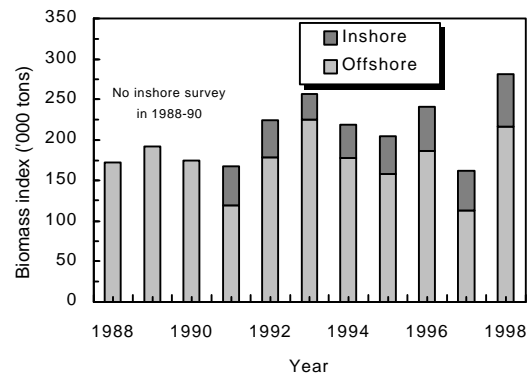
**CPUE:** A new combined standardized catch-rate index including all size groups of shrimp in the catch in the period 1976-98, indicate a stable or slightly increasing trend in the 1990s. The projected 1998 value is the highest value in the 1990s.

**Recruitment:** The 1998 survey shows an abundant year class of large males at 20 mm CL. Abundance of the female stock component appears stable in recent years. The males, which comprised the 20 mm group CL in 1998 are

expected to contribute to the female biomass over the next two years.



**Biomass:** Given the range of variability exhibited in the survey indices, there appears to be no indication of a significant change in total stock biomass in the offshore area since 1988 and in the inshore area since 1991.



**State of the Stock:** The perception of the status of the stock is more optimistic than in 1997. Based on the available commercial and survey data on CPUE and recruitment, the stock appears to have remained stable or has possibly increased slightly in recent years.

**Recommendation:** Catches in 1997 and projected catches in 1998 average about 65 000 tons. Given the uncertainty of the absolute size of incoming recruitment, Scientific Council recommend that catches of shrimp in Subareas 0 and 1 in 1999 should not exceed this average.

**Special Comments:** There is now a change of the perception of the state of the stock. The CPUE index, previously believed to be declining, is now thought to be at least stable or increasing slightly. Given the range of variability in survey biomass estimates, there appears to be no evidence of a decline in biomass in recent years.

**Sources of Information:** SCR Doc. 98/111, 113, 114, 115, 116, 118, 119, 123.

**Shrimp (*Pandalus borealis*) in Denmark Strait**

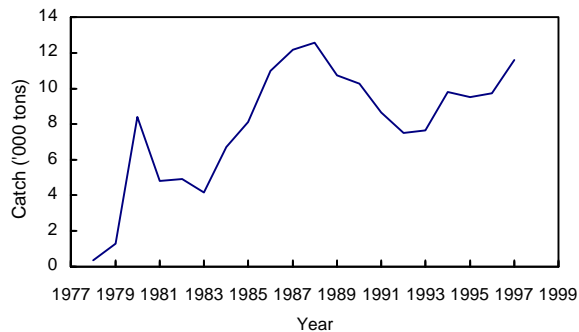
**Background:** The fishery for shrimp started in areas north of 65°N in Denmark Strait in 1978. The fishery started exploiting new areas south of 65°N after 1992.

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

Year	Catch ('000 tons)	TAC ('000 tons) Agreed <sup>2</sup>	Recommended
1992	7.5	13.0	8
1993	7.6	9.6	5
1994 <sup>1</sup>	9.8	9.6	5
1995 <sup>1</sup>	9.5	9.6	5
1996 <sup>1</sup>	9.6	9.6	5
1997 <sup>1</sup>	11.6	9.6	5
1998 <sup>1</sup> (to 1 Oct)	6.6	9.6	5

<sup>1</sup> Provisional.

<sup>2</sup> Only for Greenland EEZ



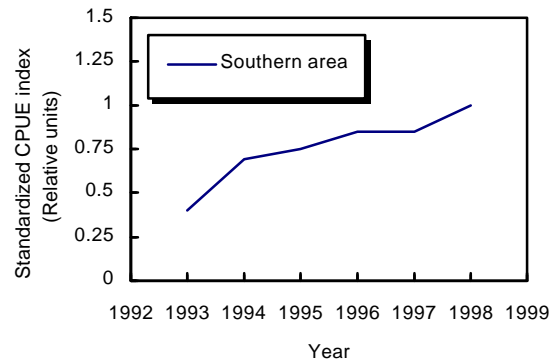
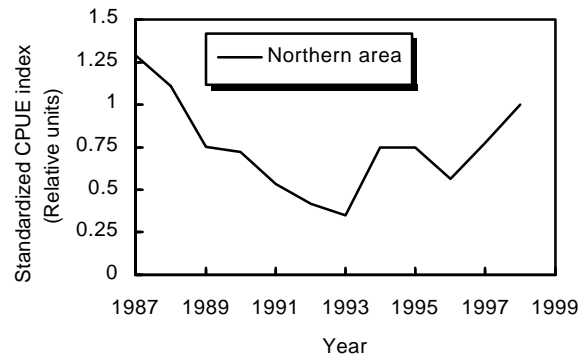
**Data:** Catch, effort and biological sampling data were available from the trawlers of several nations. No survey data were available in 1997 and 1998.

**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 and biological data.

**CPUE:** In the northern area the standardized CPUE indices are now higher than the minimum values reached in 1989-93 approaching the level observed during the mid-1980s. Catch rates in the southern areas have increased since 1993.

**Recruitment:** Based on the available data there were no immediate concerns about recruitment.

**Biomass:** No direct biomass estimates were available.



**State of the Stock:** Standardized CPUE data from both the northern and the southern areas indicate a general increasing trend in fishable biomass since 1993. Several year-classes of male and female shrimp are evident in the sampling data in recent years.

**Recommendation:** Average catches for the years 1993 to 1997, a period coinciding with increasing catch-rates, were 9 600 tons. Scientific Council recommends that catches of shrimp in Denmark Strait in 1999 should not exceed this average.

**Special Comments:** The perception of the stock is now more optimistic than in the recent years. Scientific Council notes, however, that uncertainty on stock structure and lack of surveys in 1997 and 1998 make assessment of this stock difficult.

**Sources of Information:** SCR Doc. 98/112, 117, 120, 121, 122, 124.



#### **IV. OTHER MATTERS**

##### **1. Progress Report of 1999 Symposium**

The Council was presented with a brief report on the progress made in preparation for the Symposium on "Pandalid Shrimp Fisheries - Science and Management at the Millennium" of September 1999. The Council was informed that the co-convenor P. A. Koeller (Canada) had been in consultation with the other co-convenors and that plans for the joint NAFO, ICES and PICES Symposium were progressing well.

The co-convenors were currently polling scientists in their respective organizations to submit papers, and also provide ideas on the present program. Scientific Council members at this meeting were requested to indicate who would be submitting papers.

The Council extended its appreciation to the co-convenor P. A. Koeller (Canada), for his continued work in inviting speakers and structuring the Symposium, and wished him well in developing a successful Symposium.

##### **2. Meeting of November 1999**

The Council considered the possible timing and venue of the next shrimp assessment meeting in November 1999. Noting the meeting will also include the assessment of shrimp in Div. 3M (see Scientific Council 6-18 September 1998 Meeting Report), the Council expects participation by additional experts. In this regard it was agreed that experts from ICES may be in a position to participate and provide valuable input to the assessments. The Council requested its members to look into possibilities of such participation.

The Council considered the possible participants, and the relative convenience and cost of traveling with respect to selecting the meeting venue, and Iceland was proposed. The Council requested the representative from Iceland to look into the possibility, and looks forward to hearing back from the representative.

It was agreed the next meeting would require an additional 2 days for the assessment of shrimp in Div. 3M, and accordingly scheduled the meeting for 11 to 17 November 1999 (which includes Saturday, 13 November 1999 as a working day).

#### **V. ADJOURNMENT**

There being no further business, the Chairman expressed his sincere thanks to all participants for their cooperation and hard work done during the meeting. He especially thanked the Designated Experts and the STACFIS Chairman who had to contribute the most. He extended his thanks to the Secretariat and the Greenland Institute for providing excellent meeting facilities and hospitality.

He noted that this was the second time he chaired the November Meeting and his term would be finished before the November 1999 Meeting when a new Chairman takes over. He stated that he especially enjoyed chairing these meetings which provide advice on shrimp. He wished everyone a safe journey home and adjourned the meeting.



L to R: H. P. Cornus (Chairman, Scientific Council), U. Skuladottir (Designated Expert), H. Siegstad (Designated Expert) and R. Mayo (Chairman, STACFIS)



STACFIS at work on shrimp in Subareas 0 and 1 and Denmark Strait stock assessments

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

Chairman: R. K. Mayo

Rapporteur: Various

The Committee met at Greenland Home Rule Government, Denmark Office, Pilestræde 52, Copenhagen K, Denmark, at various times during 6-10 November 1998 to consider and report on matters referred to it by the Scientific Council, particularly those pertaining to the provision of scientific advice on shrimp stocks in Subareas 0 and 1 and Denmark Strait. Representatives attended from Canada, Denmark (in respect of Greenland), Estonia, European Union, Iceland and United States of America. The Assistant Executive Secretary was in attendance.

### I. STOCK ASSESSMENTS

#### 1. Shrimp (*Pandalus borealis*) in Subareas 0 and 1 (SCR Doc. 98/111, 113, 114, 115, 116, 118, 119, 123)

##### a) Introduction

The shrimp stock off West Greenland is distributed in NAFO Div. 0A and Subarea 1 and the entire shrimp stock is assessed as a single population. The Greenland fishery exploits the stock in Subarea 1 (Div. 1A to 1F) in offshore and inshore areas (primarily Disko Bay). The Canadian fishery has been restricted to Div. 0A since 1981.

Two offshore fleet components, one from Canada and one from Greenland participated in the fishery. The offshore fleet has been restricted by areas and quotas since 1977. An inshore small-vessel Greenland fleet was unrestricted until January 1997, when quota regulation was imposed. The Canadian fishery in Div. 0A is regulated by a quota based on 17% of the advised TAC for the offshore area.

Overall catches increased until 1992, then decreased from 1993 to 1997. Catches in 1998 are projected to be the same as in 1997 (Fig. 1.1). Recent nominal catches and advised TAC (tons) for shrimp in Div. 0A and Subarea 1 are as follows:

	1988	1989	1990	1991	1992	1993	1994 <sup>1</sup>	1995 <sup>1</sup>	1996 <sup>1</sup>	1997 <sup>1</sup>	1998 <sup>1,2</sup>
Div. 0A Total	5 881	7 235	6 177	6 788	7 493	5 451	4 766	2 361	2 623	517	875
SA 1 Offshore	44 159	45 198	49 478	52 834	58 664	52 420	53 693	51 900	49 251	50 496	48 960
SA 1 Inshore	10 233	13 224	13 630	16 258	20 594	17 916	18 118	16 429	17 359	13 504	15 040
SA 1 Total	54 392	58 422	63 184	69 092	79 258	70 336	71 811	68 329	66 610	64 000	64 000
SA 0+1 Total	60 273	65 657	69 361	75 880	86 751	75 787	76 577	70 690	69 233	64 517	64 875
0+1 offshore catch	50 040	52 433	55 731	59 662	66 157	57 871	58 459	54 261	51 874	51 013	49 835
0+1 recomm. TAC <sup>3</sup>	36 000	44 000	50 000	50 000	50 000	50 000	50 000	60 000	60 000	60 000	55 000

<sup>1</sup> Provisional data (STACFIS estimates from 1994-98).

<sup>2</sup> Projected to end of 1998.

<sup>3</sup> Until 1994 the advised TAC was only for offshore south of 71°N. After 1994, the advised TAC included 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. Catches fluctuated thereafter and stabilised around a level of 54 000 tons during 1985-88, then increased to 66 000 tons in 1992 and decreased thereafter to 51 000 tons in 1997. Total catch in the offshore areas for 1998 is projected to be at the 1997 level. The Canadian fishery in Div. 0A amounted to about 2 500 tons in 1995 and 1996, declined to 500 tons in 1997 and 875 tons has been reported up to October 1998.

Historically, the fishing grounds in Div. 1B have been the most important. Since 1989, a gradual southward shift in the offshore fishery has taken place, and since 1990 catches in Div. 1C and 1D have exceeded those

from Div. 1B. At the end of the 1980s, exploitation began in Div. 1E and 1F, and catches from these areas now account for about 20% of the total catch. The distribution of the fishery has not changed since 1996.

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). Inshore catches in recent years have increased to over 20 500 tons in 1992, but decreased to 13 500 tons in 1997. During the 1990s inshore catches have accounted for about 25% of the total catch in Subarea 1. Preliminary data for 1998 (January-October) indicate inshore catches at the same level as in 1997.

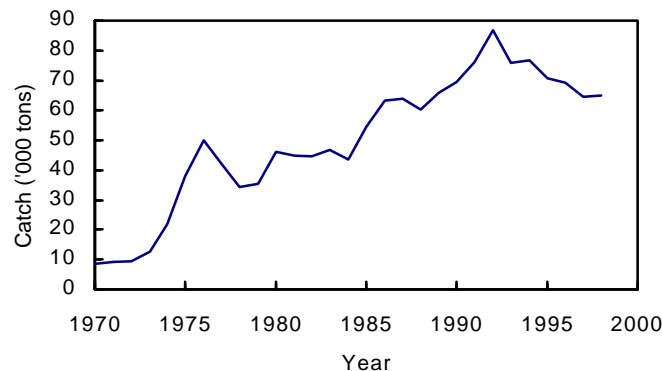


Fig. 1.1. Shrimp in Subareas 0 and 1: total catches (1998 projected to the end of the year).

## b) Input Data

### i) Commercial fishery data

**Fishing effort and CPUE.** Catch and effort data from the shrimp fishery in 1998 were available from fishing records from Canadian vessels in Div. 0A and from Greenland logbooks for Subarea 1 (SCR Doc. 98/111, 123).

Two standardized CPUE indices (Fig. 1.2) were presented (SCR Doc. 98/111,113). The standardized CPUE series (Std. A) including mainly female shrimp in the 1990s showed a declining trend in that period. The new index (Std. B) represented the CPUE series of total catch and showed a stable or slightly increasing trend in the same period. The projected 1998 value is the highest in the 1990s. This discrepancy in the two CPUE series stems from the fact they largely represent two different size components of the stock. The divergence of the two CPUE trajectories therefore suggests that the biomass or the availability of shrimp larger than 8.5 g was reduced throughout the 1990s fishery.

Although CPUE information including mainly female shrimp had been used previously as an indicator of stock size to avoid the influence of unreported discards, STACFIS agreed that CPUE information of total catch most likely reflects the overall trend in the fishable stock biomass of shrimp in Subareas 0 and 1.

Based on the new standardized CPUE index, a new standardized effort series was calculated (Fig. 1.3). Up to 1986, the new standardized effort showed a slight increasing trend. Effort more than doubled between 1987 and 1992, and decreased thereafter. Twin trawls introduced in 1995 on several Greenland trawlers have been omitted from the analyses of effort data.

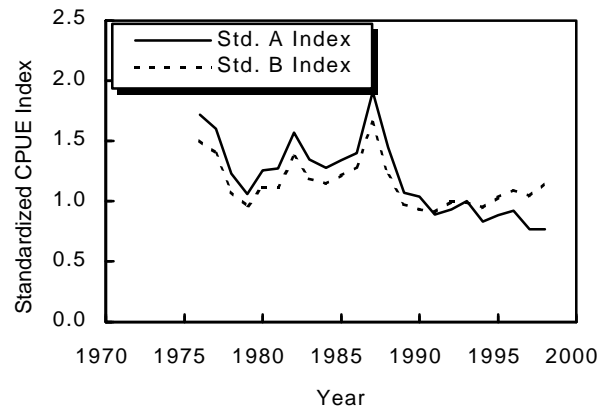


Fig. 1.2. Shrimp in Subareas 0 and 1: standardized CPUE index for female shrimp (Std. A) and for total catch (Std. B).

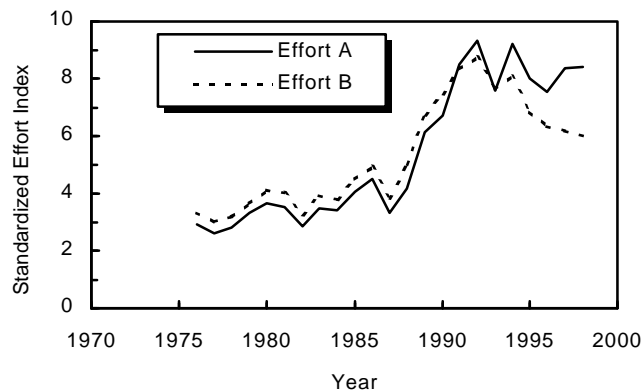


Fig. 1.3. Shrimp in Subareas 0 and 1: standardized effort index for female shrimp (Effort A) and for total catch (Effort B).

**Length and age composition.** Catch-at-length was calculated from length frequency data obtained by observers in the commercial fishery in Div. 0A from 1996 to 1998, and in Subarea 1 from 1991 to 1998 (SCR Doc. 98/111, 123). The proportion of female shrimp in the samples from the fishery has declined gradually since 1981. Also calculated mean shrimp size in catches has declined since 1991 corresponding to a mean reduction in individual weight of about 20%.

## ii) Research survey data

**Greenland trawl survey.** Stratified-random trawl surveys have been conducted since 1988 in offshore areas (Subarea 1 and Div. 0A) and since 1991 in inshore Subarea 1 (SCR Doc. 98/115, 118). Since 1992, the survey has extended further south in Div. 1F compared to the coverage from 1988 to 1991. In 1994-97 the survey was carried out as a two-phase survey allocating extra hauls to strata with high shrimp densities to reduce the variance of the biomass estimates.

In 1998, the survey was again carried out as a single-phase survey in agreement with results from a study group on evaluation of the design and efficiency of the survey (SCR Doc. 98/114). Also, following the recommendations from the study group, sampling effort was reduced in strata with shallow water (150-200 m) and increased in strata with deeper water. Further, tow duration was reduced from 60 minutes to 30 minutes in 25% of the hauls in certain strata.

The estimates of trawlable biomass ('000 tons) are as follows:

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Offshore (Div. 1A-1E, 0A)	172	192	175	119	179	225	178	158	186	113	217
Inshore (Div. 1A)	-	-	-	48	45	32	41	46	57	54	64
Offshore Div. 1F	-	-	-	-	1	20	24	2	4	26	23
Total	172	192	175	167	225	277	243	207	245	188	304

**Biomass.** In the offshore areas survey biomass estimates (Fig. 1.4) have fluctuated over the time series (SCR Doc. 98/118). The estimated biomass for 1998 was the largest in the time series. However, given the uncertainty of the 1998 estimate and the difference in conditions under which the 1994-97 surveys and the 1998 survey were conducted, STACFIS was unable to evaluate the significance of the apparent increase in the 1998 estimated biomass, until the 1994-97 survey results are re-analyzed.

The estimated biomass inshore for the period of surveys 1991-98 has exhibited good stability with only minor fluctuations (Fig. 1.4). The estimate for 1998 is the largest in the time series (SCR Doc. 98/115) and results from the entire series are based on a consistent survey design.

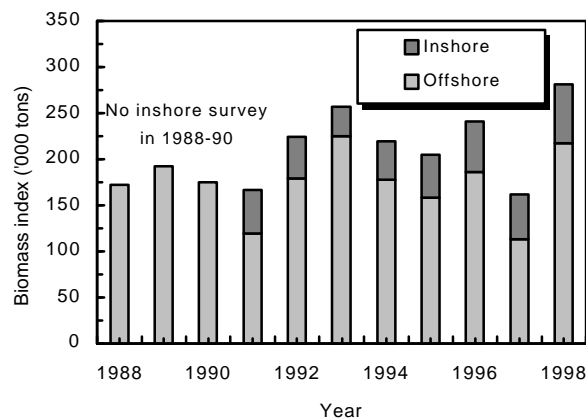


Fig. 1.4. Shrimp in Subareas 0 and 1: Combined biomass estimate from inshore and offshore surveys.

**Demographic structure offshore.** Overall length distribution and results from modal analysis of shrimp in the 1998 survey area show occurrence of a very abundant year-class of large males at 20 mm CL. Also, abundance of the female stock component appears high. Because the biomass estimate in the offshore area is not comparable between 1998 and 1994-97 abundance-at-age is not reported.

**Demographic structure inshore.** Survey samples from the Disko area from 1995 to 1998 were reanalysed by modal analysis, and a new age-at-length structure has been derived (SCR Doc. 98/104). The new interpretation indicated occurrence of only five year-classes of males or one year-class less than in the former interpretation.

Using the new interpretation, the stock composition data from the 1998 survey indicate the occurrence of a dominating size group of males at 17 mm in 1997 and at 20 mm in 1998. The female component is larger than in 1997 and of the same magnitude as in 1995 and 1996.

iii) **Other studies**

**Evaluations of trawl survey** (SCR Doc. 98/114). A study group was formed in 1998 to evaluate the design and efficiency of the survey. The group assessed the precision of the survey estimates, the effectiveness of the present stratification, the allocation of effort within the survey area, the appropriate tow duration and the suitability of two-stage sampling. The study group also recommended on future survey design and analysis. Following these recommendations the 1998 survey has reduced the tow duration to 30 minutes from the formerly used 60 minutes in about 25% of the offshore hauls in depths between 200 and 400 meters and the two-phase survey design used from 1994 to 1997 was discontinued.

**Experimental survey** (SCR Doc. 98/119). An experimental bottom-trawl survey for shrimp was carried out in 1997 to examine small-scale spatial structure of shrimp and fish population densities. This study showed that day-to-day variation was small, and there was a good correlation between days for all species, both overall and within transects. There was no serial correlation in catches along isobathic transects.

**Production model** (SCR Doc. 98/116). A logistic model of biomass dynamics was fitted to data on catch, standardized CPUE, and research survey biomass. The reliability of the conclusions was investigated by standard jackknife, omitting one year at a time from all the series of raw data. For most of the jackknife results  $F_{MSY}$  was estimated consistently, both  $MSY$  and  $B_{MSY}$  both ranged over a factor of about 170%. STACFIS concluded that further investigation of the behaviour of the model is required before it can be used as an assessment tool.

c) **Assessment Results**

*CPUE.* A new combined standardized catch-rates index including all size groups of shrimp in the catch in the period 1976-98, indicates a stable or slightly increasing trend in the 1990s. The projected 1998 value is the highest value in the 1990s.

*Recruitment.* The 1998 survey shows an abundant year-class of large males at 20 mm CL. Abundance of the female stock component appears stable in recent years. The males, which comprised the 20 mm CL group in 1998, are expected to contribute to the female biomass over the next two years.

*Biomass.* Given the range of variability exhibited in the survey indices, there appears to be no indication of a significant change in total stock biomass in the offshore area since 1988 and in the inshore area since 1991.

*State of the Stock.* The perception of the status of the stock is more optimistic than in 1997. Based on the available commercial and survey data on CPUE and recruitment, the stock appears to have remained stable or has possibly increased slightly in recent years.

d) **Research Recommendations**

For shrimp in Div. 0A and Subarea 1, STACFIS **recommended** that:

- *sampling of the commercial fishery be further improved to cover all components of the fishery by area and month,*
- *an analysis of the distribution of the shrimp stock in relation to environmental conditions be conducted,*
- *survey results for 1994-97 (both biomass estimates and size composition data) be standardized to make them comparable to results from the other years,*

- survey strategy and design be further optimized, and a study on the impact of the duration of trawl hauls on biomass estimates be undertaken, and
- an analysis of the abundance and spatial distribution over time of all by-catch species in trawl surveys be undertaken.

## 2. Shrimp (*Pandalus borealis*) in Denmark Strait (SCR Doc. 98/112, 117, 120, 121, 122, 124)

### a) Introduction

The fishery started in 1978 and, up to 1993, occurred primarily in the area of Stredbank and Dohrnbank as well as on the slopes of Storfjord Deep. However, since 1993 a fishery has also been conducted south of 65°N. The traditional northern area extends from approximately 65°N to 67°30'N and between 26°W and 34°W. The available fishing grounds at any given time depend heavily on the ice conditions.

Catches increased rapidly to about 12 000 tons in 1987 and 1988, declined thereafter to about 7 500 tons in 1992 and 1993 and increased again to about 12 000 tons in 1997. Since 1993 the nominal catches from the southern area have ranged from 1 500 tons to over 7 000 tons in 1997. The development of nominal catches (tons) are given in the following table and Fig. 2.1.

	1988	1989	1990	1991	1992	1993	1994 <sup>1</sup>	1995 <sup>1</sup>	1996 <sup>1</sup>	1997 <sup>1</sup>	1998 <sup>1,2</sup>
Nominal catches north of 65°N											
Iceland EEZ	1 431	1 326	281	465	1 750	2 553	1 514	1 151	566	2 856	1 403
Greenland EEZ	11 125	9 416	9 994	8 192	5 764	3 563	3 359	4 823	2 351	1 301	2 500
Sub-total	12 556	10 742	10 275	8 657	7 514	6 116	4 873	5 974	2 917	4 157	3 903
Nominal catches south of 65°N											
Greenland EEZ	-	-	-	-	-	1 532	4 939	3 532	6 796	7 442	2 722
Total	12 556	10 742	10 275	8 657	7 514	7 648	9 812	9 506	9 713	11 599	6 625
Recommended TAC	-	10 000	10 000	10 000	8 000	5 000	5 000	5 000	5 000	5 000	5 000

<sup>1</sup> Provisional catches as estimated by STACFIS.

<sup>2</sup> January-1 October.

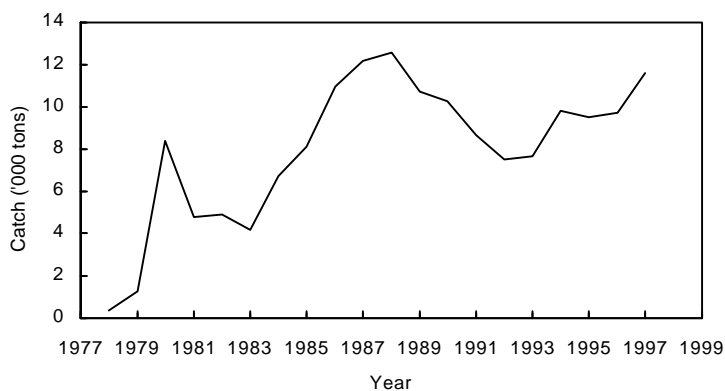


Fig. 2.1. Shrimp in Denmark Strait: nominal catches.



## b) Input Data

### i) Commercial fishery data

**Fishing effort and CPUE.** Catch and effort (hours fished) 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.

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 23 700-47 800 hours in 1994-97. In the southern area, effort increased from 12 100 hours in 1993 to 26 600 in 1997. For the whole area effort has declined from 80 000 hours in 1993 to 50 300 in 1997.

Standardized catch-rates for Greenlandic vessels in the northern area (Fig. 2.2) showed a continuous decline from 1987 to 1993 (SCR Doc. 98/112), but there has been a general increasing trend since 1993. The standardized catch-rate series for the Greenlandic vessels in the southern area showed the same trend (Fig. 2.3).

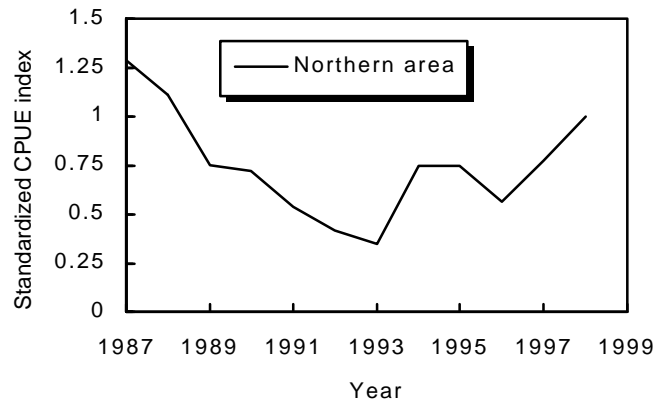


Fig. 2.2. Shrimp in Denmark Strait: annual standardized CPUE-indices (relative units) calculated for shrimp caught by Greenlandic vessels in the area north of 65°N.

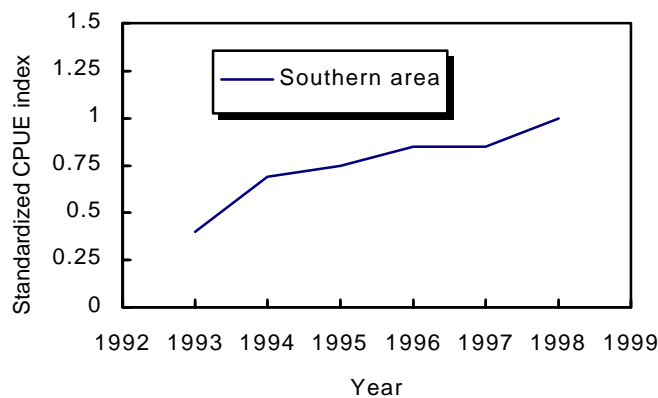


Fig. 2.3. Shrimp in Denmark Strait: annual standardized CPUE-indices (relative units) calculated for shrimp caught by Greenlandic vessels in the area south of 65°N.

In general the unstandardized catch-rates which include all fleets show trends similar to the standardized series.

**Biological data.** Commercial sampling of this fishery has generally been at a very low level but has however greatly improved in 1998. Samples from the Greenlandic and Icelandic fisheries in the late-1980s indicate that the catches were comprised mainly of females. Throughout most of the 1990s, males have dominated the catches in the north although there are indications of higher proportions of females in 1997 and 1998. Commercial samples from the Greenlandic fishery in the southern area showed a dominance of males in 1997 and 1998 (SCR Doc. 98/112, 121).

ii) **Research survey data**

No surveys were conducted in 1997 and 1998.

iii) **Other studies**

Hydrographical studies were undertaken (SCR Doc. 98/124) to see whether there were any changes in the hydrography of the areas north or south of 65°N, respectively, connected to the appearance of new concentrations of shrimp in the southern area in 1993. An advection of warm Atlantic water mass in the area north of 65°N led to increased temperatures in 1993 and thereafter. However, it is uncertain whether there is a linkage between the warming of the northern area and the shift of the fishery to the south since 1993.

A logistic surplus production model was fitted to landings, effort, unstandardized and standardized catch rates and survey indices of the northern area (SCR Doc. 98/117). Biomass trends were consistent with the catch-rate series. However, due to concerns about meeting model assumptions and the restriction of data to the northern area, the results are considered only as indicative and as auxiliary information for the evaluation of the state of the stock.

c) **Assessment Results**

*Commercial CPUE.* In the northern area the standardized CPUE indices are now higher than the minimum values reached in 1989-93 approaching the level observed during the mid-1980s. Catch rates in the southern area have increased since 1993.

*Recruitment.* Based on the available data there were no immediate concerns about recruitment.

*Biomass.* No direct biomass estimates were available.

*State of the stock.* Standardized CPUE data from both the northern and the southern areas indicate a general increasing trend in fishable biomass since 1993. Several year-classes of male and female shrimp are evident in the sampling data in recent years.

Uncertainty on stock structure, and lack of surveys in 1997 and 1998 make assessment of this stock difficult.

d) **Research Recommendations:**

For shrimp in Denmark Strait, STACFIS **recommended** that:

- *a survey be conducted, to provide fishery independent data of the stock throughout its range,*
- *all available oceanographic data regarding the area be compiled for further investigation of the warming in northern Denmark Strait beginning in 1993,*
- *commercial catch sampling of the fishery be improved to fully cover seasonal and spatial variation, so that size and sex composition of the catch can be accurately described,*
- *methods for presenting length-at-age and length-at-sex reversal be coordinated, and*
- *all available logbook data be analyzed for trends in CPUE (both standardized and unstandardized).*

## II. OTHER BUSINESS

### 1. Designated Experts

STACFIS reviewed the list of Designated Experts for assessment of shrimp stocks. Noting that there was still no Designated Expert nominated for the assessment of shrimp in Denmark Strait, it was agreed that the Secretariat should submit an official request to the Contracting Parties. A decision will then be made during the intersessional period, in preparation for the June 1999 Meeting of the Scientific Council<sup>1</sup>.

### 2. Acknowledgements

There being no other business, the Chairman thanked the participants, especially the Designated Experts for their contributions to the meeting. Expressing gratitude to the Secretariat for their continued support and assistance, the Chairman adjourned the meeting.

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<sup>1</sup> The Assistant Executive Secretary received confirmation on 8 January 1998 that Ole Folmer (Greenland Institute of Natural Resources, P. O. Box 570, DK-3900 Nuuk, Greenland) will be the Designated Expert for shrimp in Denmark Strait.