

Northwest Atlantic



Fisheries Organization

Serial No. N1786

NAFO SCR Doc. 90/64

SCIENTIFIC COUNCIL MEETING, JUNE 1990

Data and Preliminary Assessment of Shrimp in Denmark Strait

by

D. M. Carlsson

Greenland Fisheries Research Institute,
Tagensvej 135, DK-2200 Copenhagen N, Denmark

a) Introduction

The fishery on this stock was initiated in 1978 by Iceland vessels with a catch of less than 400 tons. After the additional involvement of Danish, Faroese, French and Greenland vessels the catch exceeded 8,400 tons in 1980. In 1981-83 catches decreased to a level between 4,000 and 5,000 tons, and increased during the following years to around 12,500 tons in 1988. In 1989 catches decreased to around 10,600 tons, taken by Danish, Faroese, French, Greenland, Iceland and Norwegian vessels. Reported catches and TACs throughout the history of the fishery are given in Table 1.

The shrimp fishery in Denmark Strait takes place primarily in the area of Strede Bank and Dohrn Bank as well as on the slopes of Storfjord Deep. Traditionally most of the fishery takes place in the first six months of the year, to a large extent exploiting concentrations of berried female shrimp from (December-) January to April-May; from 1980 to 1989 thus between 65 and 100% of the yearly nominal catches were taken in the first half of the year. The available fishing ground at a certain time depends extremely upon the ice conditions. The main fishing area extends from approximately 65°20'N to 67°30'N and between 28°W and 33°W. During the last five years 59-61 vessels participated in the fishery on the western side of the midline, and in 1987-89 around 30 vessels on the eastern side of the midline.

b) Input data

i) Commercial fishery

Catch rates. Catch rates for the January to June period decreased from about 400 kg per hour in 1980 to a relatively stable level between 200 and 250 kg per hour in the years 1982 to 1987 (Fig. 1). Data from the Greenland fleet indicate declining catch rates during the early months of the season in most years, in some years followed by an increase in the last one or two months of the year. In 1988 and 1989 peak catch rates early in the year did not reach the same level as in most other years, and on average there was a decline in catch rates compared to the year before. Although different fleets show different trends in the

development of reported catch rates in 1987 to 1989, all data combined (Table 2) show a significant decrease from 1987 to 1988 and a continued decrease from 1988 to 1989.

Evaluation of CPUE data from this fishery is complicated by several factors:

- 1) Differences in ice coverage of fishing grounds from month to month every year may influence the access to shrimp concentrations,
- 2) Improvement in gear technology (e.g. the introduction of larger and more efficient trawls as evidenced for the Icelandic fleet from 1984 to 1987) may result in higher catch rates than otherwise would have been obtained,
- 3) Incomplete data on fishing effort for a substantial portion of the fleet from the fishery began and up to 1986, 4) Possible, but not substantiated, changes in discard procedures in later years due to market requirements for larger shrimp and development of effective grading machines. The high number of vessels in the fishery and vessel quota limitations may result in higher, not reported, amounts of discarded shrimp.

In spite of these complications, the continued decrease in overall catch rates from 1987 to 1989 below the observed relatively stable level in preceding years may cause serious concern. It may be a sign of decreasing stock abundance caused by several years of too high total removals from the stock.

Biological data. Data from one French and one Norwegian trawler in March-April 1989 showed that shrimp with a modal group around 30 mm carapace length was dominating as in samples from previous years for all countries. Male shrimp were present in almost all samples, constituting from 0 to 20% in numbers in French samples and at average 18.7% in number in Norwegian samples. In samples from the Norwegian trawler small shrimps were more frequent in deeper water; few (<1%) female shrimp were not developing head-roes or carrying eggs.

Shrimp discards. Observer data from one Norwegian trawler in March and April 1989 showed that the quantity of discarded shrimp varied from 0 to 5.3% of the shrimp catch, with an average of about 2% of the total catch. Mean length distribution of samples of discarded shrimp showed modal groups at 18-20 mm and at 25 mm carapace length.

By-catches. Norwegian observer data from 1982 to 1989 indicate that the number of fish per kg of shrimp was substantially higher in 1987, 1988, and 1989 than in previous years. Small juvenile redfish dominated the by-catch, as it has been the case in most years.

ii) Research vessel surveys

Since 1983 a Norwegian research cruise has been conducted in

Denmark Strait every year in the autumn. The survey in August-September 1989 provided new information on the biology of this stock. As has been the case since the survey series started, males were found in highest numbers in the western and northern parts of the surveyed area, outside the area traditionally exploited by the commercial fishery. Females were most abundant in the western area and around Dohrn Bank. Most females were ovigerous, while 22% were not expected to spawn. A larger proportion of females had head-roes (19% compared to about 5% in earlier years).

Shrimp samples showed six components of males (13, 17, 21, 24, 27, and 29 mm carapace length) and only one female mode at 30 mm carapace length.

Some noticeable changes in the shrimp stock are indicated for 1989:

1. The stock was more evenly distributed than earlier and over a larger area, i.e. concentrations of shrimp were less dense than in earlier years;
2. Males and females were more evenly distributed over the areas than earlier recorded;
3. In 1988 and 1989 the relative proportion of males was higher than in preceding years, but the geographical distribution was different from 1988 to 1989, as males in relation to the total number of shrimps were more frequent in the eastern than in the western part of the survey area.

By the swept area method an estimate of 35,000 tons biomass (+/- 6,100 tons) was calculated, compared to 31,300, 44,200, 25,200, and 49,600 tons in 1985, 1986, 1987, and 1988, respectively. The biomass estimates from these surveys are heavily influenced both by the proportion of randomly selected stations that fall in areas with bottom unsuitable for trawling, and by weather conditions during the survey. Also doubt about the reliability of the biomass estimates due to the low sampling size in some areas in some years and due to changes in distribution and hence availability of shrimp, limits their value as indicators of stock abundance.

c) Prognoses

No analytical assessment of the shrimp stock in Davis Strait was undertaken, and hence no prognoses is available.

At the June 1988 Meeting of NAFO Scientific Council, it was agreed that the catch-rate series for the individual countries were inconclusive in terms of indicating stock size. It also was noted that average biomass from 1985 to 1987 was estimated to 36,000 tons, and average catch over the same period was about 10,400 tons. It was generally agreed that the level of exploitation might be a safe level, especially since there had been no apparent change in stock composition over the years, and it was advised that shrimp catches in Denmark Strait be maintained at approximately 10,000 tons for a few

years as a precautionary measure until the data base is sufficient for an improved assessment of the stock.

At the June 1989 Meeting, it was agreed that changes of this advice would only be required if new data indicated significant changes in interpretation from last year. It was noted, that length-frequency data over the years showed no apparent effects of the fishery on the mean size of the dominant size-group of female shrimp, and that the inclusion of the 1988 biomass estimate of about 50,000 tons resulted in an average level of about 38,000 tons, which was higher than in the three previous years. Although it was noted, that the 1988 catch-rates were substantially lower than those of 1987 and thereby below the apparently stable level from 1981 to 1987, it was agreed, that there was no basis for a change in the advice provided for 1988; hence it was advised that shrimp catches in Denmark Strait in 1990 be maintained at the level of 10,000 tons.

Inclusion of data from 1989 in the data series shows the following trends:

1. Catch rates show a continuation of the decreasing trend, in spite of the use of high-efficiency gears and no obvious changes in accessibility of shrimp concentrations to the fishery.
2. Trawl surveys in 1989 indicated a biomass estimate of 35,000 tons, at the same level as the average biomass from 1985 to 1988 (38,000 tons), but also showed that the higher occurrence of males found in 1988 continued, indicating either a better recruitment to the stock in coming years or a response in abundance of larger female shrimp to the high level of fishing in recent years.

The continued decrease in mean catch rate and the higher relative occurrence of males found in trawl surveys in 1988 and 1989 may indicate an increasing level of non-reported discards in the fishery, so that actual catches in recent years may be significantly higher than shown in the statistics.

Table 1. NOMINAL CATCHES AND TAC (TONS) OF SHRIMP (*Pandalus borealis*) IN DENMARK STRAIT.

Nation	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987 ¹	1988 ¹	1989 ¹	1990 ¹
Denmark	-	-	702	581	740	204	443	353	500	555	444	339	
Faroe Islands	-	-	4,233	713	737	443	668	674	727	595	679	595	
France	-	-	50	353	414	291	500	642	780	1,030	494	381	
Greenland	-	-	200	1,004	1,115	1,467	2,250	2,596	5,781	6,627	7,456	5,981	
Iceland	363	485	759	125	-	43	742	1,794	1,150	1,330	1,424	1,280	
Norway	-	800	2,461	2,016	1,896	1,727	2,128	2,051	2,026	2,041	2,052	2,098	
<u>Total</u>	<u>363</u>	<u>1,285</u>	<u>8,405</u>	<u>4,792</u>	<u>4,902</u>	<u>4,175</u>	<u>6,731</u>	<u>8,110</u>	<u>10,964</u>	<u>12,178</u>	<u>12,549</u>	<u>10,674</u>	

Advised TAC	-	-	-	-	4,200	4,200	4,200	5,000					10,000 ²
Effective TAC ³	-	-	-	8,000	4,500	5,725	5,245	6,090	7,525 ⁴	7,725 ⁴	8,725 ⁴	9,025 ⁴	14,100

1 Provisional data.
 2 Advised for a few years as a precautionary measure.
 3 On western side of midline only.
 4 Not including Greenland fishery north of 66°30' N.

Table 2. Catch rates (kg per hour trawling) and corresponding effort (hours trawling) and catch (tons) from the shrimp fishery in Denmark Strait by years .

Year	Periods	Cpue	Effort	Catch
1980	Jan-Jun	393	15775	6198.3
	Jul-Dec	117	18858	2206.4
	Mean/Total	243	34633	8404.7
1981	Jan-Jun	260	18072	4698.0
	Jul-Dec	62	1516	93.9
	Mean/Total	245	19588	4791.9
1982	Jan-Jun	212	23072	4900.0
	Jul-Dec	-	-	-
	Mean/Total	212	23072	4900.0
1983	Jan-Jun	203	17332	3524.1
	Jul-Dec	103	6338	651.3
	Mean/Total	176	23670	4175.4
1984	Jan-Jun	247	23900	5899.2
	Jul-Dec	103	8074	831.6
	Mean/Total	211	31974	6730.8
1985	Jan-Jun	181	30079	5452.0
	Jul-Dec	108	21312	2658.0
	Mean/Total	158	51391	8110.0
1986	Jan-Jun	202	38456	7755.0
	Jul-Dec	178	18058	3209.0
	Mean/Total	194	56514	10964.0
1987	Jan-Jun	244	34925	8512.0
	Jul-Dec	99	37212	3666.0
	Mean/Total	169	72137	12178.0
1988	Jan-Jun	164	49962	8190.5
	Jul-Dec	93	47777	4349.5
	Mean/Total	128	97739	12540
1989	Jan-Jun	154	45638	7034.6
	Jul-Dec	58	63515	3712.5
	Mean/Total	98	109153	10747.1

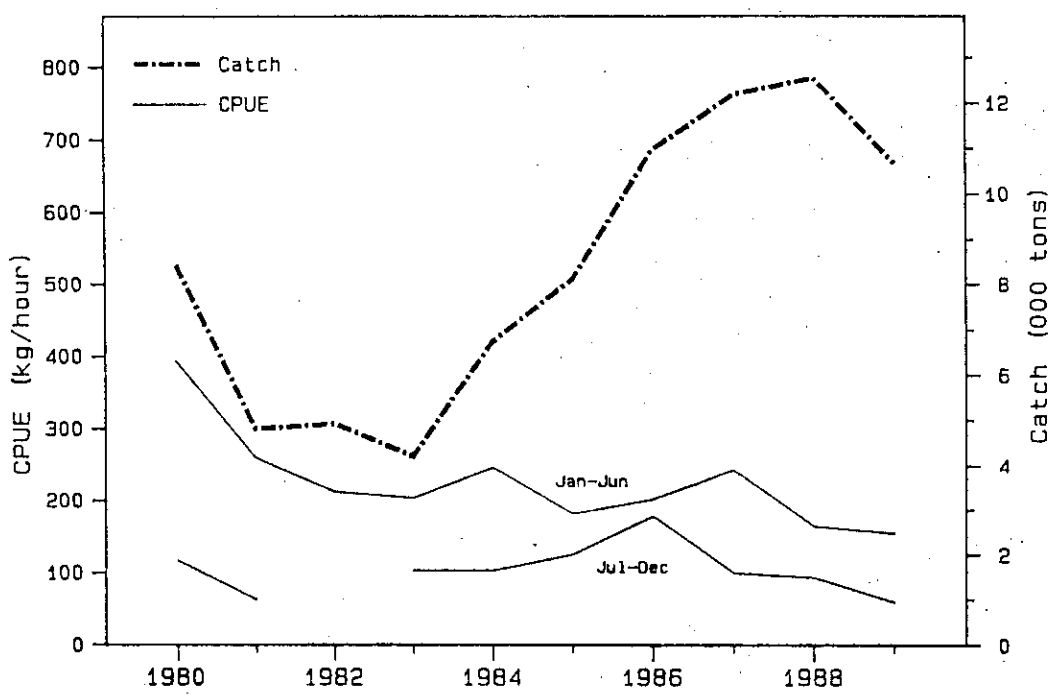


Fig. 1. Shrimp in Denmark Strait: CPUE for the January-June and July-December periods of 1980-89 compared with nominal catches.