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Data and Preliminary Assessment of Shrimp in Subareas 0+1

by

D. M. Carlsson

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

1) Introduction

The nominal catch of shrimp in the offshore areas of Subarea 1 south of 71°N and the adjacent part of Subarea 0 increased from less than 1,000 tons before 1972 to almost 43,000 tons in 1976, fluctuated thereafter, but has been at a level about 45,000 tons during 1985-88. Preliminary statistics for 1989 and 1990 indicate total catches of about 51,000 and 56,000 tons, respectively. The fishery has been regulated by TAC since 1977 (Table 1).

During the history of this fishery, the fishing grounds in Div. 1B have been the most important. Since 1987, however, there has been a southward shift in the fishery with increasing catches in Div. 1C and 1D. In 1990 the total nominal catch by larger vessels in Div. 1B and 1C are almost of the same size (Carlsson and Kanneworff, 1991).

An offshore fishery north of 71°N, outside the fishing areas in Subareas 0 and 1 for which TACs have been advised, began in 1985 and yielded about 4,300 tons that year. In 1986 and 1987 catches increased to about 11,000 tons, and thereafter decreased to about 2,100 in 1990. This fishery normally occurs from June to late in the year.

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). Preliminary statistics indicate increasing catches in recent years, namely 9,900 tons in 1988, 14,400 tons in 1989, and 16,000 tons in 1990.

Recent catches and TACs (tons) are shown in Table 1.

2) Input Data

a) Commercial fishery

Catch rates.

Catch and effort data from the shrimp fishery in 1990 were available from Canadian vessel logs in Subarea 0 and from French and Greenland logbooks in Subarea 1.

Catch and effort from one French trawler in Div. 1C and 1D in April is shown in Table 2.

Based on Canadian vessel logs from Division 0A from 1981 to 1990 unstandardized, weighted yearly catch rate was calculated. The same data were analysed using a multiplicative model without interactions to produce standardized yearly catch rates. Both series show fluctuating catch rates over the ten year period but the standardization reveals an overall declining trend (Parsons and Veitch, 1991).

Logbook data from 22 Greenland sea-processing trawlers, which enter the catch by shrimp size category in the logbook, were used in a multiplicative model to establish a CPUE-index for large shrimp. Hereby the influence on CPUE by unreported discard of smaller shrimp should be avoided. The index, covering the period from 1987 to 1990, decreases from 1987 to 1989 by about 50% and remains relatively stable from 1989 to 1990 (Carlsson and Lassen, 1991).

Biological data.

Size composition of commercial catches sampled by observers in Subarea 0 were summarized by month and 100 m depth interval (Parsons and Veitch 1991). The data show a high proportion of shrimp around 19 to 22 mm carapace length occurring in the catches in all months. There is some progression of the mode towards larger size over the season, reflecting growth of the dominant cohort, likely the 1985 year class. Larger female shrimp (25 - 26 mm) were more prevalent in

deeper water in all months. Shrimp caught in 1990 were smaller than those caught in previous years, the 1985 year class comprising about 35% of the catch. Numbers caught at length from 1981 to 1990 show a decrease in the size of the female mode between 1983 and 1985, followed by a period of similar size composition, especially from 1987 to 1989. The 1990 data, although incomplete at this point, suggest a much greater dependency on the recruiting year classes, even more so than in 1984. Despite a concern for the decrease in the proportion of female shrimp in the catch, the 1985 year class was only partially recruited in 1990 and should contribute further in 1991.

Shrimp samples from the commercial fishery in Subarea 1 were pooled by division and quarter to show the overall composition of catches (Carlsson and Kanneworff, 1991). Samples from Div. 1A in the third quarter showed a dominant peak of female shrimp around 27 mm carapace length and a smaller group of males around 21 mm. Division 1B samples from second, third and fourth quarter all show dominant peaks around 20 (males) and 24.5 mm (females) carapace length. Also these data show assumed growth in the dominant male group over the season and in the primiparous component of females from the second to the third quarter.

Shrimp discards.

In Subarea 0 observers estimated discarding rates (relative to the shrimp catch) to be at the same level as in preceding years. Since 1980 the observed average discarding percentage has fluctuated between 2 and 5 (Parsons and Veitch, 1991).

An observers program to estimate shrimp discard from shrimp factory trawlers in Subarea 1 was initiated in 1990 (Lehmann and Degel, 1991). Two types of discard were distinguished, namely quality discard (shrimp of low quality with little or no market value, due to e.g. soft or broken shell) and size discard (small shrimp, the market value of which is down to one tenth of that of the largest shrimp). The observed quality discard varied between 0 and 19%, with a general level of 6 to 7%. Size discard was estimated by comparing length-distribution of the catch (in samples from the cod-end) to samples of the production of different size groups of shrimp and the amount of these as reported in the logbook. Size discard varied between 9 and 36% of the catch. The estimated discard was about ten times higher than reported in the logbooks. STACFIS has previously agreed to consider discard reports from logbooks as unreliable.

Based on these results a minimum estimate of the total discard in 1990 for this component of the fishery is about 6,000 tons in Div. 1B and about 5,000 tons in Div. 1A+1C+1D.

By-catches.

Available observers data from the Canadian fishery in Subarea 0 from July to November 1990 showed that the percentage by-catch by weight ranged from 12% to 23% of the total catch weight of all species (Parsons and Veitch, 1991). By-catch composition was similar to that observed in 1989. Redfish was the most abundant fish species, accounting for approx. 6 to 15% of the total observed catch. Greenland halibut comprised 2.5% or less of the catch in each month. As usual the incidence of Greenland shark increased in November, from less than 1.2% of the catch in previous months to 7.5%.

Although by-catch is reported in logbooks from the Greenland fishery in Subarea 1, recordings are not considered reliable and can therefore not be used to assess the actual by-catch.

b) Research vessel surveys

In July-August 1990 a stratified-random trawl survey was carried out by two trawlers working simultaneously in Div. 0A and 1A-1D to assess the distribution and trawlable biomass of shrimp (Carlsson and Kanneworff, 1991). The area covered was extended to the south compared to surveys in 1988 and 1989 due to a southward shift in the fishery in 1989. The trawlable biomass estimate obtained by the swept area method in 1990 was 142,000 tons in the areas south of 69°30'N, and 10,228 tons in the northern area, compared to 138,000 and 24,500 tons in the respective areas in 1988 and 185,000 and 11,725 tons in 1989. During all three surveys trawls of the same type and size was used, but the trawl doors used in 1989 were different from those used the other years. In the 1988 survey it was not possible to directly measure wing spread of the trawl, and swept area had to be based on wing spread estimated in tank experiments. In 1989 and 1990 wing spread was measured by acoustic equipment to 17.2 and 28.1 m at average, respectively. The rigging of the gear in 1990 was very similar to that used in 1988, and the wing spread in 1988 estimated in tank experiments to 26.5 m is therefore supposed to be realistic. However, the biomass estimate in 1989 using a narrower and higher trawl geometry may be biased due to shrimp occurrence in the water above the bottom when compared to the biomasses estimated in 1988 and 1990.

Overall length-frequency distributions based on pooling of samples from the 1990-survey weighted by catch and stratum area showed some significant trends in stock composition when compared to corresponding distributions from the surveys in 1988 and 1989. The number of male shrimp increased significantly from 1988 to 1989, when a new male group was recruited to the fishery, and decreased again in 1990 to the level of 1988. The number of female shrimp decreased from 1988 to 1989 and increased somewhat in 1990. During the same years, the number of multiparous females decreased steadily, and the increase of the female group in 1990 is based on a male group transitioning to primiparous females. There are no indications of new recruitment of males in 1990. The data show a displacement of the stock abundance to southern areas in 1989, where the newly recruited males are found in shallower water. In 1990 there is a shift back to the northern slopes of Store Hellefiske Bank and to deeper water. North of 69°30'N there is a significant decrease in abundance of shrimp for all sizes over the three years except for a minor increase in the male group between 1989 and 1990 north of 71°N.

3) Assessment Results

Both simple and standardized catch-rate indices from Subarea 0 and the standardized index for mean catch of large shrimp in Div. 1B show a significant decrease from 1987 to 1989 and a stabilization between 1989 and 1990. The southward shift in the fishery in recent years continued in 1990, and the catch-rate indices are therefore based on a decreasing part of the total fishery. Div. 1B is, however, still the most important fishing area.

Biomass estimates from trawl surveys indicate the same abundance in 1988 and 1990 south of 69°30'N, while the estimate in 1989 was about 30% higher. The high figure in 1989 may at least to some degree be explained by the substantial recruitment in 1989 of a new group of male shrimp. The supposed high discard from the fishery in 1989, and the reported discard in 1990 by observers, is mainly based on this year-class.

The estimated minimum discards of 6,000 tons of shrimp in Div. 1B and 5,000 tons in Div. 1A+C+D indicate that actual catches in recent years have been considerably higher than reported.

Size composition of the biomass based on results from shrimp surveys indicate that the group of females (large shrimp, i.e. > 8.5 g) will decrease further in 1991, as there are no evidence of significant recruitment to this group from the male group in 1991. In 1992, however, the male group recruited to the fishery in 1989 may contribute significantly to the female group, depending on the fishing pressure on this year-class in 1990 and 1991. In 1990 there were no indications of recruitment of a new group of small males, and the abundance of males in 1992 will depend heavily on new recruitment in 1991.

References

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

	1980	1981	1982	1983	1984	1985	1986	1987 ¹	1988 ¹	1989 ¹	1990 ¹	1991 ¹
Div. OA												
Canada	59	1,590	858	2,030	448	233	126	3,252	6,087	7,235	6,177	
Denmark	-	1,923	946	2,627	526	916	1,208	529	-	-	-	-
France	-	-	-	-	436	-	-	-	-	-	-	-
Faroe Islands	-	1,686	-	756	730	142	530	2,359	-	-	-	-
Greenland	815	85	8	-	2	1,349	1,131	-	-	-	-	-
Total	874	5,284	1,812	5,413	2,142	2,640	2,995	6,140	6,087	7,235	6,177	
SA 1 Offshore, South of 71°N												
Canada	590	-	-	-	-	-	-	-	-	-	-	-
Denmark	872	995	959	451	397	417	572	502	312	391	353	
France	247	535	672	408	404	416	535	596	423	420	400	
Faroe Islands	3,554	1,234	530	1,583	360	471	481	474	421	476	223	
Greenland	27,501	28,197	32,016	30,929	32,129	37,788	39,537	37,998	35,947	42,164	48,938	
Norway	3,014	1,055	838	483	451	455	464	450	459	448	-	
Total	35,778	32,016	35,015	33,854	33,741	39,547	41,589	40,020	37,562	43,899	49,914	
0+1 offshore catch ²	36,652	37,300	36,827	39,267	35,883	42,187	44,584	46,160	43,649	51,134	56,091	
0+1 advised TAC ²	29,500	29,500	29,500	29,500	29,500	36,000	36,000	36,000	36,000	44,000	50,000	50,000
0+1 effective TAC ²	29,500	35,000 ³	34,800 ³	34,625 ³	34,925 ³	42,120 ⁴	42,120 ⁴	40,120 ⁴	40,120 ⁴	40,120 ⁵	44,975 ⁵	46,225 ⁶

¹ Preliminary data.

² South of 71°N.

³ Including TAC of 5,000 tons in SA 0.

⁴ Including TAC of 6,120 tons in SA 0.

⁵ Including TAC of 7,520 tons in Div. OA.

⁶ Including TAC of 1,500 tons in Div. OA.

Table 1B. Shrimp in Subarea 1: total nominal catches.

	1980	1981	1982	1983	1984	1985	1986	1987	1988 ¹	1989 ¹	1990 ¹
SA 1 offshore (south of 71°N)	35,778	32,016	35,015	33,854	33,741	39,547	41,589	40,020	37,562	43,899	48,938
Greenland (N of 71°N)	-	-	-	-	-	4,349	11,045	10,700	6,660	2,522	2,121
Greenland (Inshore ²)	7,500	7,500	7,500	7,500	7,500	7,500	7,500	6,921	10,233	14,428	15,950
SA1 Total	43,278	39,516	42,515	41,354	41,241	51,396	60,134	57,641	54,455	60,849	67,009

¹ Preliminary.

² Inside 3-mile limit. Inshore component of total catch 1980-86 was estimated.

Table 2. Catches of shrimp, effort and average catch per unit of effort provided by the fishing logbook of one French trawler.

NAFO Division	Month	Vessel Tonnage class	Catch (kg)	Effort (hours)	CPUE (kg/hours)	Discard of redfish (kg)
1D	April	7	70410	192	335	1670
1C	April	7	7857	30	262	310