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Data and Preliminary Assessment of Shrimp in Subareas 0+1

by

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a) Introduction

The nominal catch of shrimp in the offshore areas of Subareas 0 and 1 increased from less than 1,000 tons before 1972 to almost 43,000 tons in 1976, decreased to 27,000 tons in 1978 and 1979, and increased to around 38,000 tons annually in 1981-84. This was followed by further increases to around 45,000 tons in 1985-88. Preliminary statistics for 1989 indicate total catches of about 51,000 tons. The offshore fishery has been regulated by TAC since 1977.

A new offshore fishery north of 71°N yielded about 4,300 tons in 1985, increased to about 11,000 tons in 1986 and 1987, and then decreased to about 6,700 tons in 1988 and 2,500 tons in 1989. This northern area is presently considered to be outside the fishing areas in Subareas 0 and 1, for which TACs have been advised in the past.

The west Greenland inshore shrimp fishery has been relatively stable with estimated catches of 7,000-8,000 tons annually from 1972 to 1987 (except 10,000 tons in 1974). Preliminary catch statistics indicate an increase in inshore catches to 9,900 tons in 1988 and 14,400 tons in 1989.

Recent TACs and catches are shown in Table 1.

The 1989 fishery in Subareas 0+1 occurred from January to December and in Div. 1A north of 71°N from May to December.

b) Input data

i) Commercial fishery

Catch rates. Catch and effort data for the shrimp fishery in 1989 were available from Canadian vessel logs from Subarea 0 and from French, Greenland and Norwegian logbooks from Subarea 1. Mean catch-rate indices for the July-September period for the national fisheries in Division 1B (standardized to 1976) and for the Canadian fishery in Division 0A (standardized to

the average of the other indices in 1980) are given in Table 2.

From 1984 to 1987, the Greenland index (based on seven trawlers of 721-1,000 GRT) increased by 57% while the Canadian index remained stable from 1984 to 1986 and then increased sharply in 1987. Both indices decreased in 1988 by approximately 28%. In 1989, the Canadian index was similar to the year before, while the Greenland index decreased further by 13% compared to 1988.

Biological data. Size compositions of samples from commercial shrimp catches in Division 0A in 1989 show a prominent mode around 25-26 mm carapace length occurring in all months (Figure 1). These animals are primarily females as evidenced in October and November when they are egg-bearing.

Several age groups of smaller male shrimp (ranging from about 17 to 24 mm) were present in the samples, especially from those taken in shallower water. The occurrence of these male shrimp was proportionally greater during the August-November period. The numbers caught per hour were greater in the 200-300 m depth interval in June and July compared to the 300-400 meter interval in August and September. In October and November effort shifted to deeper water, where densities were highest in the 300-400 m depth range. The size composition of shrimp catches in Subarea 0 in 1989 was very similar to those of the previous two years in that there was a dominant mode of female shrimp and a substantial proportion of male shrimp comprised of several size/age groups. The reduction in numbers caught per unit of effort from 1987 to 1989 occurred over all size/age groups.

A comparison of Canadian catch-at-length data from Div. 0A from 1980 to 1989 indicated that the mean size of the largest mode decreased during 1983-85 (Fig. 3).

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 discard percentage has fluctuated between 2 and 5. No estimates of discard were available from the fishery in Subarea 1.

By-catches. Observer data on catch composition in Division 0A from June to November 1989 showed that redfish comprised between 9 and 16% of the catch by weight, with maximum occurrence in July and August. As in 1988 Greenland shark was most frequent in November, comprising around 15% of the catch weight. Mean catch rates of redfish and Greenland halibut were in 1989 close to 1988-values, namely 82 kg per hour and 11 kg per hour, respectively.

No other information on by-catches was available.

ii) Research vessel surveys

In July-August 1989 a stratified-random trawl survey was carried out in NAFO Division 0A and 1A-1B to assess the distribution and trawlable biomass of shrimp. The area covered was in

principle similar to that investigated in the July 1988-survey, although minor changes occurred. The area was divided at 69°30'N into northern and southern parts. The southern part was stratified by area and depth, while the northern part due to lack of knowledge on bottom topography was divided into commercial and non-commercial areas. North of 69°30'N an area with very low shrimp densities in the 1988-survey was omitted in 1989, while a new area of interest to the commercial fishery in 1989 was added to the survey area. A total of 135 stations was occupied. A shrimp biomass estimate was calculated by means of the swept area method.

The total biomass estimate obtained in 1989 was 185,000 tons (+/- 39%) in the areas south of 69°30'N, and 11,725 tons (+/- 58%) in the northern areas, compared to 138,000 tons in the southern area and 24,500 tons in the northern area in 1988. In 1989 a more southern distribution of the stock was evident, and the biomass was more concentrated in depths between 200 and 300 meters.

Shrimp samples from the two successive trawl surveys in 1988 and 1989 was compared to demonstrate possible variations in distribution and relative abundance of shrimp of different sexual stages. In this material a more southern distribution in 1989 of the stock is also evident. The group of males and juveniles show a significant concentration in the 200-300 meter depth layer in all strata. A comparison of 1989/1988 ratios of calculated numbers of shrimp per stratum with corresponding ratios for survey biomass estimates indicate an overall reduction of shrimp mean size (in weight) of shrimp from 1988 to 1989. A minor increase in mean size is indicated for some of the strata, especially in the shallow areas.

In the 1988 survey it was not possible to measure wing spread of the trawls used directly, and the swept area for each haul used in calculations had to be based on an estimated wing spread. It is therefore not possible to make direct comparisons between biomass estimates obtained in the two years. The apparent increase in biomass in the southern area is not reflected in the commercial catch rates from logbook information and may be due to differences in the trawling gear used in the two surveys.

c) Assessment results

Figure 1 shows a comparison between offshore catches in Subareas 0 and 1 (excluding catches in the Northwest Greenland fishery) and the catch-rate index for Greenland trawlers from the July-September period in Division 1B. It is difficult to interpret the catch-rate series in terms of stock abundance because of the changes that have occurred in the fishery during its history (improvement of gear performance, possible changes in discarding procedures etc.). However, the decrease in catch rates from 1987 through 1989 can hardly be explained by such changes, but may reflect some decrease in abundance or availability over the period in Division 1B.

Considering that the old CPUE-index covered only a certain part of the

year, where there might be changes in availability of shrimp inside years, a multiple regression analysis was carried out on the data for the seven Greenland trawlers from 1976 to 1989 in order to derive an index which would be an improved representation of the performance of the fleet. Although significant interactions between year-month, vessel-year and area-year were found, these were included as random noise in the data and a final analysis was made without interaction terms. The resulting index show a similar increasing trend as the old index (Figure 1) from 1977 to 1987. While a number of interpretations of the development is possible inside this period, a significant drop is seen in both series from 1987 to 1989.

Assuming that the catch rates have been relatively stable over the period from 1977 to 1987 and at the same time a continued improvement in fishing performance, it is possible that abundance has actually been declining over the same years. The decline from 1987 to 1989 in the Greenland CPUE indices indicates that the stock biomass in actually decreasing.

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

	1980	1981	1982	1983	1984	1985	1986	1987 ¹	1988 ¹	1989 ³	1990 ¹
Div. 0A											
Canada	59	1,590	858	2,030	448	233	126	3,252	6,087	7,235	
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	

SA 1 Offshore, South of 71°N											
Canada	590	-	-	-	-	-	-	-	-	-	
Denmark	872	995	959	451	397	417	572	502	312	391	
France	247	535	672	408	404	416	535	596	423	420	
Faroe Islands	3,554	1,234	530	1,583	360	471	481	474	421	476	
Greenland	27,501	28,197	32,016	30,929	32,129	37,788	39,537	37,998	35,947	42,164	
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	

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	
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
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

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. 0A.

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	
Greenland (N of 71°N)	-	-	-	-	-	4,349	11,045	10,700	6,660	2,522	
Greenland (Inshore ²)	7,500	7,500	7,500	7,500	7,500	7,500	7,500	6,921	10,233	14,428	
SA1 Total	43,278	39,516	42,515	41,354	41,241	51,396	60,134	57,641	54,455	60,849	

¹ Preliminary.² Inside 3-mile limit. Inshore component of total catch 1980-86 was estimated.

Table 2. Shrimp in Div. 0A and 1B: CPUE indices (July-September) from Greenland, Norwegian, and French fisheries in Div. 1B and the Canadian fishery in Div. 0A, 1976-89.

		1976	1977	1978	1979	1980	1981	1982	1983
Greenland	1B	1.00	0.74	0.67	0.51	0.63	0.59	0.74	0.66
Norway	1B	1.00	0.84	0.60	0.47	0.60	0.43	0.57 ¹	0.56
France ²	1B	1.00	1.13	0.61	0.48	0.58	0.80	0.60	-
Canada ³	0A	-	-	-	-	0.60	0.66	0.78	0.63
		1984	1985	1986	1987	1988	1989		
Greenland	1B	0.67	0.76	0.84	1.05	0.76	0.66		
Norway	1B	0.611	-	-	-	-	-		
France ²	1B	-	0.62	1.01	0.67	-	-		
Canada ³	0A	0.64	0.61	0.67	1.31	0.92	0.90		

¹ July only

² All French data are from July only except 1985 (August only) and 1986-87 (July and August)

³ Div. 0A (1980 is the average of the other 3 indices)

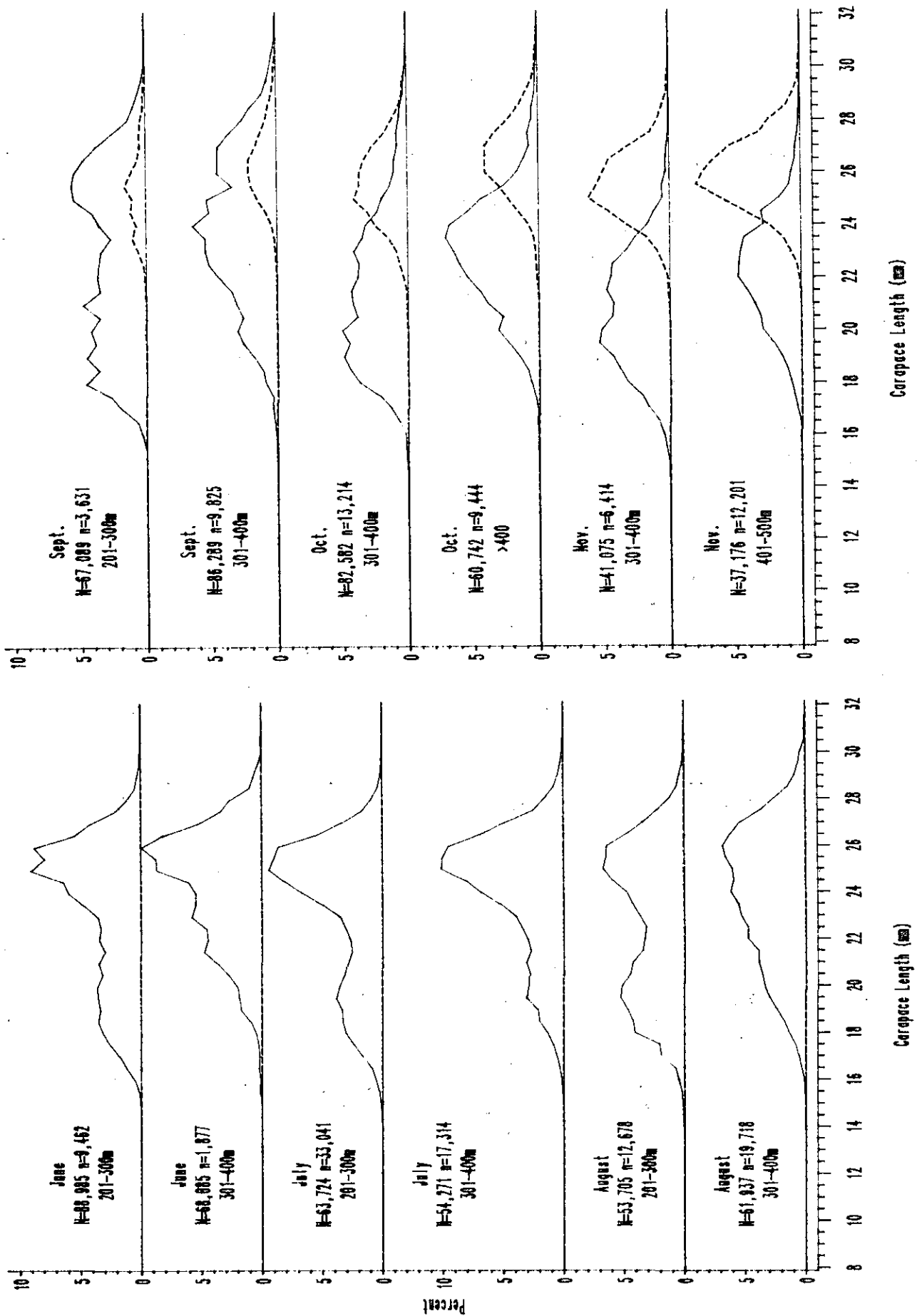


Fig.1. Size composition (CL) of commercial catches in Div. 0A, summarized by month and 100 m depth intervals.

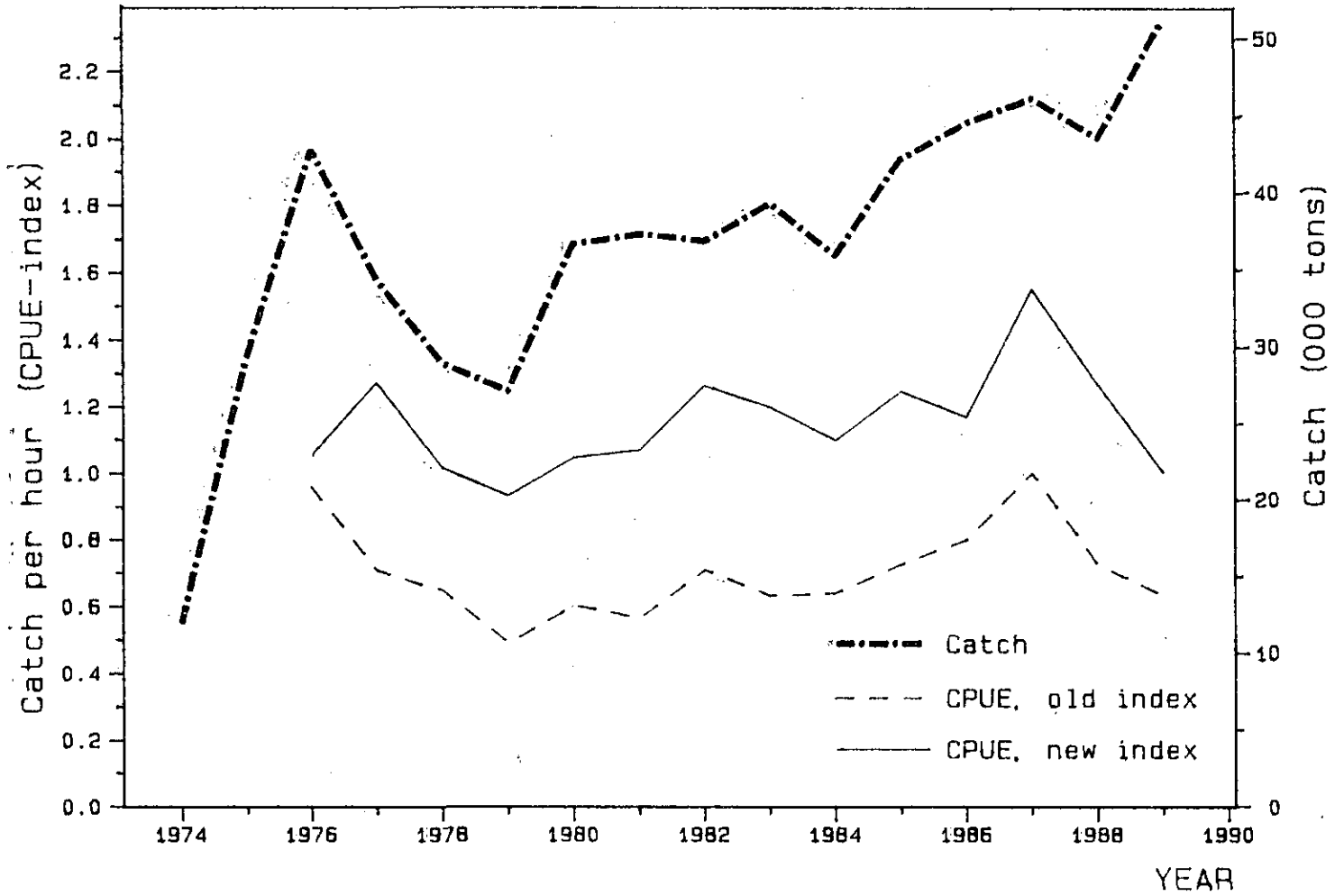


Fig. 2. Shrimp in Subareas 0 and 1: CPUE indices compared with total offshore catches (excluding catches in the Northwest Greenland area north of 71°N).

Old index: CPUE index for the July-September period.
New index: Standardized index including all months of the year.

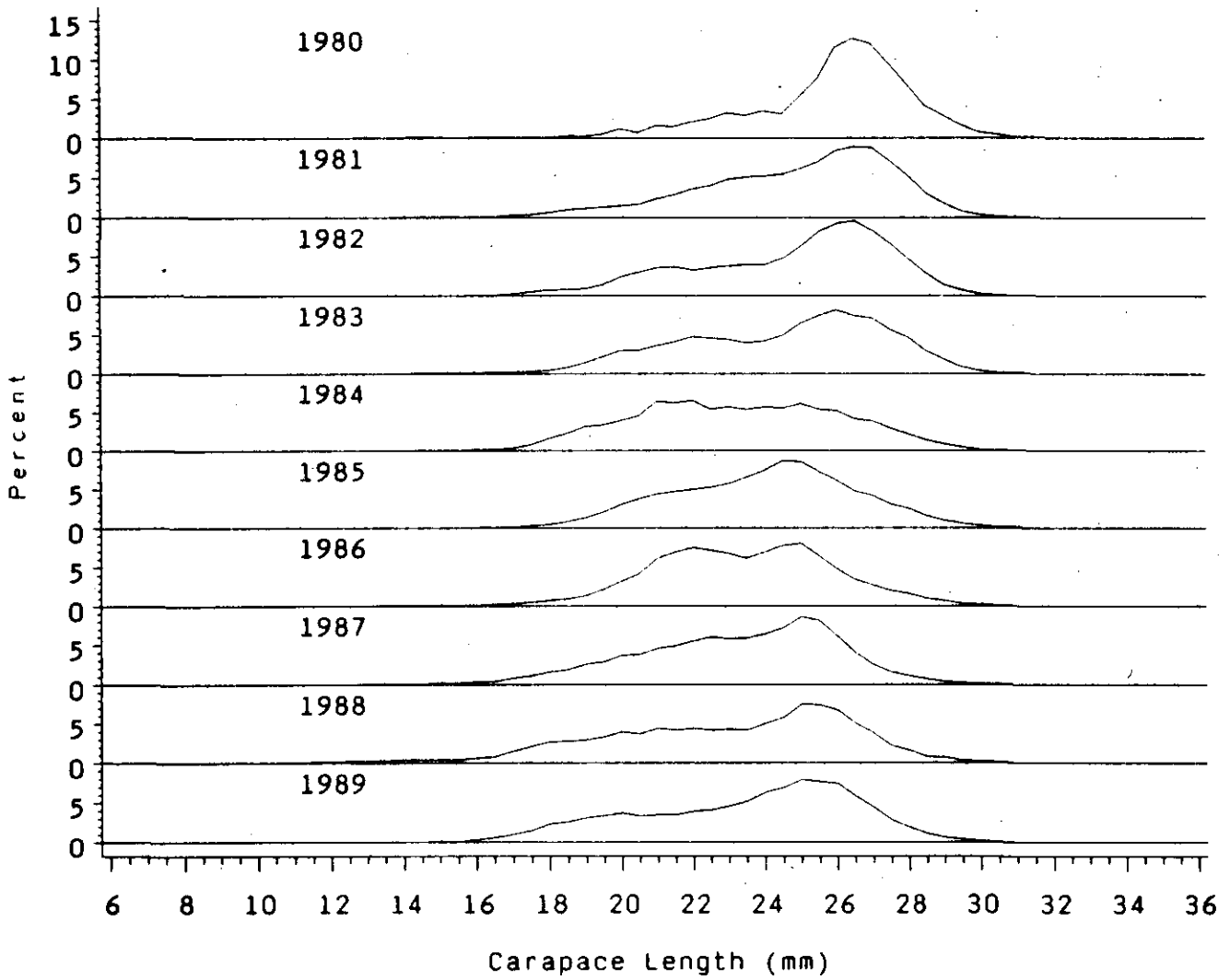


Fig. 3. Catch-at-length for northern shrimp - Div. 0A, 1980-89.