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Preliminary Report of a Cruise with M/T Håkøy-II to

East Greenland Waters in September 1989

by

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INTRODUCTION

In the last years a total of about 10 000 tons of shrimp have been fished in Denmark Strait. Except for sampling of the commercial catches, little is known about the stock in this area. Therefore, Norway has since 1983 conducted scientific cruises in East Greenland waters (Smedstad, 1984, 1985, 1986, 1987, 1988 and 1989). In 1983 the cruise was carried out with R/V "Eldjarn" in november, but the investigations were very hampered by ice. In 1984 we therefore carried out the investigations earlier in the autumn. A freshfish trawler were hired for the period 7 - 28 September. The experiences from this cruise were so good that the same period and also the same ship were chosen for 1985, 1986, and 1987. In 1988 we had to hire another vessel of the same size. This vessel was also used in 1989. The cruise in 1989 was carried out in the period 29. August - 21. September. This report gives some results from that cruise.

MATERIAL AND METHODS

The investigated area lies between 65°N and 68°N (Fig. 1). We had no problems with ice.

M/T "Håkøy-II" T 50 T is a commercial freshfish trawler 46.5 m long with a main engine of 1500 Hp. The bottom trawl equipment was as follows:

Trawldoors:	Steinshavn nr 8 (about 8 m").
Bridles :	40 m.
Gear :	Six 21" steelbobbins on each side, and six 24" steelbobbins in the middle.
Trawl :	"Campelen Super 1800 mesh" shrimp trawl with 35 mm meshes in the codend. 50 extra floats along the sides and about 20 extra floats along the fishline.

Towing speed was 2.5 knots and standard towing distance was 1 nautical mile. In the western area, the bottom conditions were so bad that we had to decrease towing distance to 0.5 nautical mile. 58 trawlstations were taken. The positions are seen in Fig. 1

For calculations of "swept area" we used 11.7 m as the width of the trawl. This is the same width as used in the Barents Sea for the same trawl (Teigsmark and Øynes, 1982).

In lack of good depth data over the area, the different strata were defined as statistical squares (Fig. 2). Because of few trawl hauls, some strata were combined. The combined strata are: 8 + 9, 12 + 19, 25 + 32, 26 + 27 and 29 + 30.

The statistical treatment of the catch data was done as described in Randa and Smedstad (1982). For biomass calculations the following length/weight relations were used (Smedstad 1986):

Ovigerous females:

$$w = 0.003498 * L^{2.51}$$

Individuals without eggs:

$$w = 0.00148 * L^{2.71}$$

The carapace length was measured to nearest mm below.

The determination of sex was based on the form of the endopodite of the first pleopod as described by Rasmussen (1953). Females and transitionals were classified by use of the following scheme:

1. (BR - E): Ovigerous females, eyes not visible on the eggs.
2. (BR + E): Ovigerous females, eyes visible on the eggs.
3. (JH) : Females with setae on the pleopods.
4. (HR) : Females or transitionals with head roe.
5. (WR) : Females or transitionals without roe.

Stages found on this cruise were males, females without roe, females with head roe and ovigerous females with no eyes on the eggs.

On this cruise we had no possibility to take hydrographical samples.

RESULTS

The shrimp catches are seen in Fig 3. The biggest catches of shrimp were taken in the area close to the boarder between Greenland and Iceland and in the western area. However, the catches are not so big in the densest areas, and a bit bigger in the lesser dens areas than in the earlier years. The commercial fishery showed the same. During the investigation period the fishing vessels reported relatively small catches, but they were fishing over a large area. This indicates that the shrimp not have concentrated in the same way as in the earlier years.

Horizontal distribution

The horizontal distribution of the sexes shows that males were found in greatest numbers in the western and northern areas (Fig. 4), but this year the relative distribution of the sexes in the rest of the investigated area are more even than in the earlier years (Fig. 5). For the total investigated area 58.0 % of the shrimp in numbers were males.

Females were found in greatest numbers in the western area and northeast of Dohrn Bank (Fig. 6 and 8). Most of the females were ovigerous (BR - E), but 22 % of the females were without roe (WR). The frequencies of females without roe were more evenly distributed over the investigated area than in earlier years (Fig. 7). 1989 is also outstanding in numbers of females with head roe (HR). More than half of the females had head roe in the southwestern area. For the total area about 19 % of the females with roe had still head roe, while in earlier years only about 5 % had head roe. No intersexes were found in the samples.

Length distribution

Fig. 11 shows length distributions of shrimp from selected strata. The strata represent a line from north to south (Fig. 2). It is clearly seen from these samples that the shrimps increase in length southwards. The smallest males are mainly found in the north, and the proportions of females increase southwards. Fig. 12 shows the length distribution of the estimated stock for the investigated area.

By going through the length distributions for the different years with the method of Bhattacharya in the ELEFAN software package it is possible to separate different "age groups". This analysis is not finished but a preliminary examination of the data indicates that there is 6 length groups of males. The smallest males that can be separated in our material has a carapace length of about 13 mm. The next peaks in the length distributions seems to be at 17 mm, 21 mm, 24 mm, 27 mm and 29 mm (Table 5). The length distributions of females have only one peak at about 30 mm. If the analysis is done on total samples of both sexes seven "age groups" are found. The two oldest "age groups" have an average length of 30.7 mm and 32.9 mm (Table 6). If the different peaks of males represent age groups the material indicates that the shrimps at East-Greenland are about 6 years old when they shift to females.

Biomass

Table 1 and Fig. 10 show the calculated biomass for each stratum. The stock in the investigated area was estimated to 35 000 tons with a Standard Error of 6100 tons.

DISCUSSION

The large variations in the stock estimate from 1987 to 1989 is not real. Table 3 and 4 show some of the results separated on a western and an eastern area. The western area has very difficult bottom for trawling. The estimates in this area are based on very few and very short trawl hauls. The variations between hauls and between years are therefore larger in this area. The large increase in the estimate in this area from 1987 to 1988 can, to a great extent, be explained by differences in the weather conditions. In 1987 the weather was very windy, while we had almost no wind in 1988.

The results from the eastern area gives a better picture of the stock. However, also in this area there are factors that complicate the comparison of the results from year to year. In 1985 we had no hauls in the Islandic zone. In 1985 and 1986 we were trawling both day and night, while in 1987 most of the hauls were taken during daytime, and from 1988 all hauls are taken during daytime. The wind conditions will also in this area influence the results, but because of longer hauls and a greater number of hauls the influence of the wind will not be so big as in the western area.

The proportion of males has increased from 1986 to 1988, but this trend halted in 1989 (Table 5). The increase may be due to increased exploitation of female shrimp, but it may also be due to stronger year classes recruiting the stock.

The results from 1989 are outstanding on several points:

1. The shrimps are not found in so dense concentrations as in earlier years. They are more evenly distributed over greater areas.
2. The proportions of the sexes are more evenly distributed throughout the investigated area than earlier.
3. The proportion of females with head roe (HR) is much greater than in the earlier years.
4. The proportion of males is the same in 1989 as in 1988 but the geographical distribution is different. In 1989 the frequency of males is higher in the eastern area than in the western.

These differences may be explained if the investigation in 1989 were carried out on an earlier biological time than in the former years. Especially the high frequencies of females with head roe may lead to such an explanation. If this explanation is correct we may expect an increase in the proportion of females in the eastern area, which also will increase the biomass in this area.

There is a big variation in our stock estimates during these years, but it is still fair to say that this stock has been relatively stable in recent years. The results from 1989 may, however, indicate that the stock is beginning to respond to the high exploitation in the eastern area the last years.

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Table 1. Estimated abundance of shrimp in each stratum at East Greenland

STRATA	NUMBER OF HAULS	AREAL NAUT.N.M. ²	SWEPT AREA NUMBER	STANDARD ERROR	SWEPT AREA WEIGHT	STANDARD ERROR	MEAN LENGTH
1	2	681	1,75 E +08	1,75 E +08	1.16 E +08	1.16 E +06	21.67
8+9	6	1392	9.56 E +06	5.99 E +06	1.14 E +05	6.76 E +04	27.11
12+19	3	1434	4.52 E +08	1.34 E +08	6.00 E +06	1.84 E +06	27.67
13	3	710	1.37 E +08	6.40 E +07	1.65 E +06	7.60 E +05	26.65
14	3	710	8.03 E +07	3.18 E +07	9.90 E +05	4.42 E +05	26.90
15	4	710	1.90 E +08	5.00 E +07	2.38 E +06	5.80 E +05	27.10
16	6	710	2.56 E +08	3.72 E +07	3.43 E +06	5.12 E +05	27.80
17	2	710	8.86 E +07	1.73 E +07	1.10 E +06	1.75 E +05	27.04
20	2	724	3.09 E +08	4.29 E +07	4.76 E +06	4.85 E +05	28.78
21	4	724	6.54 E +07	1.70 E +07	6.37 E +05	1.43 E +05	24.38
22	4	724	8.13 E +07	2.86 E +07	1.17 E +06	4.63 E +05	28.35
23	6	724	1.73 E +08	6.41 E +07	2.47 E +06	8.95 E +05	28.22
25+32	2	1492	3.56 E +08	3.35 E +08	4.16 E +06	3.80 E +06	25.98
26+27	2	1478	3.40 E +08	3.14 E +08	4.31 E +06	3.93 E +06	27.38
29+30	3	1478	3.12 E +07	1.94 E +07	3.37 E +05	1.89 E +05	25.35
WEST	12	5838	1.60 E +09	4.84 E +08	2.09 E +07	5.84 E +06	27.36
EAST	40	8563	1.15 E +09	2.04 E +08	1.38 E +07	1.80 E +06	26.47
TOTAL	52	14401	2.75 E +09	5.24 E +08	3.47 E +07	6.10 E +06	26.98

Table 2. Total biomass (1000 tonnes) and corresponding Standard Error of shrimp east and west of 31°W in different years.

	West of 31°W		East of 31°W		TOTAL	
	Biomass	SE in %	Biomass	SE in %	Biomass	SE in %
1985	19,2	35,2	12,0	20,9	31,3	23,2
1986	14,8	24,9	29,3	16,6	44,2	13,9
1987	6,5	25,0	18,7	21,5	25,2	17,1
1988	28,8	26,3	20,8	15,9	49,6	16,7
1989	20,9	28,0	13,8	13,1	34,7	17,6

Table 3. Number of males (millions) and corresponding Standard Error of shrimp east and west of 31°W in different years.

	West of 31°W		East of 31°W		TOTAL	
	Numbers	SE in %	Numbers	SE in %	Numbers	SE in %
1985	742	46,7	285	22,8	1030	34,4
1986	370	44,4	919	16,5	1290	17,4
1987	238	35,2	818	29,8	1060	24,5
1988	1370	32,4	887	36,9	2260	24,4
1989	886	35,3	707	24,3	1590	22,4

Table 4. Males in per cent of total number east and west of 31°W in different years.

	West of 31°W	East of 31°W	TOTAL
	Males in %	Males in %	Males in %
1985	50.1	32.8	43.8
1986	36.3	44.0	41.4
1987	47.3	55.3	53.5
1988	61.2	54.8	58.5
1989	55.5	61.5	58.0

Table 5. Mean length (carapace length in mm) in different "age groups" of males in different years.

	"AGE GROUPS"					
	1	2	3	4	5	6
1985			22,09	24,30	26,62	30,00
1986	13,00	17,30	20,68	23,42	26,50	28,33
1987	13,00	17,53	21,34	24,35	26,90	
1988		17,86	20,86	24,03	27,48	
1989		15,40	21,13	24,00	27,93	
MEAN	13,00	17,02	21,22	24,02	27,08	29,17

Table 6. Mean lengths (carapace length in mm) for different "age groups" for both sexes combined in different years.

	"AGE GROUPS"						
	1	2	3	4	5	6	7
1985			22,09	24,35	26,93	30,43	32,47
1986	13,00	17,30	20,68	23,48	26,53	30,15	32,89
1987	13,00	17,58	21,27	24,40	27,71	30,91	33,03
1988		17,86	21,02	24,08	27,98	30,84	32,81
1989		15,40	21,13	24,06	28,62	30,98	33,13
MEAN	13,00	17,03	21,23	24,07	27,55	30,66	32,86

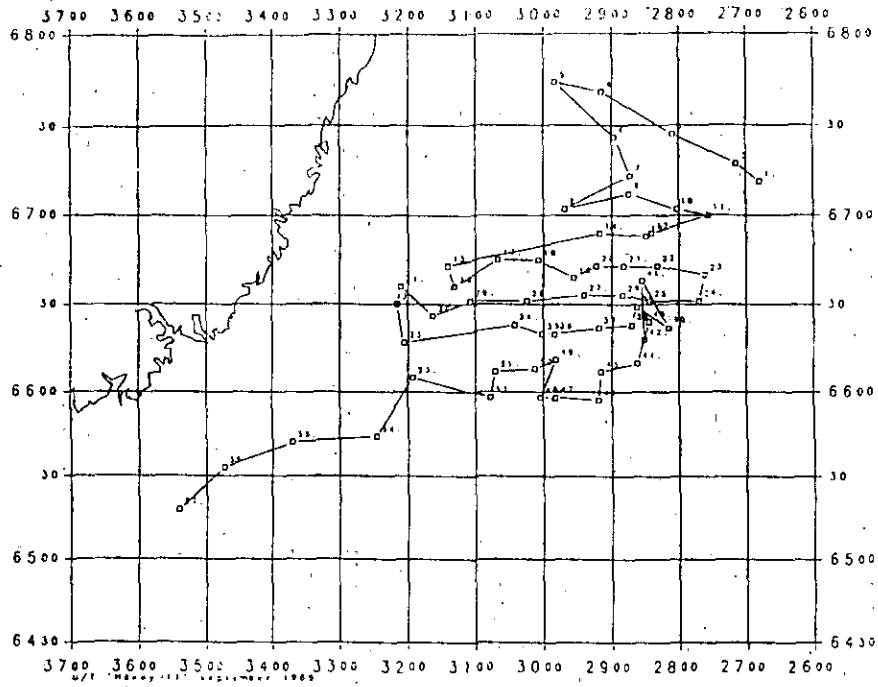


Fig. 1. Survey tracks and trawl stations by M/T "Håkøy - II" in September 1989

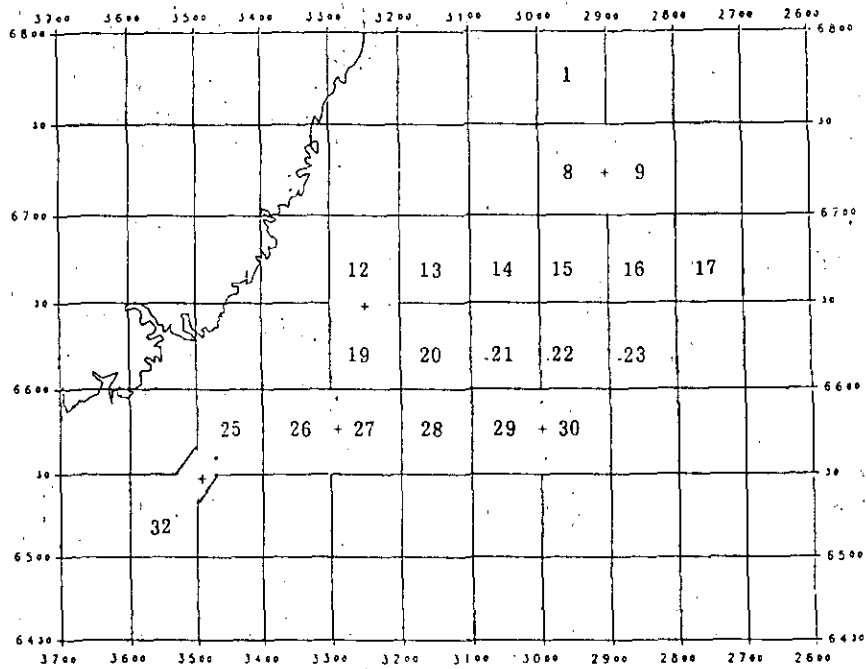


Fig. 2. Stratum number

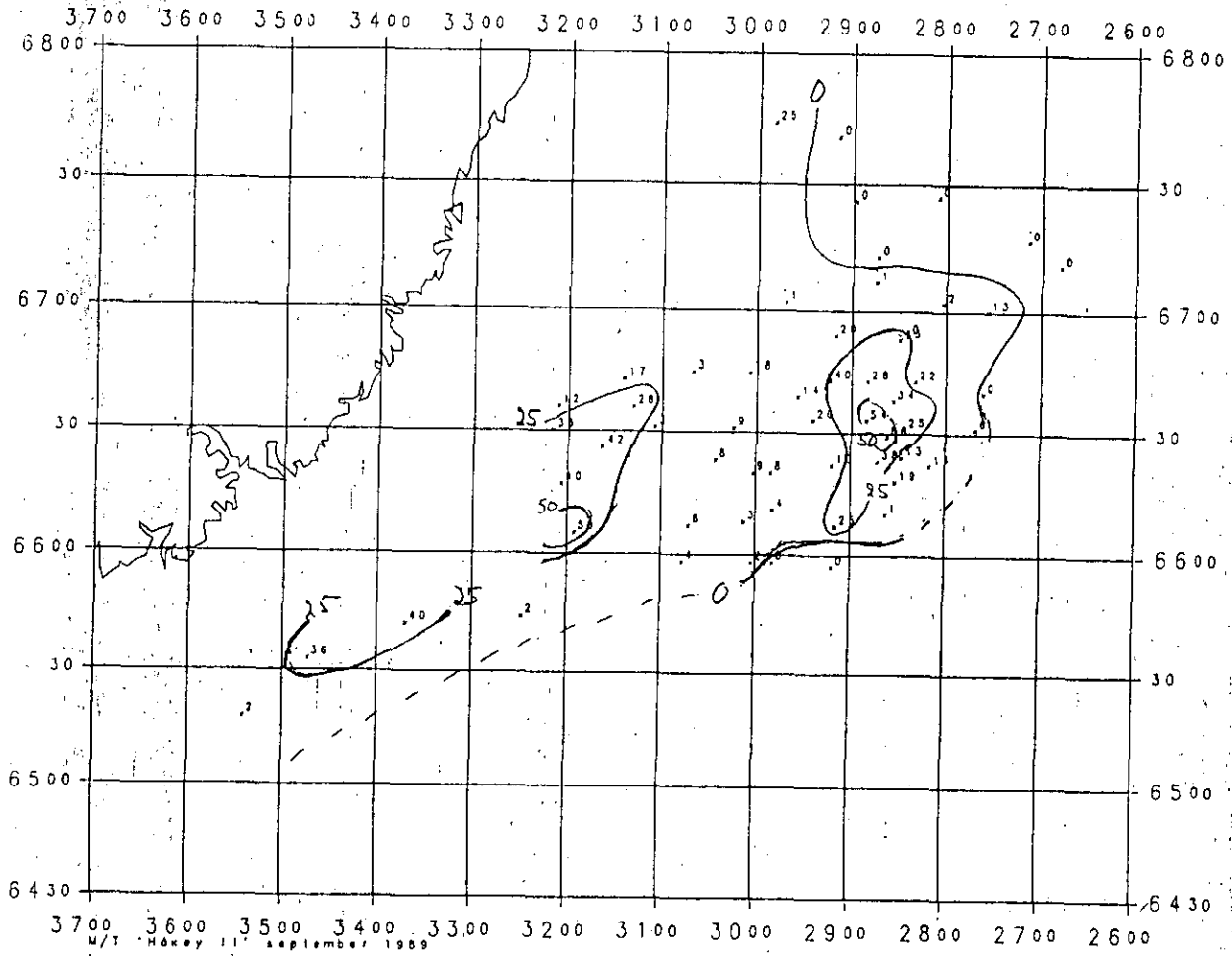


Fig. 3. Catches of shrimps in kg per nautical miles towed.

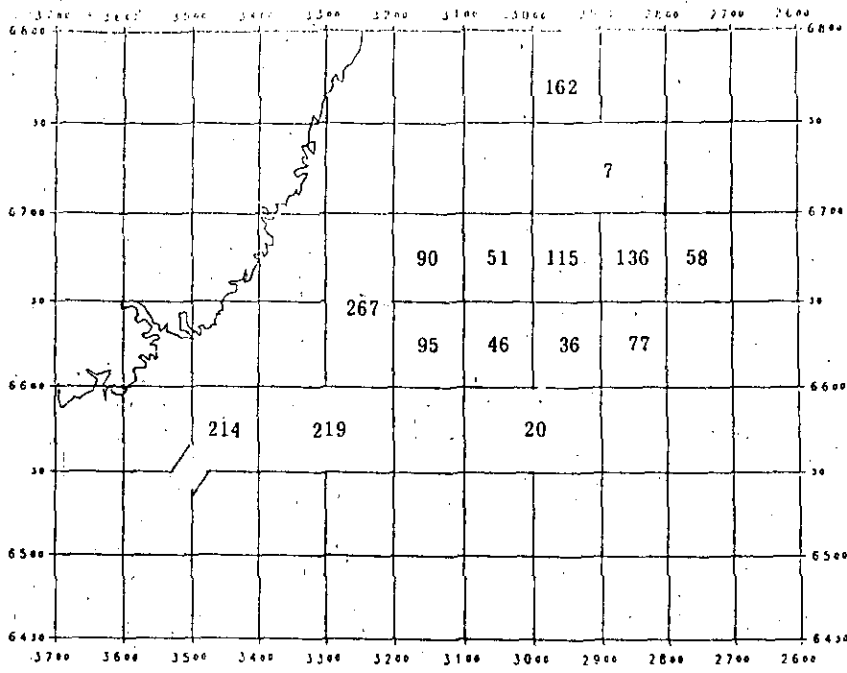


Fig. 4. Calculated numbers of males (in millions).

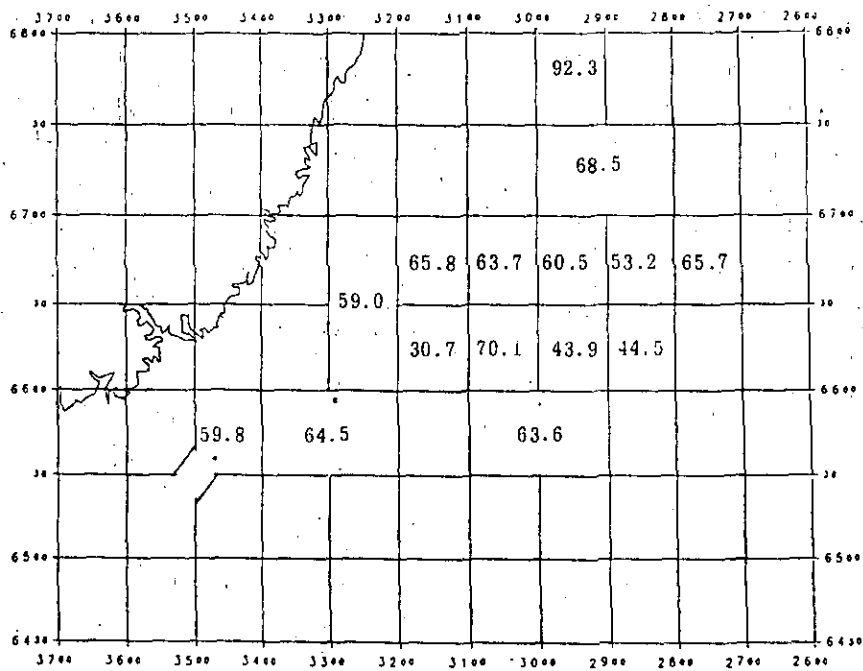


Fig. 5. Males in per cent of total number.

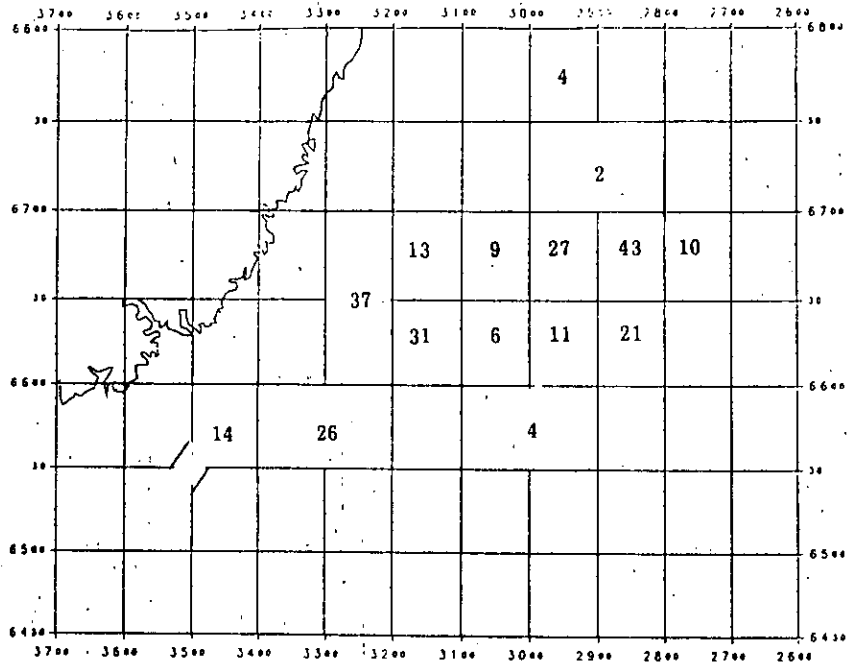


Fig. 6. Calculated numbers of females without roe (in millions)

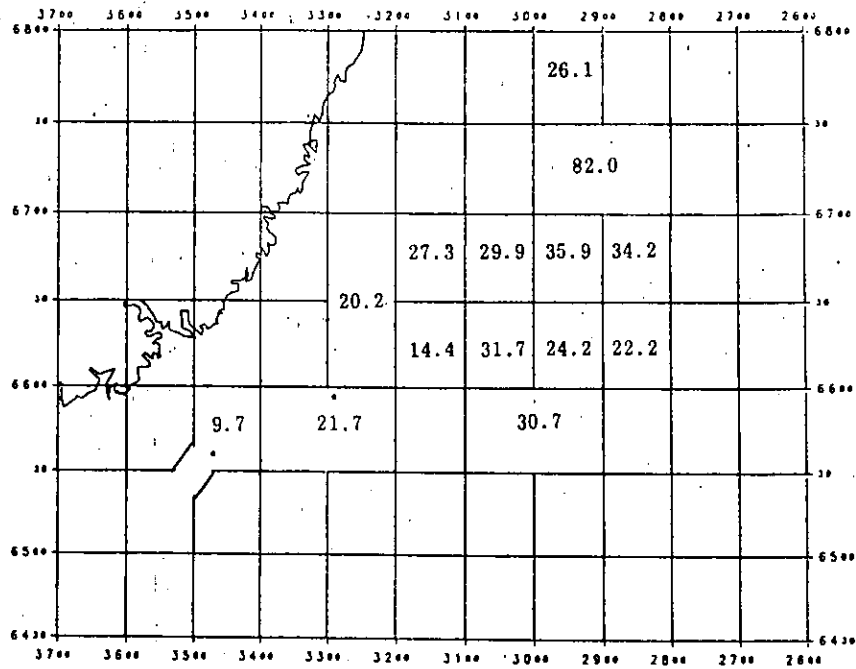


Fig. 7. Female shrimps without roe in per cent of total females.

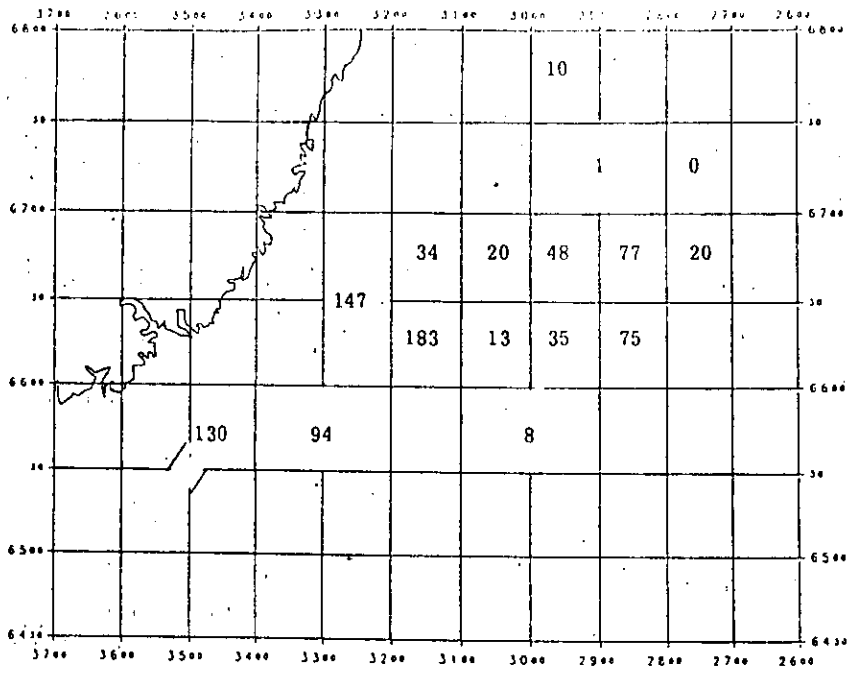


Fig. 8. Calculated numbers of female shrimps with roe (in millions).

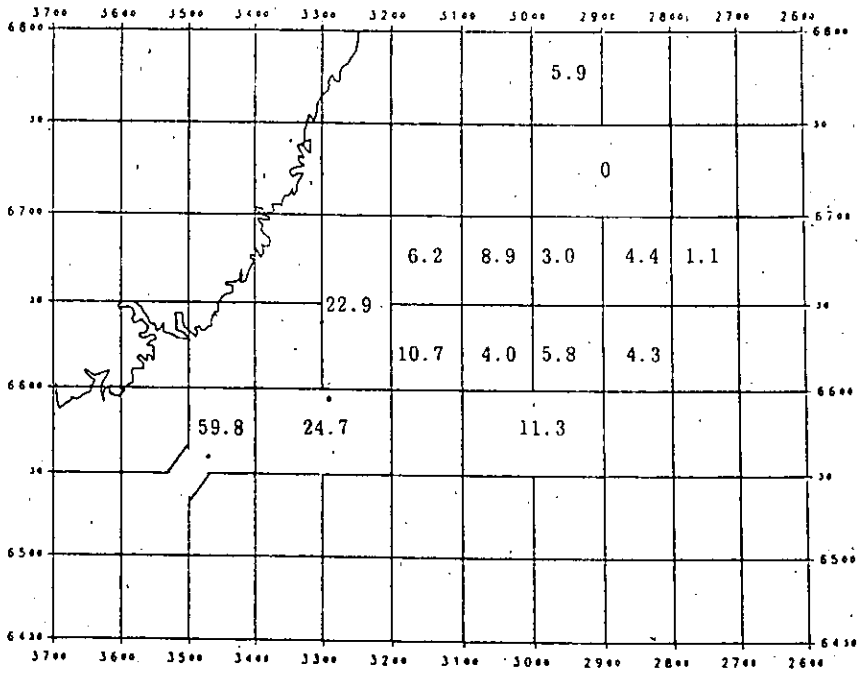


Fig. 9. Females with head roe (HR) in per cent of females with roe (HR plus BR).

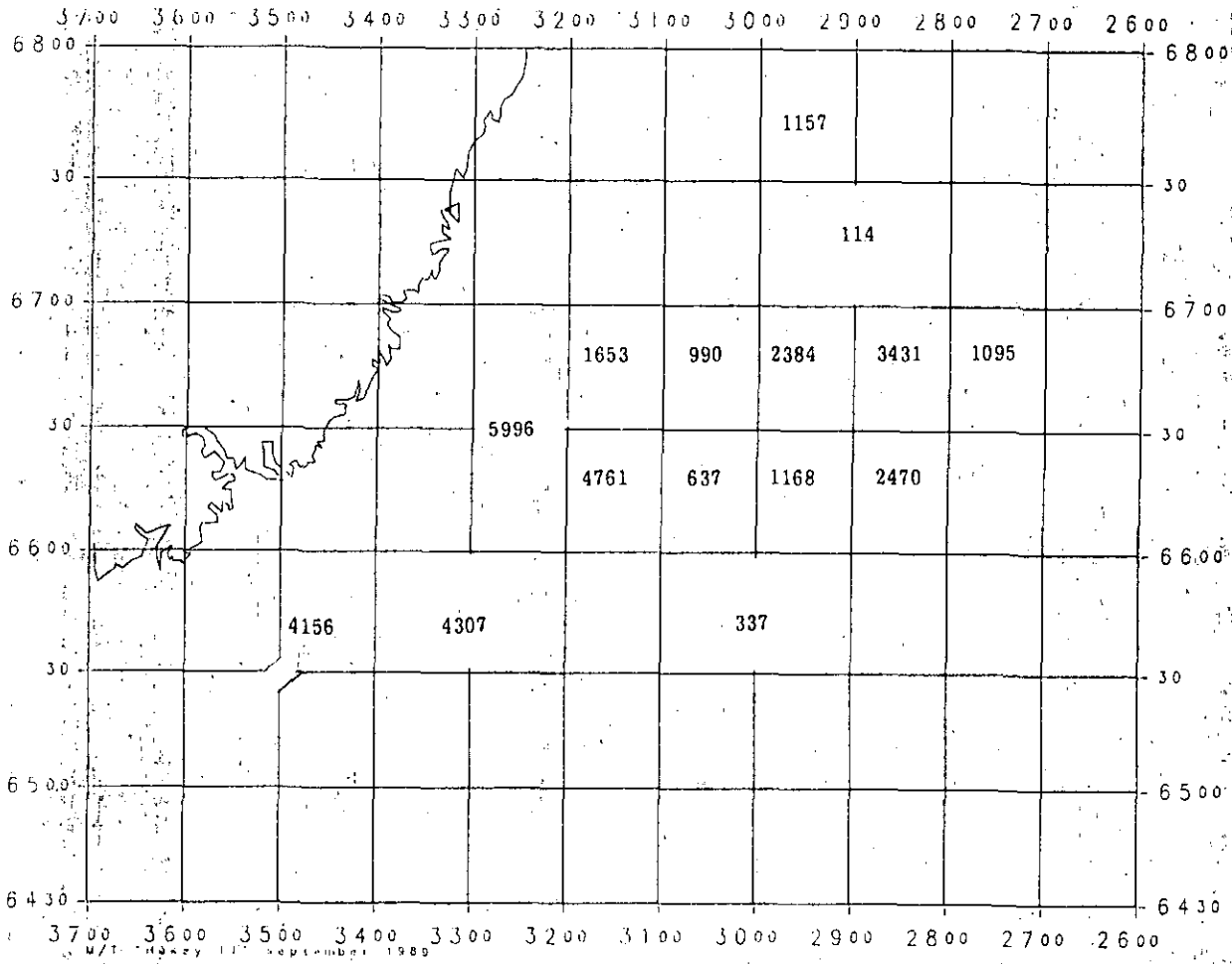


Fig. 10. Calculated total biomass of shrimps in tonnes.

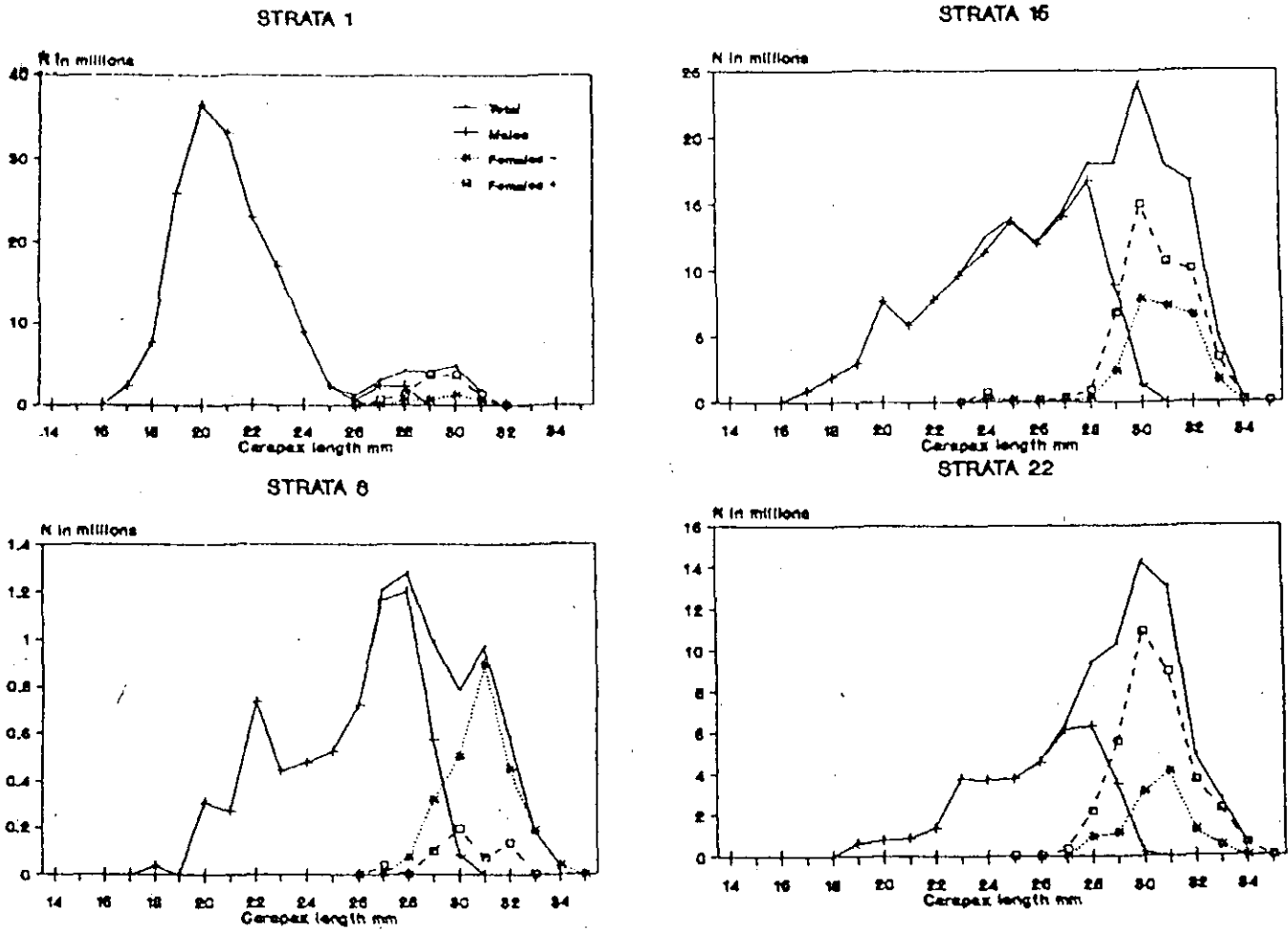


Fig. 11. Length distributions of shrimp from selected strata from north (strata 1) to south (strata 22).

TOTAL AREA

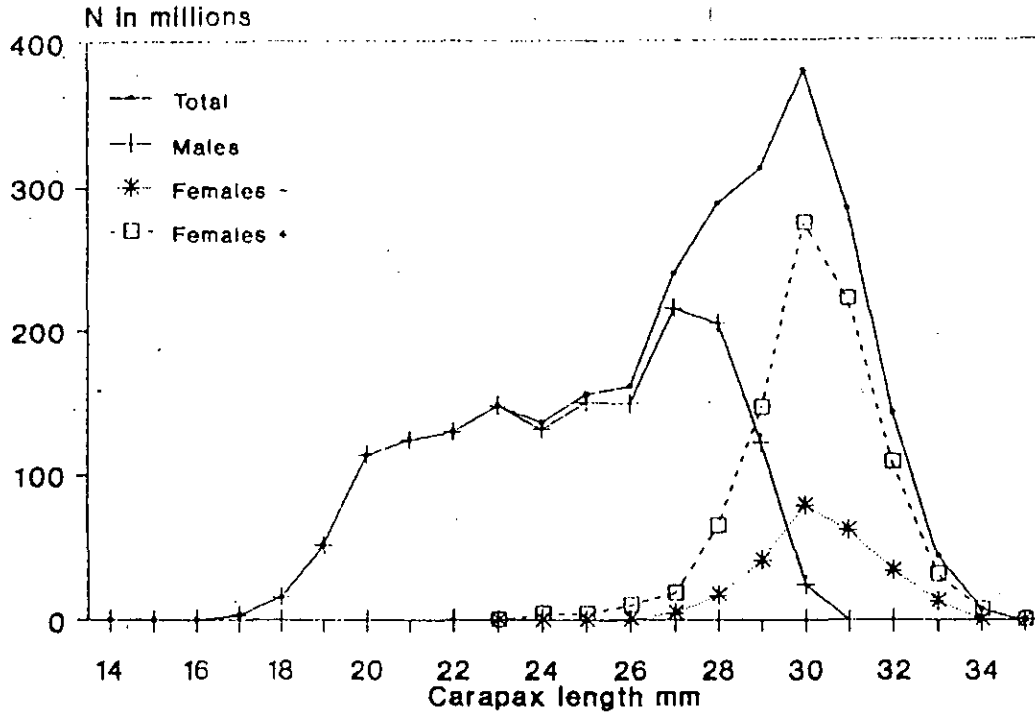


Fig. 12. Length distribution of the shrimp stock in the investigated area.