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Stratified-Random Trawl Survey for Shrimp (*Pandalus borealis*)
in Disko Bay, West Greenland, 1994.

by

M. Andersen¹, D. M. Carlsson², and P. Kanneworff²

Greenland Fisheries Research Institute

¹Box 570, DK-3900 Nuuk, Greenland

²Tagensvej 135, DK-2200 Copenhagen N, Denmark

Introduction

A major part of the inshore fishery for shrimp in West Greenland takes place in Disko Bay, NAFO Div. 1A. Since 1991 Greenland Fisheries Research Institute has performed an annual survey in this area. This paper presents results from the survey in 1994.

Materials and Methods

The survey area covers the inshore West Greenland area between 68°42'N and 70°37.5'N, a total of 9364 sq.km (Figure 1). 30 hauls were taken in the period from August 20th to August 26th, 1994. One haul thus represents 312 sq.km. Depth contours are not mapped in detail, so stratification based on depth is not possible. Stratification to ensure a reasonable subdivision of the survey area is therefore done by separating the area into strata based on information from the commercial fishery.

The survey was performed with a 722 GRT trawler, the M/TR "Paamiut", OYZC, using a twin cod-end 3000/20 meshes "SKJERVØY" bottom trawl. Mesh size in the cod-end was 20 mm (stretched mesh). Trawl doors were "3.7 GREENLAND PERFECT", measuring 370*250 cm and weighing 2420 kg. Trawl geometry was measured with "SCANMAR" acoustic sensors, mounted on the trawl doors and on the headrope.

Standard towing time was 30 minutes and towing speed was around 2.5 knots. Trawling was carried out from 0900 to 1900 UTC only, to prevent impacts of nocturnal vertical migrations. The mean wingspread was calculated for each haul, based on information on size and type of trawl, trawl doors, warp length, towing speed and distance between doors.

The starting position and time were recorded from GPS when the pressure on the winches increased after shooting the trawl, ending position and time were recorded when the winches began to haul. Swept area was calculated as the distance between starting and ending positions multiplied by the mean wingspread.

From each haul a sample of approx. 5 kg of shrimp was taken from the cod-end of the trawl, before it was emptied into the pounder. The shrimp were sorted by sex, and oblique carapax length was measured by slide callipers to the nearest 0.1 mm.

The samples were weighted by catch and stratum area to obtain estimates of the total number of shrimp by sex and length group for each stratum and for the total survey area.

The total catch was sorted by species and weighed.

Results and Discussion

Table 1 lists the stations by stratum and shows the catch in kg of shrimp, cod, Greenland halibut, redfish, and other species combined.

Biomass and density

Table 2 shows the area in sq.km, the number of successful hauls, the mean density of shrimp in kg per sq.km, and the calculated biomass in tons for each stratum. The total biomass estimate from the 1994 survey is 41306 tons (+/- 21514 tons).

Table 3 shows the calculated biomass per stratum for each year.

The total biomass has increased since last year, to a level close to that of the two first years of survey in the area.

In Figure 2 the estimated biomass per year is shown for groups of strata. Apparently the increase in biomass is caused by increased abundance in the two southern strata, D1 and D2, only. A fairly stable situation is seen in the rest of the groups.

However - from table 3 it is seen that a more dynamic shift has taken place. A decrease in D2 is overruled by the increase in D1, when the two strata are grouped. When the more northern strata (D3-D6) are regarded as a group, there is no apparent change since 1993, but abundance has increased in D3 and decreased in D6. The results thus reflect a westward displacement of stock concentration, with an increase in abundance in the two strata D1 and D3 in the western part of the bay, close to the area where concentrations were observed in the offshore survey (Andersen *et al.* 1994), and with similar densities.

In Vaigat (D7-D9) some reduction in biomass is observed, mainly due to a decrease in stratum D9.

Stock composition

The estimated total numbers of shrimp (billions) in the survey area over the years are as follows:

Year	males	females	total
1991	5.46	1.97	7.43
1992	5.55	1.55	7.10
1993	3.20	1.45	4.65
1994	4.94	1.63	6.57

The increase in estimated biomass from 1993 to 1994 is based on increasing numbers of both males and females. Fig. 3 shows numbers of shrimp (males, females, and total) by stratum. Both males and females are most abundant in the western and central parts of the Disko Bay (stratum D1, D3, and D4). As in earlier years female abundance is also relatively high in the Hareø area. Compared to 1993 (Andersen *et al.*, 1993) abundance of both sexes has increased drastically in the western Disko Bay (strata D1 and D3) and decreased more or less in all other strata, except for a minor increase in abundance of males in the Vaigat (strata D7 and D8) and of females in the northern Disko Bay (stratum D6).

Overall length distributions of shrimp from 1991 to 1994 are shown in Fig. 4. Based on the theoretical size at age as interpreted in shrimp samples from the Davis Strait (Savard *et al.*, 1994), the recruitment and growth of year classes can be followed over the years:

In 1991 the overall distribution was dominated by two components of males at 17 and 21 mm CL - assumed to represent the 1987 and 1985 year class. The female group was composed of several size groups.

In 1992 dominant male peaks were found at 18.5 and 22 mm CL (1987 and 1985 year classes), and a recruiting year class (1989) was indicated. A dominating female peak at 25 mm CL was supposed to represent a transitioning component of the 1985 year class.

In 1993 the male group was dominated by a peak at 20.5 mm CL representing the 1987 year class, but peaks at 16, 18, and 22.5 mm CL were also evident (1990, 1989, and 1986 year classes). Several female modes were present with a dominant peak at 25.5 mm CL, probably mainly representing the 1985 year class.

In 1994 a number of male peaks are present, among which the 1990 year class is found at 18 mm CL and the 1991 year class at 16 mm. A small peak at 11.5 mm CL indicates the occurrence of the 1992 year class. The female group is dominated by one peak at 26 mm CL, which may represent a transitioning part of the 1987 year class.

New year classes are recruiting to the stock almost every year, but none of them have so far reached the size of the 1987 and - especially - the 1985 year class.

Fig. 5 (a-b) shows the overall length distributions by strata in 1994. The year classes - as described above for 1993 and 1994 - can be identified in most strata. The high abundance of shrimp in stratum D1, D3, and D4 is reflected, but different year classes of males dominate in each stratum. In stratum D1 the 1989 (19.5 mm) and the 1988 (21.5 mm) year classes are most abundant, while in stratum D3 the 1991 (16 mm) and 1990 (18 mm) are dominating. Stratum D4 is dominated at a lower level by the 1988 year class. In all three strata the female group is dominated by the group around 25-26 mm CL.

References

ANDERSEN, M., D. M. CARLSSON, and P. KANNEWORFF. 1993. Stratified-random trawl survey for shrimp (*Pandalus borealis*) offshore in NAFO Subareas 0 & 1, in 1993. *NAFO SCR Doc.*, No. 132, Serial No. N2344, 19 p.

NAFO, 1992. Scientific Council Reports.

CARLSSON, D. M., and P. KANNEWORFF. 1993. Stratified-random trawl survey for shrimp (*Pandalus borealis*) in inshore areas at West Greenland, NAFO Subarea 1, in 1992. *NAFO SCR Doc.*, No. 72, Serial No. N2256, 12 p.

CARLSSON, D. M., M. ANDERSEN, P. KANNEWORFF, D. G. PARSONS, and H. SIEGSTAD. 1993a. Assessment of shrimp in Davis Strait (Subareas 0+1). *NAFO SCR Doc.*, No. 81, Serial No. N2266, 19 p.

CARLSSON, D. M., P. KANNEWORFF, and D. G. PARSONS. 1993b. Stratified-random survey for shrimp (*Pandalus borealis*) in NAFO Subarea 0+1 1992. *NAFO SCR Doc.*, No. 70, Serial No. N2254, 23 p.

Savard, L., D.G. Parsons, and D.M. Carlsson, 1994. Estimation of age and growth of northern shrimp (*Pandalus borealis*) in Davis Strait (NAFO Subareas 0+1) using cluster and modal analyses. *J. Northw. Atl. Sci.*, 16: 63-74.

Table 1: List of trawl stations in the inshore shrimp survey 1994. Catches are given in kg.

STATION-IDENTIFICATION	AREA-CODE	DEPTH	TR-TIME	SHR	COD	CHL	RED	MIX	TOTAL
STRATUM D1									
94PA0070038	302 LDO22	273.5	30	1162	0	10	12	49	1232
94PA0070041	304 LEO23	303.0	30	135	0	5	1	41	182
94PA0070037	305 LEO25	263.5	30	119	0	1	0	22	142
STRATUM D2									
94PA0070035	301 LDO26	386.5	30	57	0	19	8	19	103
94PA0070036	303 LEO27	364.0	30	26	0	17	1	8	51
STRATUM D3									
94PA0070040	308 LGO20	481.0	25	50	0	5	4	9	68
94PA0070031	311 LGO21	313.5	30	76	0	-1	0	10	88
94PA0070039	315 LHO19	306.0	30	665	0	10	0	98	773
STRATUM D4									
94PA0070034	306 LFO23	353.0	30	101	0	7	1	4	113
94PA0070030	312 LGO22	526.5	30	69	0	18	2	17	105
94PA0070029	309 LGO23	454.5	30	222	0	63	12	40	337
94PA0070027	314 LGO25	434.0	30	261	0	27	4	47	339
94PA0070032	316 LHO23	403.5	30	192	0	6	0	21	219
94PA0070033	319 LHO23	404.5	30	237	0	10	0	24	271
STRATUM D5									
94PA0070026	310 LGO26	406.0	30	228	0	38	5	40	311
94PA0070025	313 LHO27	396.5	30	141	0	34	2	39	215
STRATUM D6									
94PA0070028	317 LHO26	334.5	31	314	0	13	0	13	341
94PA0070024	318 LJO27	289.0	30	1	0	1	0	1	3
94PA0070023	320 LLO26	312.5	30	63	0	1	0	11	76
STRATUM D7									
94PA0070020	323 LMO25	478.5	22	133	0	10	0	14	157
94PA0070021	321 LMO25	254.5	28	279	0	1	0	93	374
94PA0070022	322 LMO27	532.5	30	22	0	23	1	7	53
94PA0070019	325 LPO21	363.5	31	72	0	7	0	23	101
94PA0070018	324 LPO23	419.0	30	11	0	7	0	6	24
STRATUM D8									
94PA0070017	326 LRO21	506.5	26	116	0	14	0	7	136
94PA0070016	328 LSO19	311.0	30	221	0	47	3	88	359
STRATUM D9									
94PA0070012	327 LSO12	249.0	30	2	0	0	0	33	35
94PA0070013	329 LT012	229.0	30	1	0	0	0	19	20
94PA0070014	331 LT014	216.5	30	15	0	0	0	40	56
94PA0070015	330 LT015	430.0	31	399	0	13	0	76	488

TABLE 2. The area in sq.km, number of hauls, mean density in kg per sq.km, and calculated biomass per stratum.

Stratum	Area	# hauls	Density	Biomass
D1	819	3	12789	10474
D2	566	2	1156	654
D3	1124	3	6636	7459
D4	1834	6	3990	7318
D5	612	2	4180	2558
D6	1014	3	2844	2884
D7	1447	5	2761	3995
D8	652	2	3946	2573
D9	1296	4	2617	3391
Total	9364	30		41306

TABLE 3. Estimated trawlable biomass per stratum and year in the Disko Bay - Vaigat area 1991-93.

Stratum	1991	1992	1993	1994
D1	9390	3238	2595	10474
D2	5869	1510	1765	654
D3	5667	5700	1719	7459
D4	7928	13676	7686	7318
D5	892	3416	2890	2558
D6	4006	5552	4717	2884
D7	5298	6077	3643	3995
D8	3264	1046	2084	2573
D9	5264	4953	5156	3391
Total	47578	45168	32255	41306

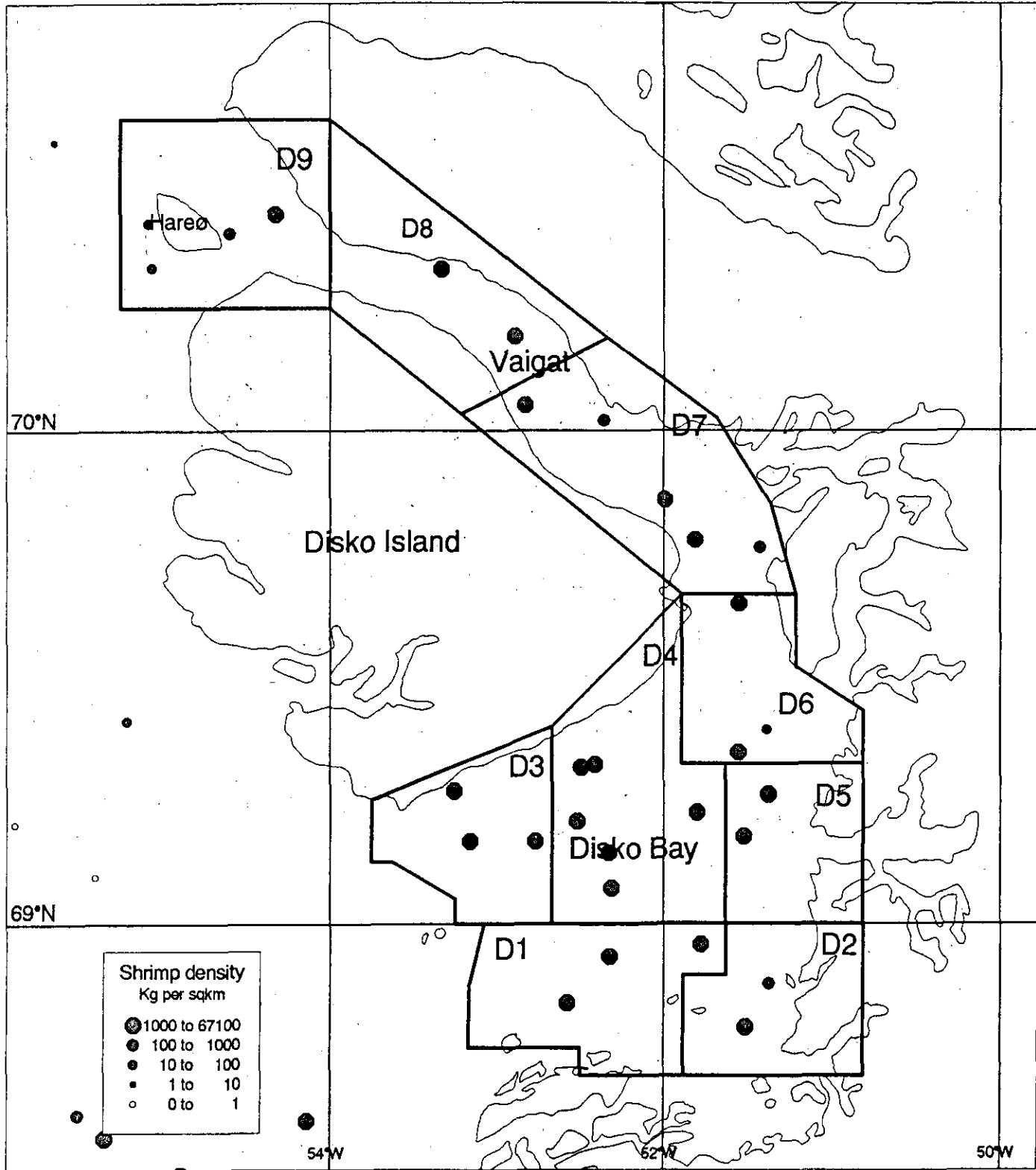


Figure 1. Stratification scheme and sampling sites in the Disko Bay - Vaigat survey 1994. Trawl catch levels (kg per standard area) are also indicated.

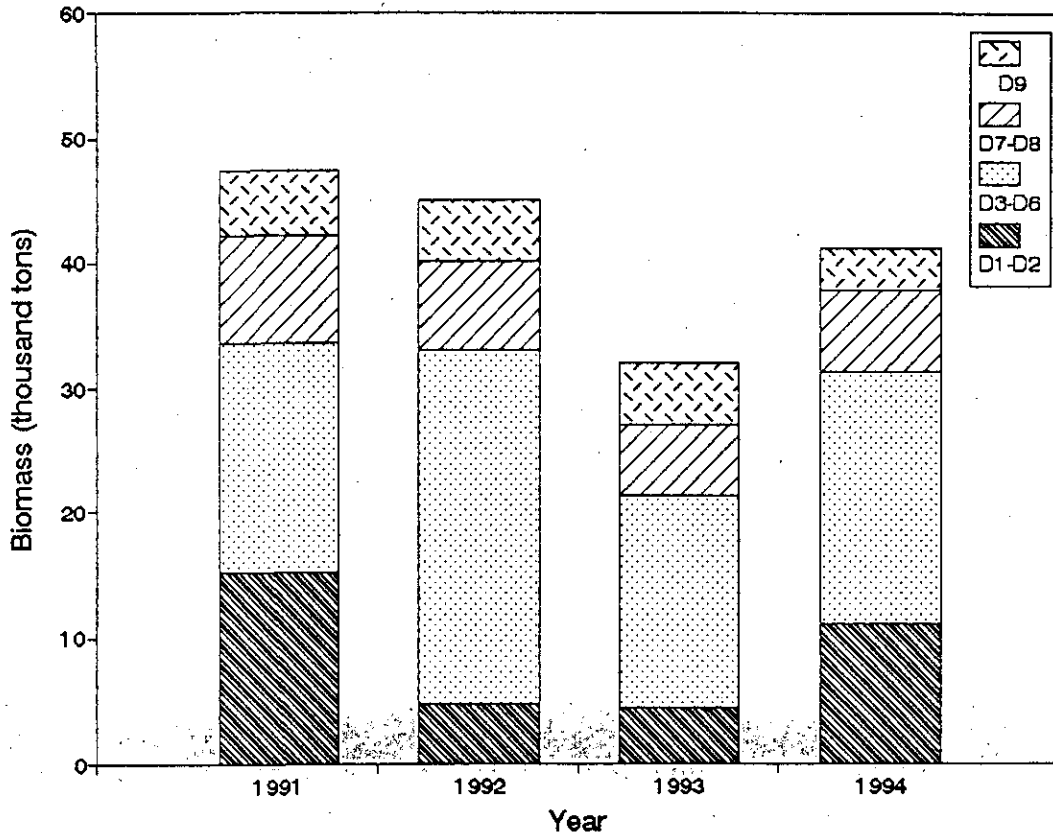


Figure 2. Estimated total biomass 1991-94 for groups of strata in the Disko Bay - Vaigat area.

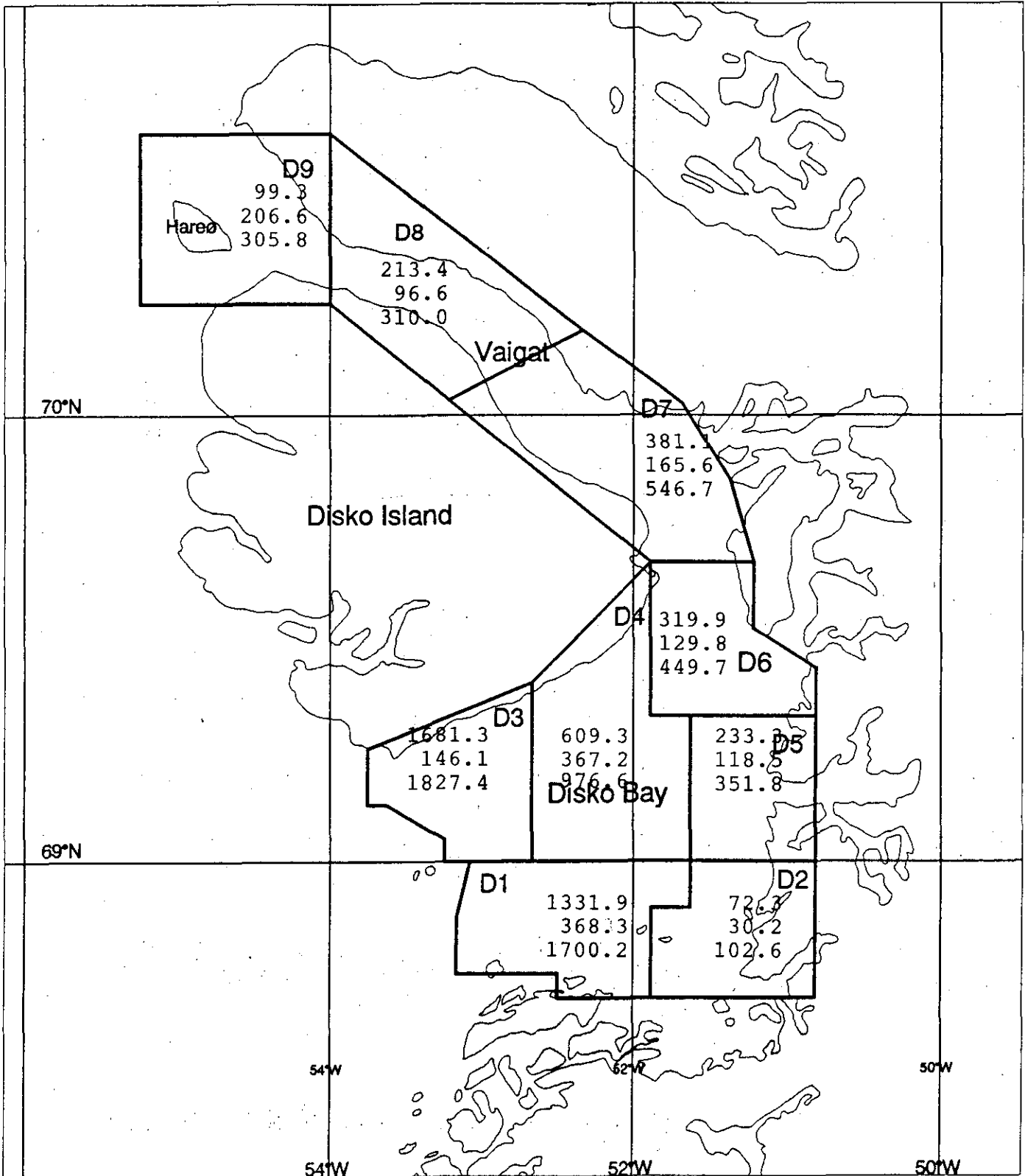


Figure 3. Calculated numbers of shrimp (males, females and total, in millions) per stratum in 1994.

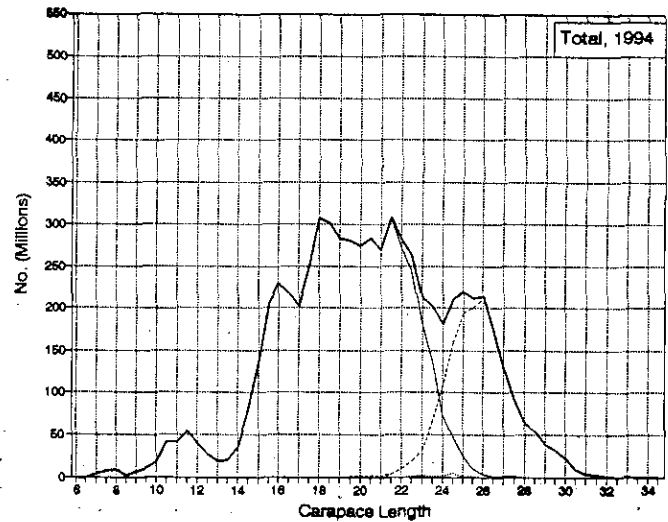
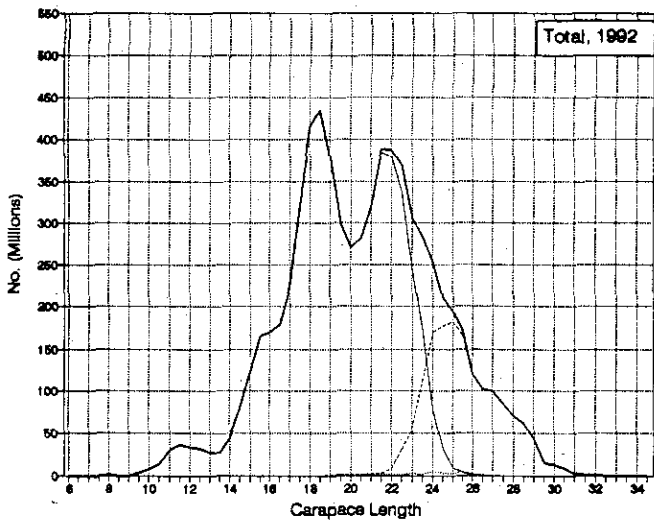
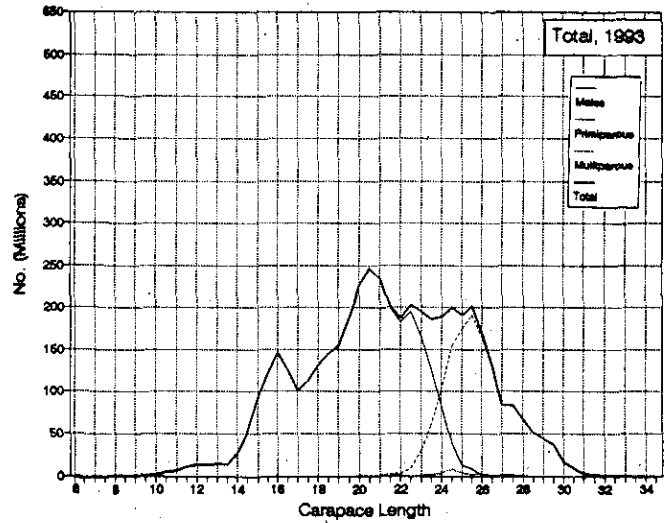
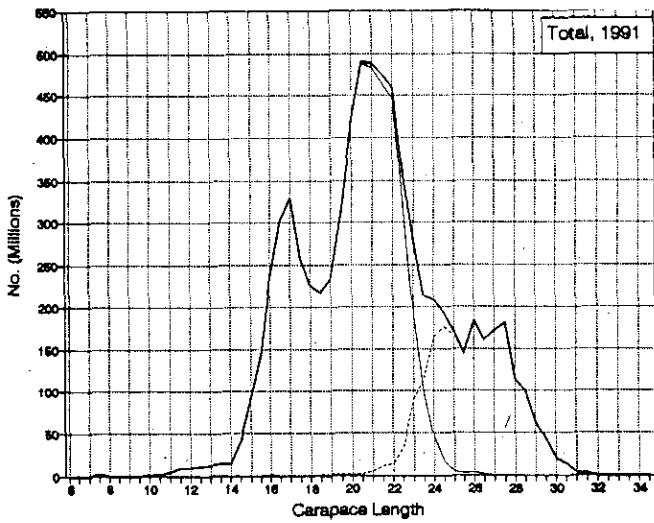


Figure 4. Numbers of shrimp per length group (CL) in the total survey area in 1991-94, based on pooling of samples weighted by catch and stratum areas.

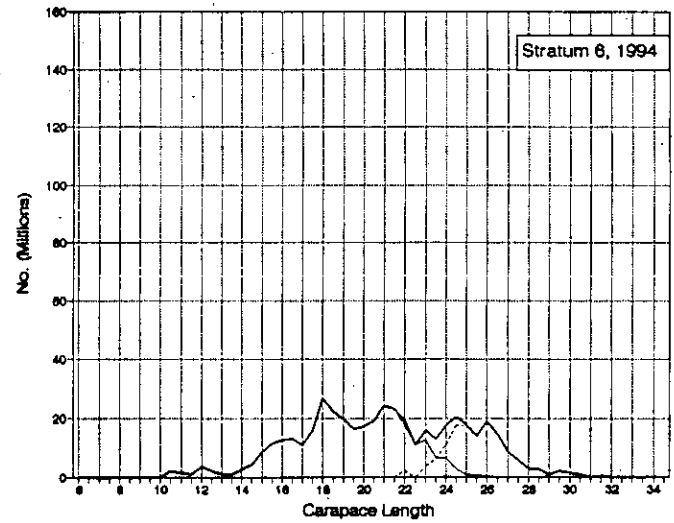
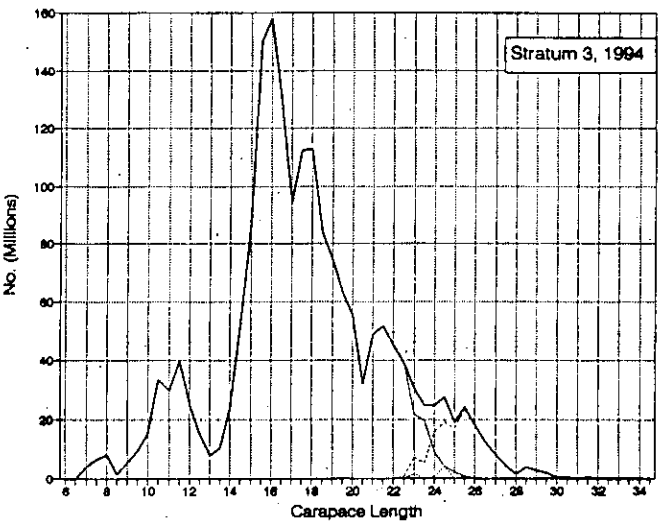
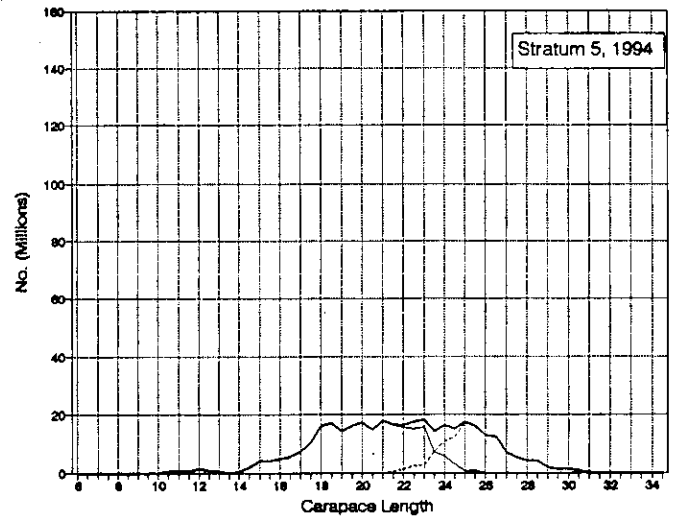
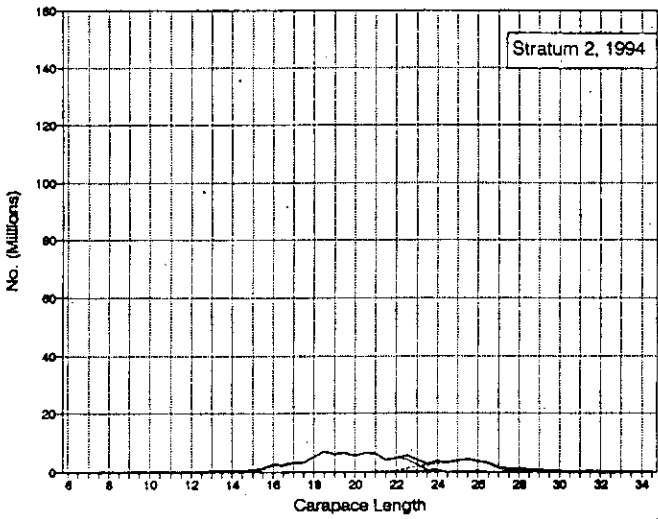
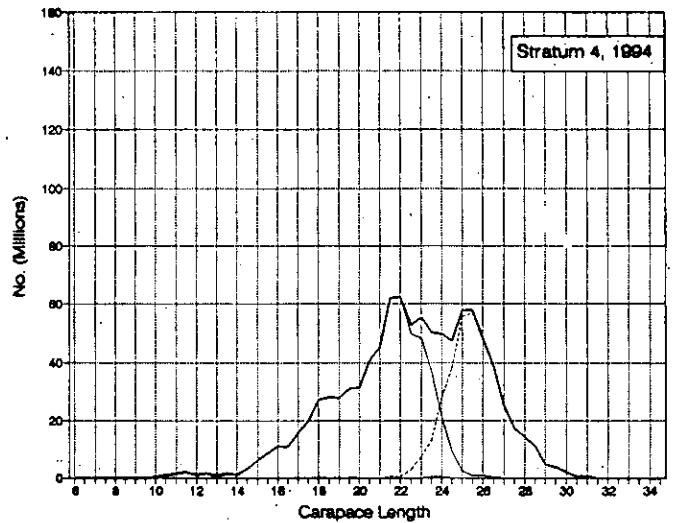
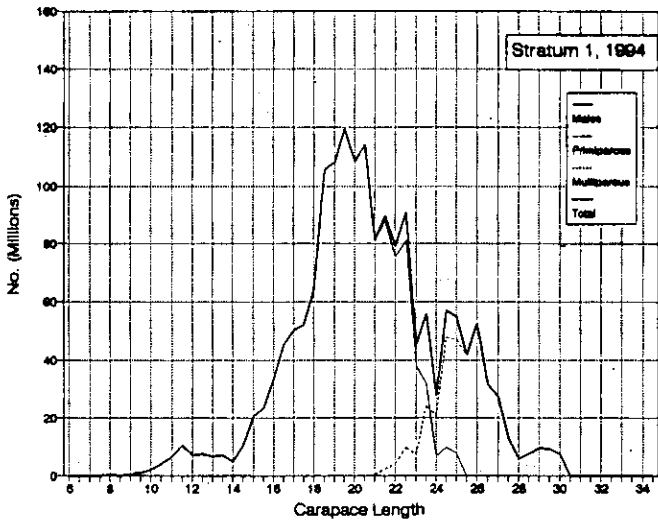


Figure 5a. Numbers of shrimp per length group (CL) in strata 1-6 (see Fig. 1), based on pooling of samples weighted by catch and stratum areas.

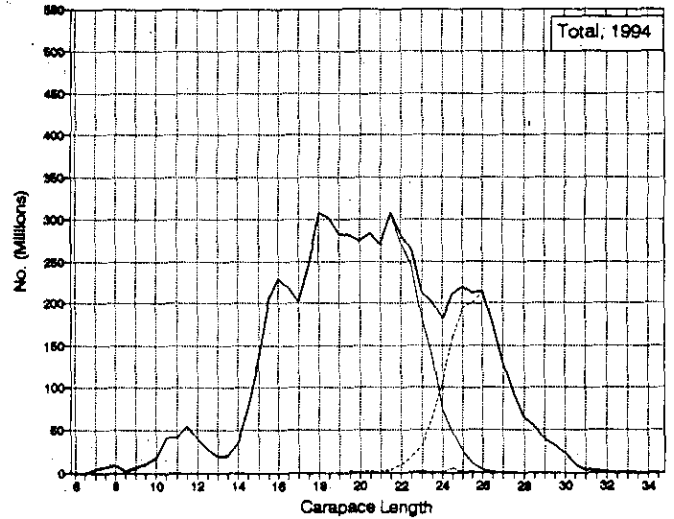
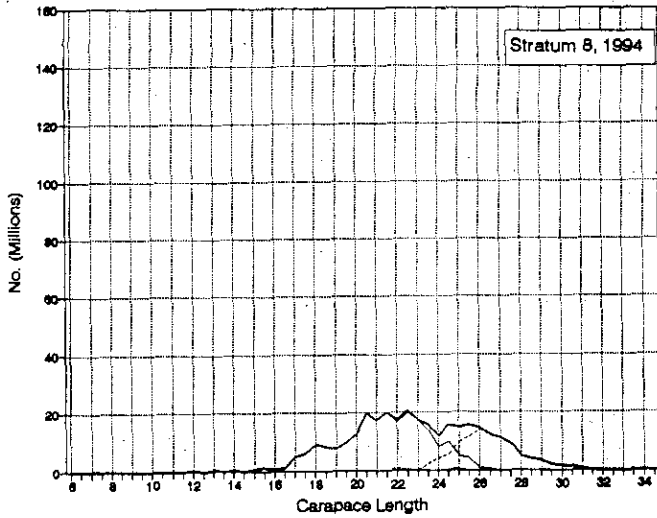
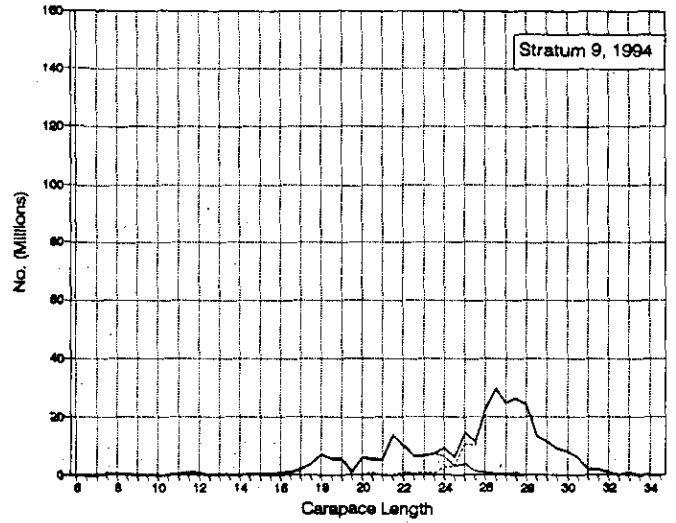
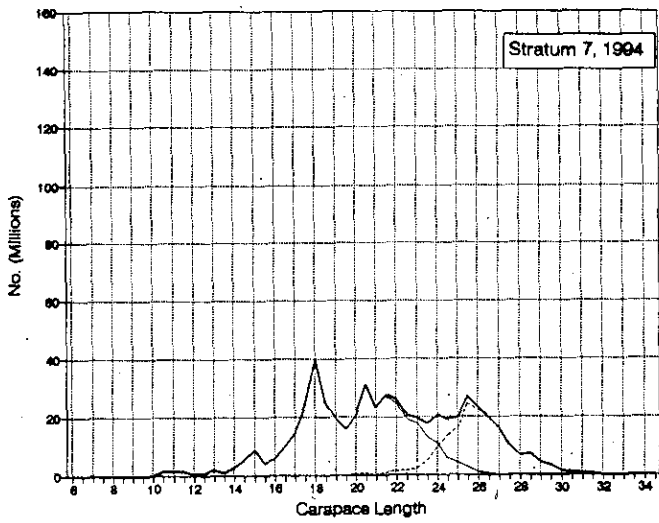


Figure 5b. Numbers of shrimp per length group (CL) in strata 7-9 (see Fig. 1), and total for the whole area, based on pooling of samples weighted by catch and stratum areas.