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Stratified-Random Trawl Survey for Shrimp (*Pandalus borealis*) in inshore areas at West Greenland, NAFO Subarea 1, in 1992

by

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INTRODUCTION

In 1991, the first stratified-random trawl survey was conducted in a part of the inshore areas of West Greenland (Disko Bay and Vaigat) to assess the trawlable biomass of shrimp and to collect information on the size composition of this stock component. The present paper reports on a similar survey in 1992 covering the same areas.

The fishery in West Greenland inshore areas (inside the three-mile limit) was relatively stable with catch levels ranging from 5,000 to 8,000 tons in the period 1965-87. Since then catches have increased to more than 21,000 tons in 1992. The increasing catches in recent years have made an evaluation of the Disko Bay and Vaigat resource essential, this being the most important inshore resource for the commercial fishery.

MATERIAL AND METHODS

The survey was carried out in depths between 150 and 600 m in the area shown in Fig. 1, bordering to the west the offshore shrimp survey strata (Carlsson & Kanneworff, 1993).

The survey was conducted in both years with the 722 GRT stern trawler *M/T PAAMIUT*, the same vessel used in the offshore surveys. The trawl was a SKJERVOY 3000/20 rigged with bobbin gear and a double-bag with 44 mm mesh size (streched) in the codend. Trawl doors were of the type PERFECT GREENLAND, size 370*250 cm, weight 2420 kg. Mean wing spread of the trawl was estimated from measured distances (SCANMAR) between the doors and information on the rigging of the trawl to 23.1 m by the Danish Institute for Fishing Technology (U.J. Hansen, pers.comm.).

Due to the more variable bottom topography in the inshore areas the planned duration of hauls was only 30 minutes, being half of the standard trawling time in the offshore surveys. 44 trawl stations were planned, with a coverage per haul of 210 sq.km. In order to minimize the influence of vertical migrations of the shrimp the trawling operations were - as in the offshore surveys - carried out at day time only (0900-1900 UTC).

Stratification of the area was based on information on the distribution of the commercial fishery, and nine strata were defined (Fig. 1). As information on depth in the area is unreliable, it was not possible to stratify after depth. The size of the strata was calculated by using an estimated 150 meters depth isoline as border. Depths greater than 600 m are rarely encountered.

Shrimp catches from each station (Table 1) and calculated swept area was used to estimate stratum biomasses. Mean biomass estimates were calculated for all strata.

Biological samples were taken from all catches. Shrimp were sorted by sexual characteristics, and oblique carapace length was measured to the nearest 0.1 mm and afterwards pooled in 0.5 mm groups. 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.

RESULTS AND DISCUSSION

Shrimp catches from all 44 stations were used to estimate the minimum trawlable biomass from all strata (Table 2). A total biomass of 46,585 tons (+/-12,676 tons) was estimated, similar to the 1991 biomass estimate (Carlsson et al., 1992).

In both years catches were fairly uniform over the total area (Fig. 2-3) with shrimp being present in all catches, apart from a few stations in the western part of stratum 9. Stratum 4 and 5 exhibited the highest and most stable catches, and the northern part of Vaigat (stratum 8) had the lowest catches.

The abundance of shrimp in the Disko Bay area is remarkably high taking into account the increasing fishing pressure in recent years. The estimated mean shrimp density in the area (5.0 tons/km²) is almost twice the mean density of the offshore stock in Davis Strait south of 69°30'N (2.7 tons/km²).

The estimated total numbers of shrimp (billions) in 1991 and 1992 are as follows (all females are multiparous at the time of the year, when the survey takes place):

Year	males	females	total
1991	5.5	1.9	7.5
1992	5.9	1.7	7.6

While the total numbers estimated are almost the same in both years, there is an evident shift in shrimp abundance between areas in 1992 when compared to 1991 (Fig. 4 and 5). Total number of shrimp increased in the central parts of the Disko Bay (stratum 4, 5, and 6), and in the southern and the northern part of the Vaigat (stratum 7 and 9). Numbers decreased especially in the southermost strata (1 and 2) and the central area in the Vaigat (stratum 8). In stratum 4 and 5 abundance of both males and females increased, while in stratum 6, 7, and 9 the increase was due to a higher abundance of males only. The lower shrimp density in stratum 1, 2, and 8 was based on decreasing numbers of both groups.

The overall length frequency distributions of shrimp in 1991 and 1992 are shown in Fig. 6. In 1991 the distribution was dominated by two components of males at 17 and 21 mm carapace length (CL), respectively - assumed to be the 1987 and 1985 year class. Females were dominated by a size group at 24.5 mm CL and several larger size groups.

In 1992 the 1987 year class was found around 18.5 mm CL and another significant male group at 22 mm CL. This year the 1985 year class was expected to have undergone transition to females, but - as discussed by Carlsson et al. (1993) - there remains doubt whether this actually took place for all individuals. If not, the component at 22 mm CL may contain part of the 1985 year class. Otherwise, this indicates a rather strong 1986 year class, which has not previously been identified in the data. Early recruitment of younger year classes of males is indicated at 11.5 and 15.5 mm CL. As in 1991, several year classes of female shrimp are found.

Fig. 7 (a-c) shows the overall length frequency distributions by strata in 1991 and 1992. The shift in shrimp abundance between strata in 1992 when compared to 1991 as described above is evident. In the strata with increasing numbers of shrimp (stratum 4, 5, 6, 7, and 9) the male group at 18.5 mm CL is dominating in stratum 6, 7, and 9, while the 22 mm group dominates in stratum 4 and 5. All the size groups described above can be identified in most strata.

By-catches in the present survey were higher than observed in the offshore areas, about 15% of the total catch at average. Greenland halibut, polar cod and redfish were the most common by-catch species.

REFERENCES

Carlsson, D.M., P. Kanneworff & D.G. Parsons, 1993. Stratified-Random Trawl Survey for Shrimp (*Pandalus borealis*) in NAFO Subarea 0+1 1992. NAFO SCR Doc. 93/70. Serial No. N2254.

Carlsson, D.M., P. Kanneworff & K.H. Nygaard, 1992. Report on a Stratified-Random Trawl Survey for Shrimp (*Pandalus borealis*) in Inshore Areas West Greenland, NAFO Subarea 1, in 1991. NAFO SCR Doc. 92/55. Serial No. N2108.

Table 1. List of trawl stations in the inshore shrimp survey 1992. Catches are given in kg.

STATION-IDENTIFICATION	AREA-CODE	DEPTH	TR-TIME	SHR	COD	GHL	RED	MIX	TOTAL
			STRATUM 1						
92PA0130042 002	LD023	279.0	30	245	.	6	4	5	260
92PA0130043 003	LD023	261.5	30	468	.	0	3	37	508
92PA0130044 008	LE023	265.0	23	29	.	.	0	1	30
92PA0130011 009	LE025	246.0	30	6	.	3	.	1	10
			STRATUM 2						
92PA0130008 001	LB026	285.0	30	106	.	1	0	15	122
92PA0130007 004	LD026	287.5	30	100	.	2	0	13	115
92PA0130009 006	LD027	323.0	31	176	.	27	2	17	222
92PA0130010 005	LE026	355.5	30	124	.	51	6	25	206
			STRATUM 3						
92PA0130001 017	LG020	447.5	30	144	.	18	2	8	172
92PA0130002 018	LG021	535.5	30	37	1	19	5	4	66
92PA0130003 022	LH019	260.5	30	633	.	4	1	34	671
			STRATUM 4						
92PA0130012 013	LF024	516.0	25	71	.	16	2	3	92
92PA0130041 012	LF024	385.5	30	696	.	28	8	25	758
92PA0130013 020	LG024	456.0	30	284	.	38	6	4	333
92PA0130017 021	LG025	369.5	30	322	.	12	0	20	354
92PA0130004 023	LH022	301.0	30	351	.	15	0	24	390
92PA0130005 019	LH023	488.0	30	255	.	17	3	8	282
92PA0130006 024	LH024	412.5	30	552	.	18	3	28	601
			STRATUM 5						
92PA0130015 014	LF026	417.5	28	309	.	67	4	12	392
92PA0130014 015	LF027	350.5	30	204	.	26	3	9	241
92PA0130016 016	LF027	313.5	30	240	.	56	0	14	310
92PA0130018 025	LH026	414.0	30	361	.	55	5	16	437
92PA0130019 026	LH027	397.5	30	275	.	53	2	22	351
			STRATUM 6						
92PA0130020 027	LH028	375.5	30	291	.	82	7	24	403
92PA0130021 028	LJ026	310.0	30	438	.	12	0	12	463
92PA0130040 029	LJ028	323.0	30	175	.	25	1	14	215
92PA0130022 030	LK025	247.5	27	101	.	1	.	6	108
92PA0130023 031	LK026	299.5	30	269	.	8	.	12	290
			STRATUM 7						
92PA0130026 032	LM024	202.5	30	289	.	1	.	8	297
92PA0130024 033	LM025	523.0	30	63	.	42	1	7	112
92PA0130027 035	LN022	167.0	30	260	.	.	.	15	274
92PA0130036 036	LN025	501.5	30	21	.	66	0	2	89
92PA0130025 034	LN026	427.0	30	160	.	26	.	9	195
92PA0130037 038	LP022	495.0	30	316	.	18	1	10	345
			STRATUM 8						
92PA0130038 037	LR021	403.0	30	237	.	23	0	29	289
92PA0130039 039	LR021	512.0	30	48	.	7	.	6	61
92PA0130034 044	LS017	551.0	30	36	.	13	4	4	56
92PA0130035 045	LS018	578.5	30	5	.	7	.	2	14
			STRATUM 9						
92PA0130030 040	LS012	197.5	30	0	.	.	1	3	4
92PA0130031 041	LS013	256.0	30	60	.	1	.	7	69
92PA0130032 042	LS014	247.5	30	147	.	1	.	8	157
92PA0130033 043	LT015	397.0	30	702	.	8	0	9	719
92PA0130028 046	LV012	221.5	30	0	.	.	0	6	6
92PA0130029 047	LV012	368.0	30	230	.	1	1	17	248

Table 2. Estimated trawlable biomass in the Disko Bay - Vaigat area, 1992.

STRATUM	SQKM	BIOMASS IN STRATA					
		TONS	HAULS	STD	STDERR	MIN	MAX
AREA 1	819	3303.6	4	3855.1	1927.5	140	8514
AREA 2	566	1509.9	4	733.6	366.8	926	2568
AREA 3	1124	5726.7	3	6355.5	3669.3	859	12917
AREA 4	1834	14269.0	7	7729.5	2921.5	3084	26541
AREA 5	612	3461.9	5	1063.2	475.5	2139	4632
AREA 6	1014	5551.6	5	2344.4	1048.4	2924	8741
AREA 7	1447	6415.5	6	4424.9	1806.4	631	10804
AREA 8	652	1047.8	4	1313.3	656.6	71	2971
AREA 9	1296	5299.6	6	7470.9	3050.0	0	19733

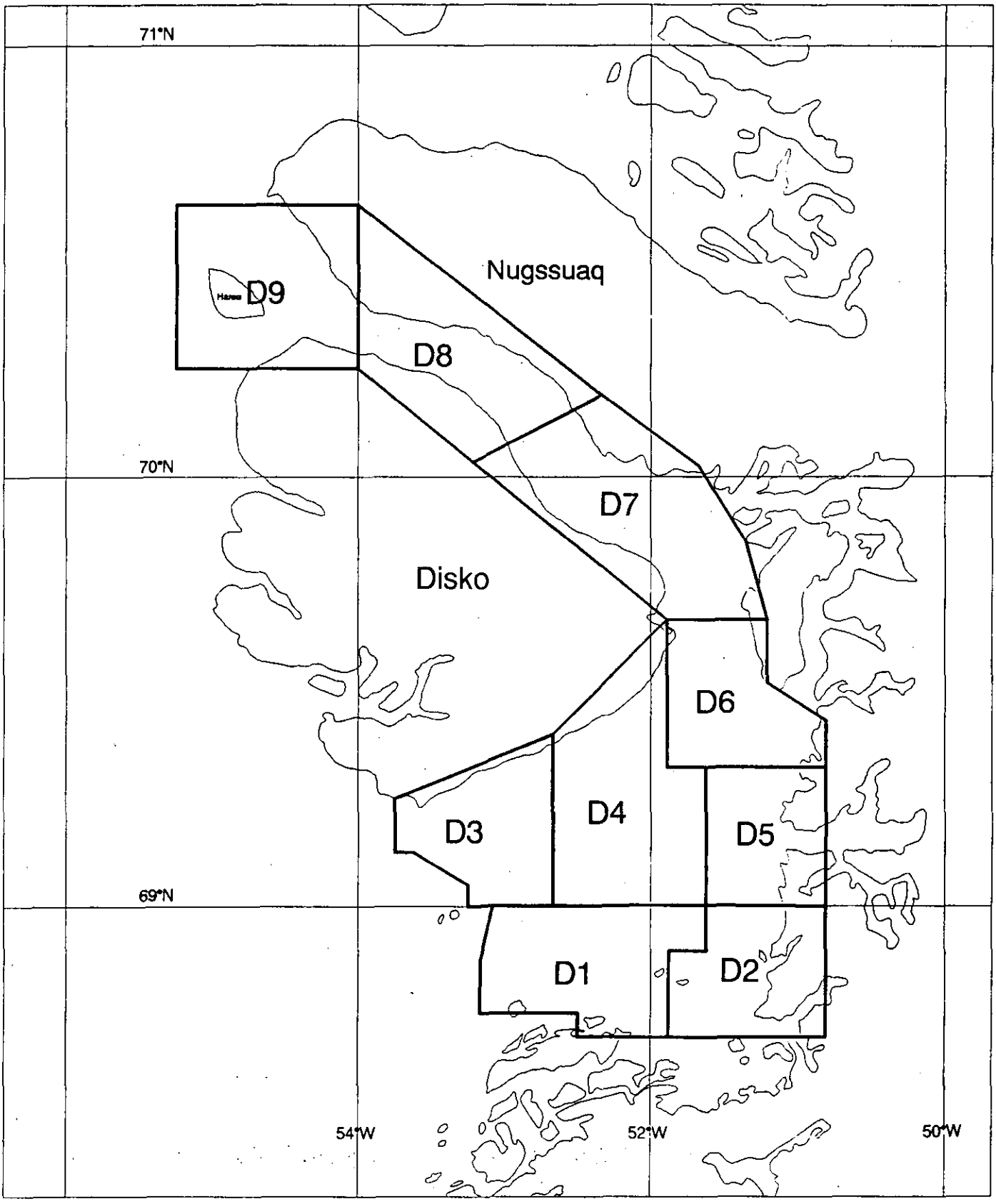

Figure 1. Stratification scheme for the Disko Bay – Vaigat shrimp survey, showing stratum numbering as used in the text.

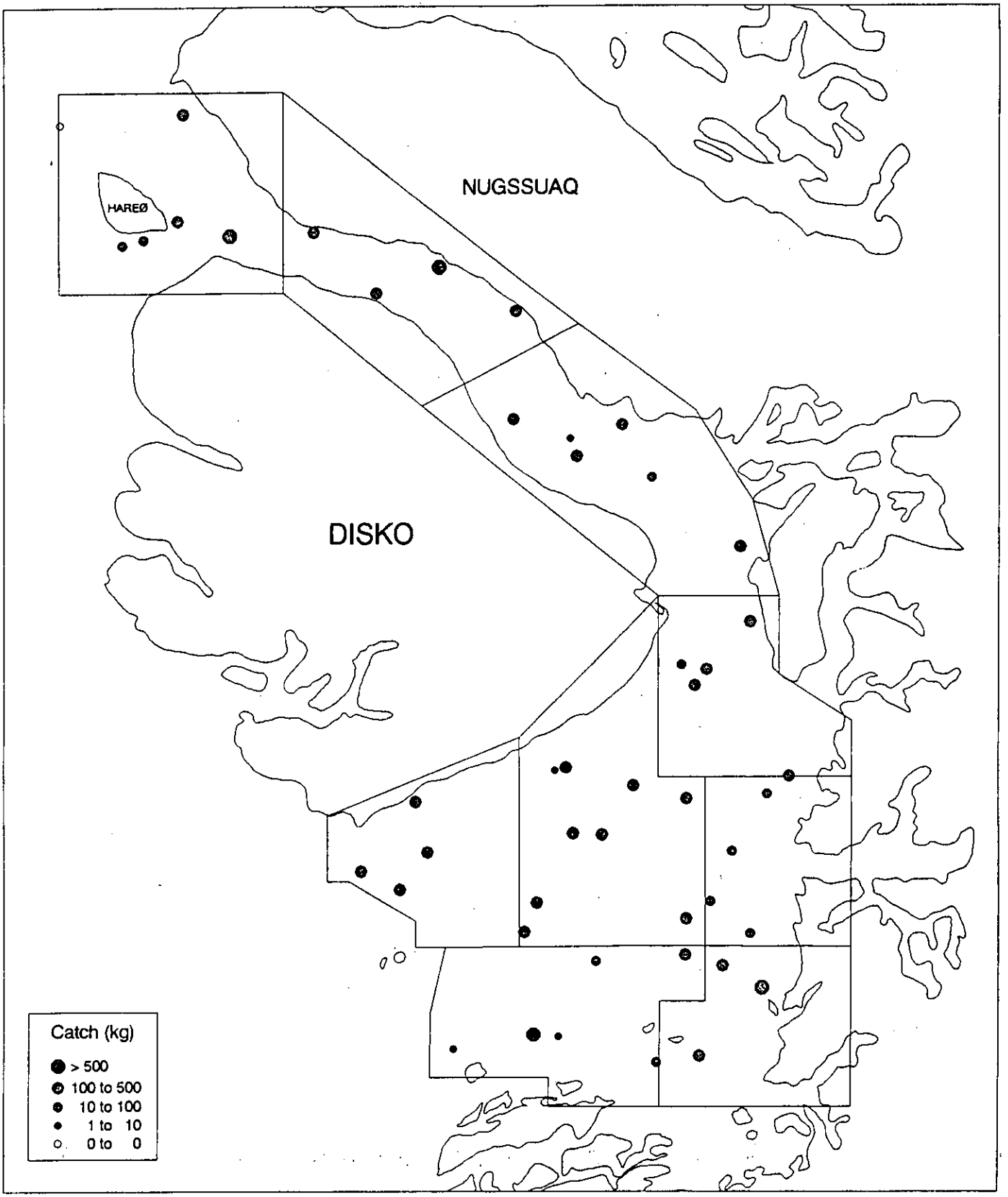

Figure 2. Sampling sites and trawl catch levels in the 1991 inshore survey.

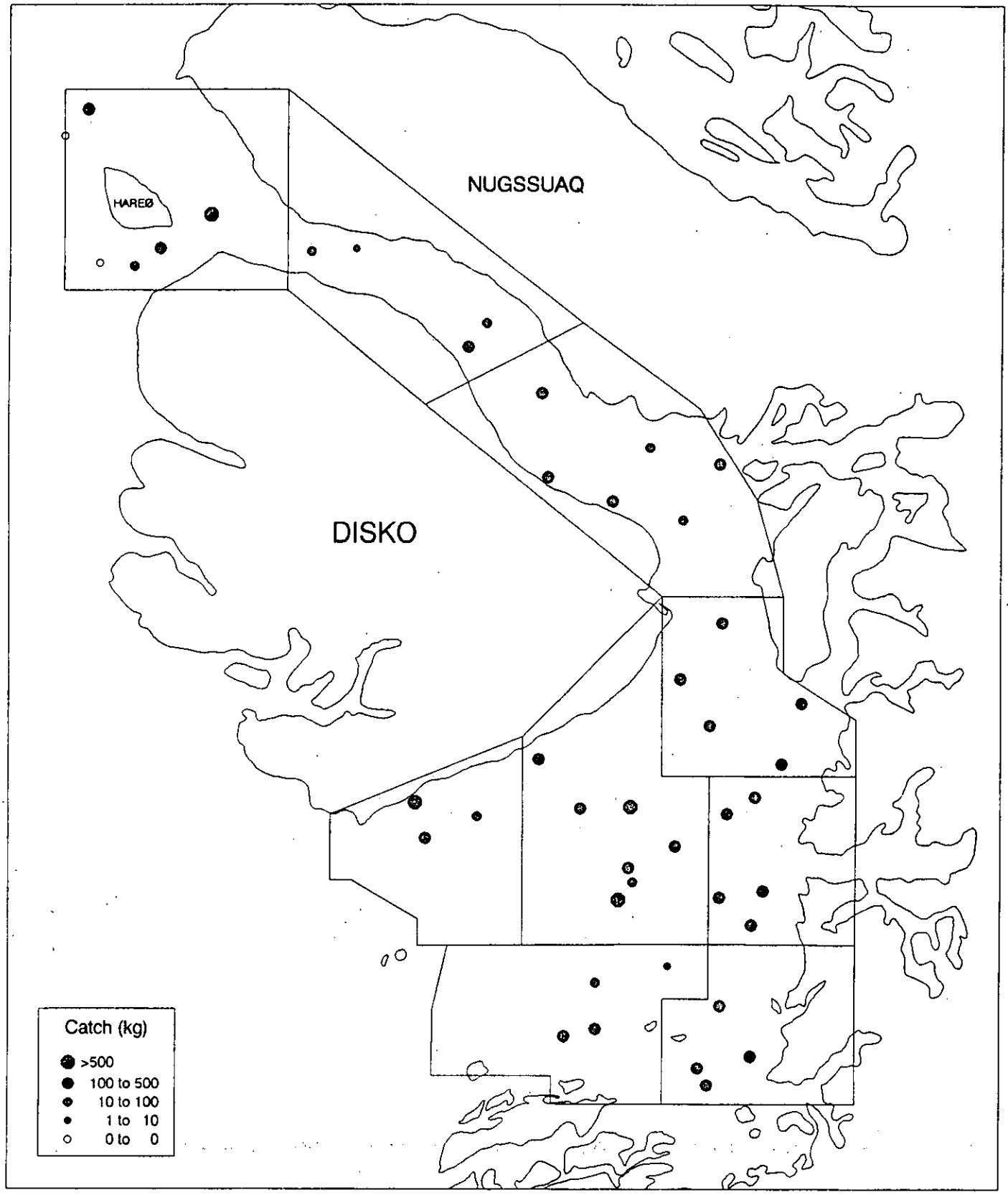

Figure 3. Sampling sites and trawl catch levels in the 1992 inshore survey.

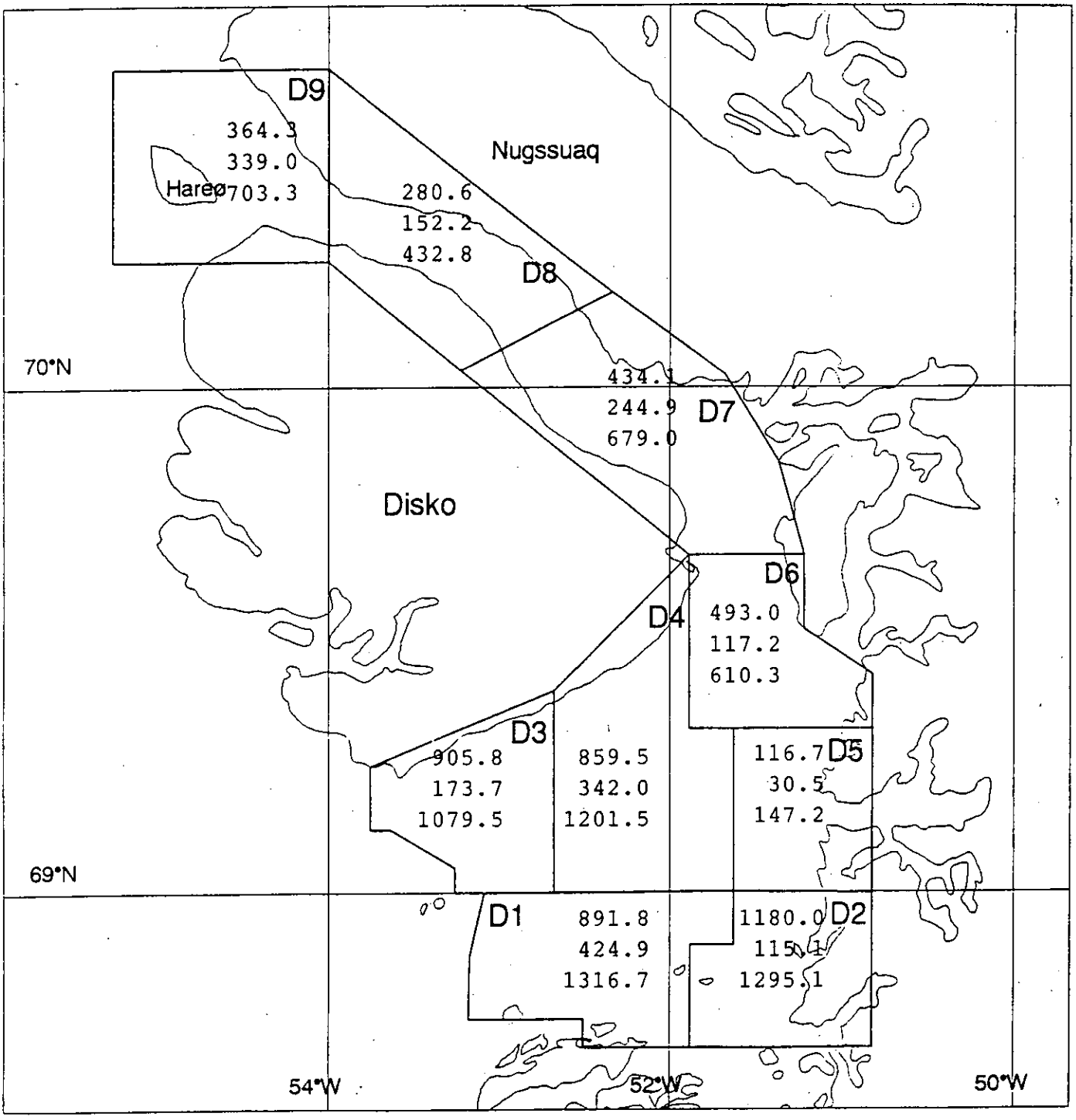

Figure 4. Calculated numbers of shrimp (males, females and total, in millions) per stratum in 1991.

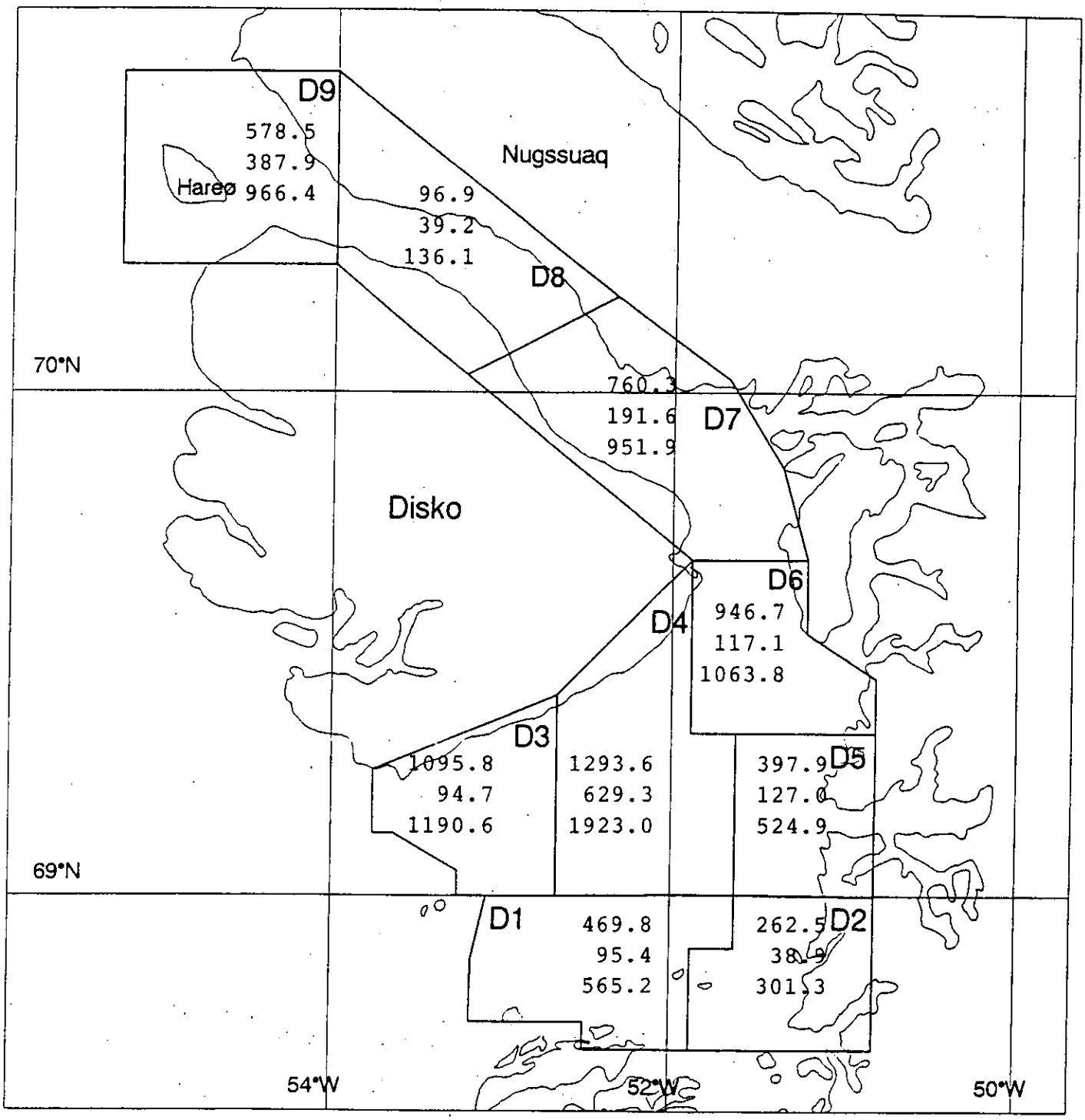

Figure 5. Calculated numbers of shrimp (males, females and total, in millions) per stratum in 1992.

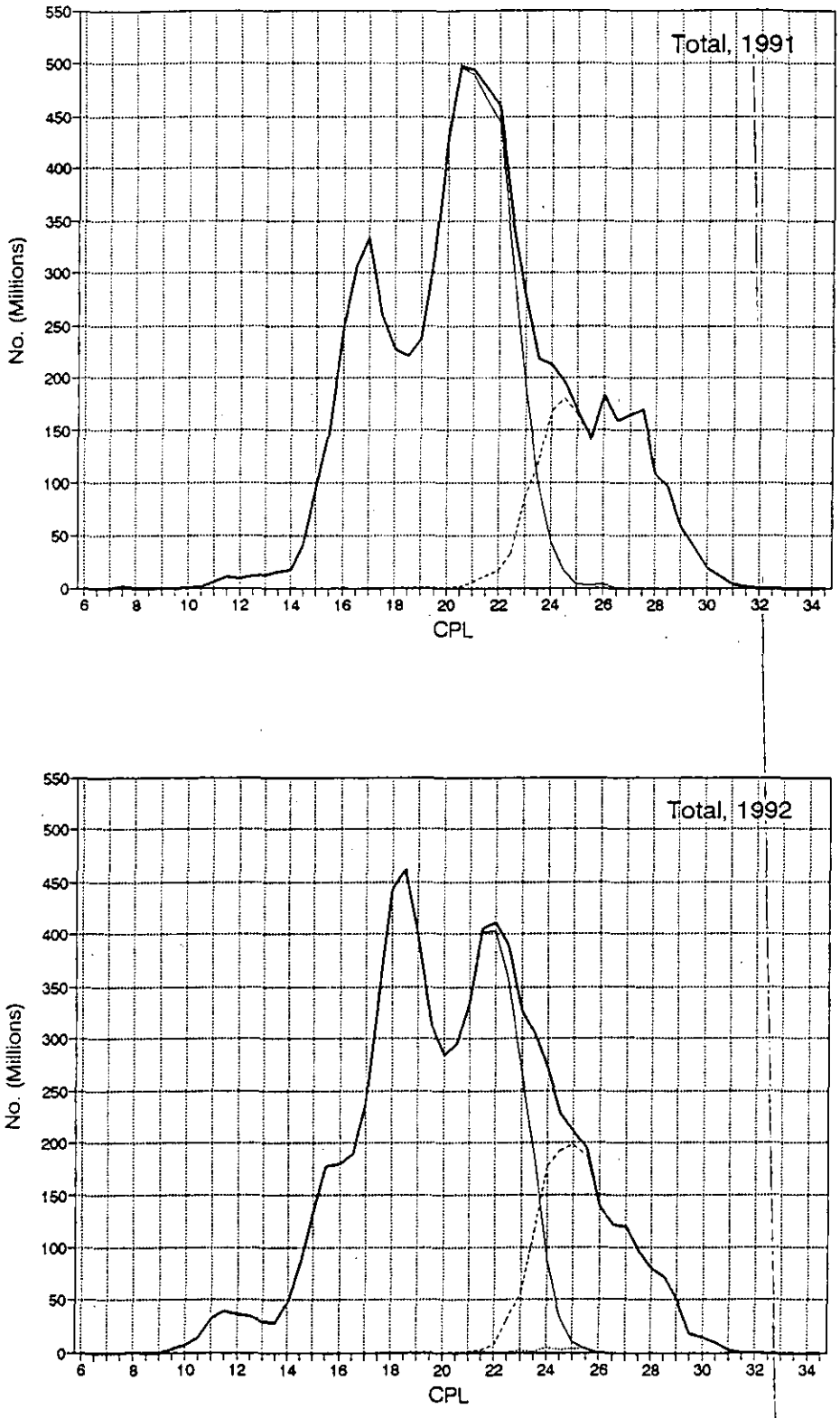

Figure 6. Numbers of shrimp by length group (CL) in the total survey area in 1991 and 1992, based on pooling of samples weighted by catch and stratum areas.

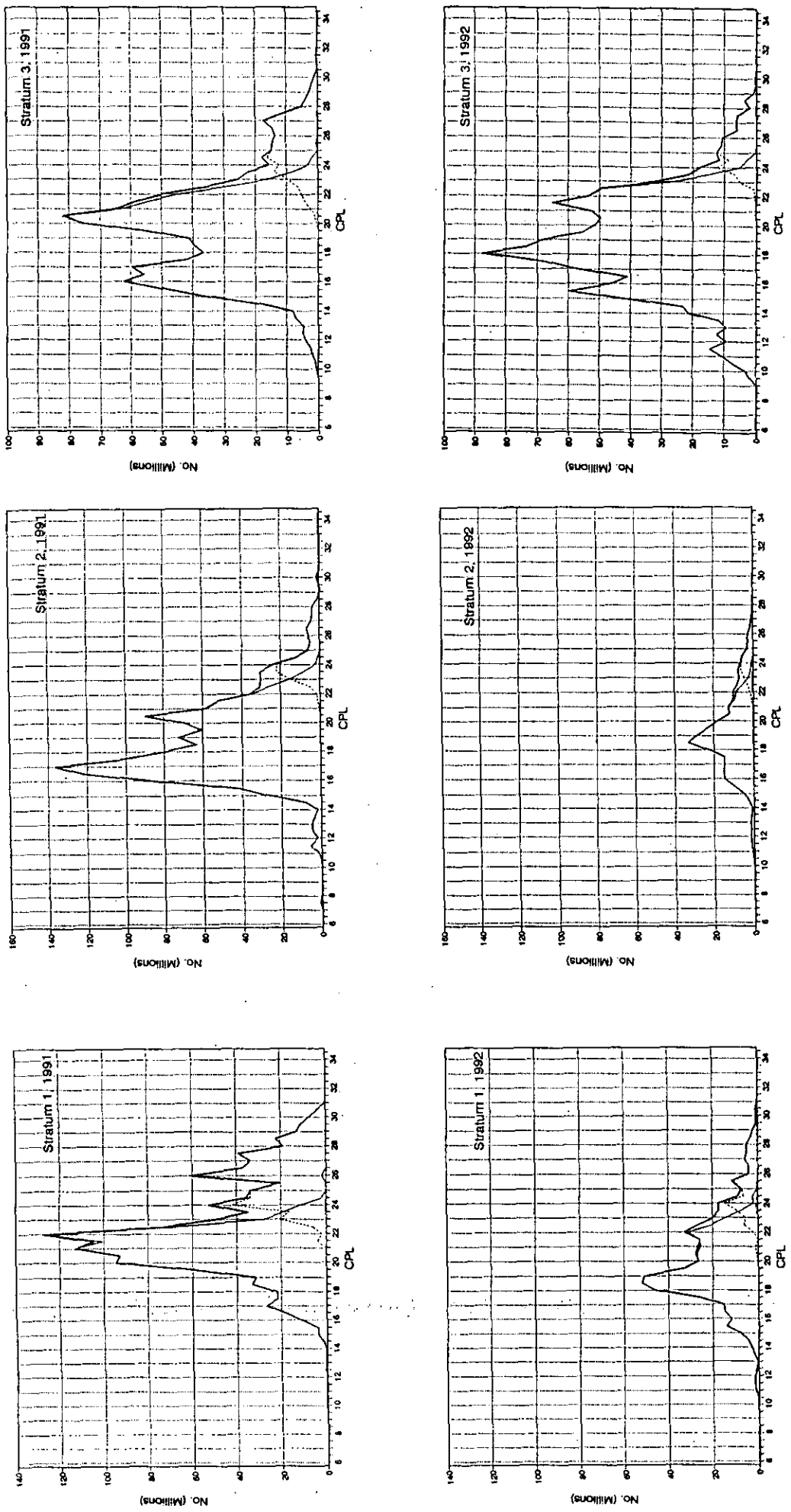

Figure 7a. Numbers of shrimp by length group (CL) in strata D1–D3 (see Fig. 1) in 1991 and 1992, based on pooling of samples weighted by catch and stratum area.

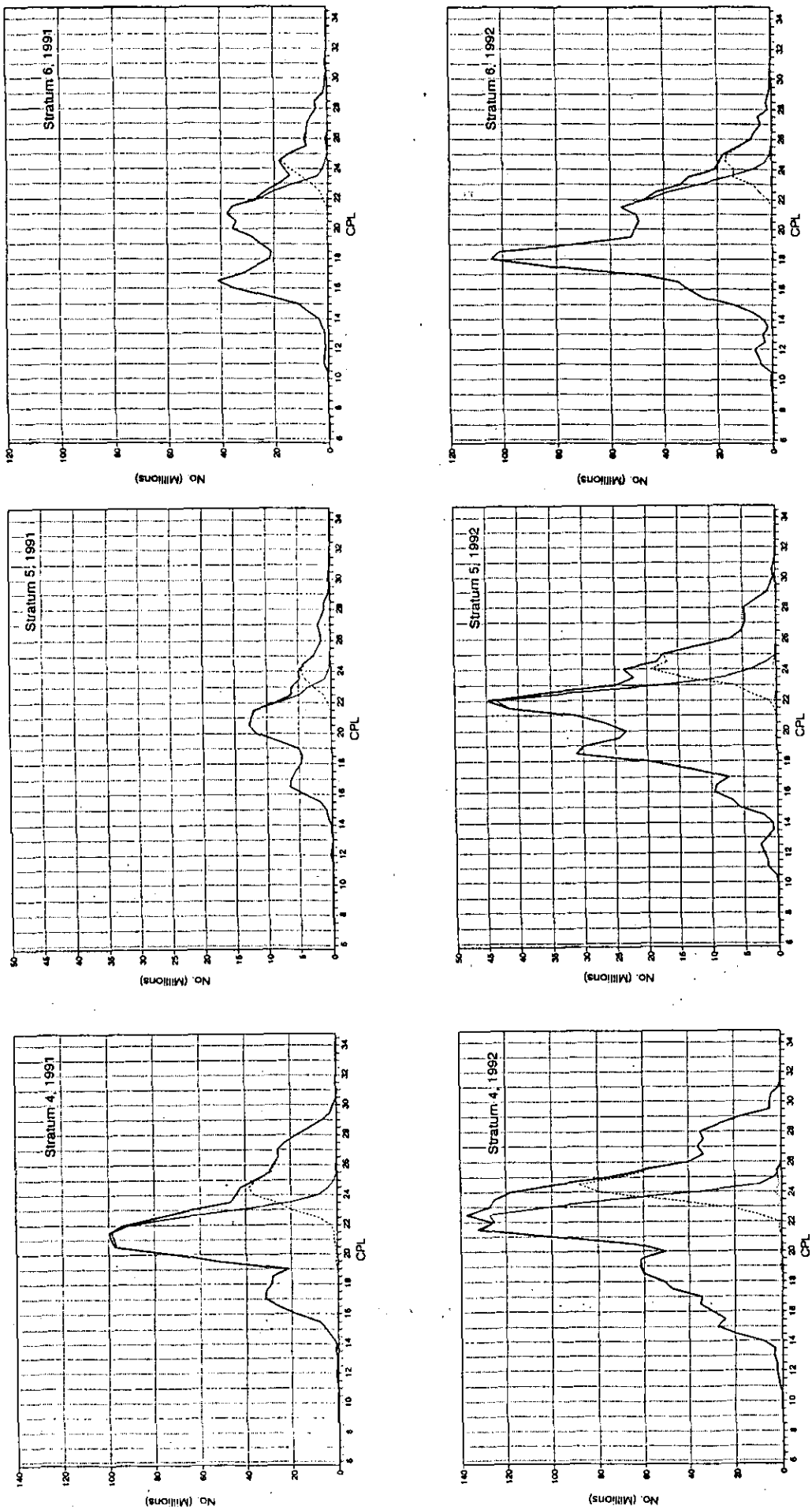

Figure 7b. Numbers of shrimp by length group (CL) in strata D4–D6 (see Fig. 1) in 1991 and 1992, based on pooling of samples weighted by catch and stratum area.

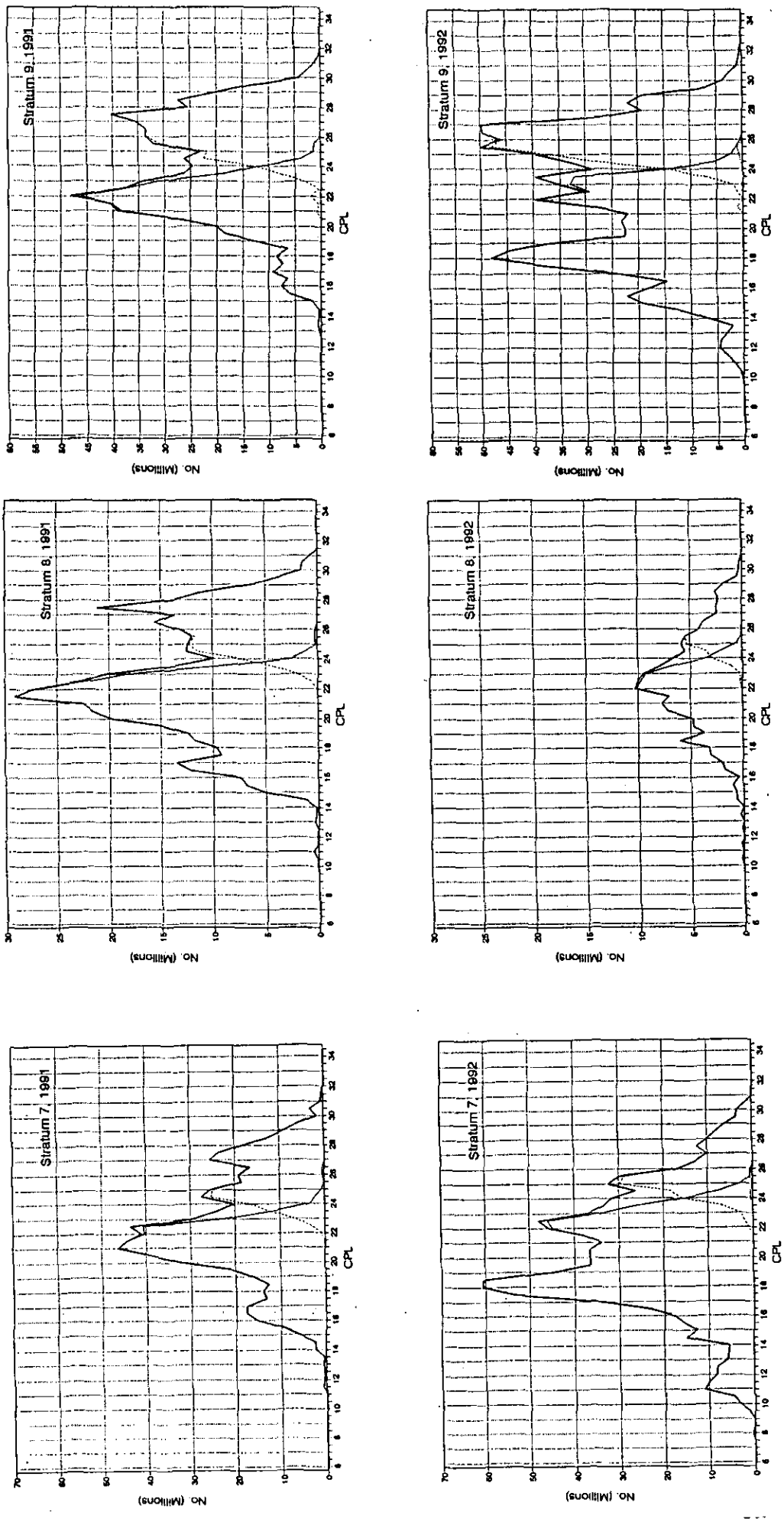

Figure 7c. Numbers of shrimp by length group (CL) in strata D7–D9 (see Fig. 1) in 1991 and 1992, based on pooling of samples weighted by catch and stratum area.