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Stratified-Random Trawl Survey for Shrimp (*Pandalus borealis*) Offshore in NAFO Subareas 0 and 1, in 1993

by

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Introduction

Greenland Fisheries Research Institute has conducted stratified-random surveys on and around the shrimp fishing grounds off West Greenland since 1988, during the months July-September (Fig. 1).

The survey is assumed to cover the offshore distributional area of the shrimp stock, *i.e.* the southern parts of NAFO Div. 1A, those parts of NAFO Div. 1B-F that lies within the depth range from 150-600 meters (in 1F from 100 meters), and a small part of south eastern NAFO Div. 0A.

The commercial catch of shrimp in the survey area totalled approximately 63,500 tons in 1992.

Materials and methods

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.

To prevent effects of nocturnal vertical migrations, stations were only fished in the timespan 0900-1900 UTC. Standard towing time was 60 minutes and towing speed was kept around 2.5 knots. The towing time was counted from the moment the pressure on the winches increased after shooting the gear. The termination of the tow was defined as the moment the winches began to haul. The position of the vessel was noted at the beginning and end of each tow.

Details on trawl performance on the bottom has been obtained from Danish Institute of Fishing Technology and Aquaculture in Denmark, based on information on size and type of trawl, trawl doors, warp length, towing speed and distance between doors. The mean wingspread was calculated to be 20.7 m, a little less than former years, in concordance with the increased water pressure on the gear, due to the finer meshed codend used this year.

Swept area was calculated as the distance between starting and ending position, multiplied by the mean wingspread.

Stratification

All shrimp within the survey area are assumed to belong to a single stock (NAFO, 1992) occurring mainly at depths between 150 and 600 meters. Stratification within the area of shrimp occurrence is based on the distribution of the commercial fishery. Three regions are defined:

N: The northern region off West Greenland. The northern limit is at 72°30'N and the western at 59°00'W. The eastern limit is an approximated 3 nm limit line. North of 69°30'N bottom topography is not well known, so depth stratification cannot be performed. This line is therefore set as the southern limit of the region. The region is divided into seven strata, based on commercial catches in statistical units of 7.5° latitude and 15° longitude.

W: Together with C, the main area of shrimp distribution. More than 95 % of the biomass (1993) is found in these two regions. The region is divided into eight areas, based on distribution of commercial catches and bottom topography. Each of these are further divided into strata, based on depth. In the areas W1-W7, depth strata recognized are; 150-200 meters, 200-300 meters,

300-400 meters, and 400-600 meters. In the southernmost area (W8), introduced to the survey in 1992, improper sea charts makes stratification, based on depth, difficult. Only two strata, 100-200 meters and 200-600 meters, can be identified. The area of the region has been increased somewhat over the six years the surveys have been conducted. In 1993 the area of areas W1, W2 and W4 have been extended towards East, an increase in the survey area of 3,133 sq.km. Further, the inclusion of W8 adds 12,525 sq.km to the area of this region.

C: The part of the main distributional area that lies within Canadian territorial waters. Two areas (C1, C3) with the same depth stratification as in W.

Hauls were allocated to strata proportionally to the area of these. Strata with a low commercial catch in N (2 and 6) were only given half the coverage. At least two hauls were planned in each stratum.

From each haul a sample of approx. 5 kg of shrimp was taken from the codend of the trawl, before it was emptied into the pounder. After 10 minutes of drip-drying the sample was weighed. The shrimp were sorted by sex and the oblique carapax length was measured by slide calliper to the nearest 0.1 mm. The total catch was sorted by species and weighed.

Results and discussion

The 126 hauls that were taken in the shrimp strata in the period between July 10th and September 27th are shown in Fig. 2. Table 1 lists the stations by stratum and shows the catch in kg of shrimp, cod, Greenland halibut, redfish, and other species combined. 1993 has been a year with exceptionally much ice, and access to stations in the western part of the survey area was hampered, resulting in a distribution of effort, somewhat different from that originally planned. The resulting number of hauls and estimated biomass per stratum are shown in Table 2.

In W8 a large biomass of shrimp in the depth 200-600 meters is indicated. This might be a considerable overestimation, however. The catch statistics from this area (Carlsson *et al.* 1993) shows that the fishery is restricted to a small part of the area. This indicates low densities in the rest (major part) of the area, and suggests the risk of overestimation of biomass in cases where the stations (by chance) concentrates around the fishing fields. The stratification of the area will have to be reconsidered.

The total biomass in tons in each of the three regions are shown in the following text table. Because of the special circumstances in Julianehaab Bay, mentioned above, biomass is calculated for the whole region as well as for the region used in earlier yearstional survey area (strata W1-W7) only.

Area	Biomass	+/-
N	9057	9052
C	3609	3930
W1-W7	211966	60813
W1-W8	246470	75909

In table 3 the biomass is shown by region for each year since 1988. Figure 3 shows the biomass by year in groups of strata. The total biomass estimate from the 1993 survey is the highest in the survey series. It is also evident that displacement between strata have taken place from year to year.

In region N a decrease in biomass in 1993 compared to 1992 is seen, but only to a level similar to that of the years 1988 to 1991. Figure 3 shows that the decline is particularly pronounced in the southern strata, N5-N7, but also evident in the northern parts.

In region C the picture is much the same as in region N - a decrease from 1992 to 1993, but not outside the range of the estimate in other years.

Only in region W there is an increase in total biomass. The increase is most pronounced in the northern parts of the region (strata W1 and W2), and in the south (stratum W6).

Figure 4 shows that the bulk of the biomass is concentrated in the eastern part of the area, close to the coast. This is different from 1992 (Carlsson *et al.* 1993b) when high densities were found further to the West.

From table 4 it is seen that there has been no obvious change in the overall distribution of biomass by depth from 1992 to 1993.

The introduction of a finer meshed codend in 1993 (20 mm as opposed to 44 mm, used in previous years) does not seem to account for any of the observed increase in estimated biomass. The variation between hauls taken with the same mesh size is at a level that exceeds the variation between hauls with different mesh sizes. 30 sets of hauls spread over the entire survey area, with two hauls at each station (keeping all parameters except mesh size equal) showed no significant difference in the weight of shrimp caught.

There was, however, a significant increase in the amount of other species caught, particularly of those fish species which in this paper are pooled as "mix", and pelagic amphipods.

Stock Composition

Overall length-frequency distributions of shrimp for the traditional survey area (strata N1-N7, C1, C3, W1-W6) in 1988-93 are given in Fig. 5. The text table below shows total numbers of males and females as calculated by year.

No. of shrimp (billions)	1988	1989	1990	1991	1992	1993
males	18.1	31.9	21.9	12.2	20.9	31.8
females	7.7	6.0	8.0	4.4	5.5	7.9
Total	25.9	37.8	29.8	16.6	26.5	39.7

The table shows an increase in numbers of both males and females from 1992 to 1993 and an increase in total number of shrimp to the level of 1989. The overall 1993 distribution suggests that the increasing number of females is due at least partly to transition of that part of the 1985 year class, that did not undergo transition in 1992 (found around 22 mm CL in 1992). The number of males found in 1993 is biased upwards when compared to earlier years due to the introduction in 1993 of a 20 mm mesh size in the cod-end of the survey gear.

Figures 6a and 6b show length frequencies by stratum in 1993. The strata north of 69°30'N are combined (stratum NW = N1-N4, NS = N5-N7), as are strata on the Canadian side of the midline (stratum C = C1+C3). Overall frequencies for stratum NW, NS, and C show decreasing numbers of both males and females in 1993 compared to 1992 (Carlsson *et al*, 1993b). In strata W1 to W6 shrimp abundance is increasing to the north (W1+W2) and to the south (W6), but decreasing in W3 and W5. In W1 prominent peaks of males are found at 12, 18.5 and 21 mm CL. In W2 one prominent male peak is found at 20.5 mm CL, smaller male groups being present but not numerous. In W6 the increase is occurring in male groups peaking at 17, 19 and 20 mm CL, representing at least two year classes. In W2 and W6 the increase in abundance is also due to increasing numbers of females.

Conclusions

The total biomass estimate from the stratified-random trawl survey indicates an increase in biomass between 1992 and 1993. No overall change of distribution of biomass by depth has been observed, but a displacement of biomass towards the eastern and southern parts of the area south of 69°30'N is indicated.

Total number of shrimp increased between 1992 and 1993 to the level of 1988. The number of females increased, probably mainly due to transition of the remaining males from the 1985 year class. Also the number of males increased, but it may be biased upwards due to the introduction in 1993 of 20 mm mesh size in the cod-end (against 44 mm used in earlier years). However a number of male size groups are present in the stock, indicating a basis for recruitment to the fishery in coming years.

References

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TABLE 1a. List of trawl stations in strata west of the midline, and north of 69°30'N in the Davis Strait survey, July-August 1993. Catches are given in kg.

STATION-IDENTIFICATION	AREA-CODE	DEPTH	TR-TIME	SHR	COD	GHL	RED	MIX	TOTAL
STRATUM C1-3									
93PA0060009 056	KX438	316.5	60	48	0	2	5	20	74
STRATUM C1-4									
93PA0060007 059	KX435	495.5	60	72	0	8	85	28	192
STRATUM C3-2									
93PA0060015 069	KN439	283.0	60	3	0	1	1	3	7
STRATUM C3-3									
93PA0060013 081	KR439	307.0	60	72	0	3	2	5	82
93PA0060012 048	KS439	397.5	60	620	0	74	358	8	1060
93PA0060010 057	KV436	319.0	60	3	0	1	1	13	18
93PA0060011 051	KV436	308.5	60	1	0	1	0	6	9
STRATUM C3-4									
93PA0060014 045	KN439	518.0	60	32	0	6	56	34	127
93PA0060008 055	KV435	432.0	60	173	0	18	167	35	392
STRATUM N1									
93PA0050018 122	ML007	296.0	60	77	0	7	0	206	289
93PA0050016 125	MM001	354.5	60	3	0	2	0	351	357
93PA0050015 124	MM440	310.0	60	0	0	0	0	10	10
93PA0050017 126	MP007	422.5	60	217	0	29	0	51	297
STRATUM N2									
93PA0050013 113	MB438	366.0	60	35	0	6	0	23	65
93PA0050014 120	MH001	262.5	40	0	0	0	0	49	49
93PA0050019 121	MJ005	181.0	42	0	0	0	0	17	17
STRATUM N3									
93PA0050021 117	MF007	268.0	60	2	0	1	0	50	54
93PA0050020 119	MG007	277.5	60	47	0	9	0	120	175
STRATUM N4									
93PA0050024 114	MB003	321.5	60	3	0	1	0	15	19
93PA0050022 116	MB006	357.5	60	0	0	0	0	3	3
93PA0050023 115	MB006	367.0	61	453	0	5	0	77	535
STRATUM N5									
93PA0060003 099	LL439	325.5	60	0	0	1	2	50	53
93PA0060001 101	LM438	299.5	60	0	0	0	2	24	26
93PA0060002 100	LM438	339.5	60	0	0	0	0	0	0
93PA0050009 105	LT438	506.5	60	0	0	16	3	3	23
93PA0050010 108	LX440	499.5	60	1	0	9	6	2	17
93PA0050011 110	LZ440	474.0	60	2	0	10	0	47	58
93PA0050012 112	MA439	355.5	60	1	0	1	3	22	26
STRATUM N6									
93PA0050008 102	LP003	291.0	45	0	0	0	0	1	2
93PA0050025 111	MA006	533.5	60	12	0	44	1	14	70
STRATUM N7									
93PA0050027 107	LS011	151.0	60	0	0	0	0	17	17
93PA0050026 109	LV009	215.0	60	0	0	1	0	4	5

TABLE 1b. List of trawl stations in strata between 67°00'N and 69°30'N, east of the midline in the Davis Strait survey, July-August 1993. Catches are given in kg.

STATION-IDENTIFICATION	AREA-CODE	DEPTH	TR-TIME	SHR	COD	GHL	RED	MIX	TOTAL
STRATUM W1-1									
93PA0040045 086	LE008	179.5	60	0	0	0	0	1	1
93PA0040038 094	LG012	150.5	60	0	0	0	0	0	0
93PA0040040 095	LH010	195.5	60	0	0	0	0	30	30
STRATUM W1-2									
93PA0050007 091	LF001	287.0	60	0	0	0	0	15	15
93PA0040042 093	LG004	212.5	50	0	0	0	0	0	0
93PA0040041 097	LJ005	207.5	60	0	0	0	0	0	0
93PA0040036 098	LJ010	248.5	60	99	0	9	0	337	445
93PA0040037 096	LJ012	234.0	60	7	0	3	1	53	63
STRATUM W1-3									
93PA0050003 067	LA003	341.5	60	552	0	31	92	9	684
93PA0050002 068	LA004	344.0	60	840	0	34	17	8	899
93PA0050001 066	LA006	392.0	60	73	0	9	221	6	309
93PA0050004 065	LA440	330.5	60	285	0	14	12	19	329
93PA0050005 074	LB002	311.0	60	40	0	2	4	9	55
93PA0050006 078	LB002	305.5	60	124	0	5	2	14	144
93PA0040043 077	LB004	307.0	60	1064	0	55	39	35	1193
93PA0040044 075	LB005	322.0	60	1560	0	45	30	45	1680
93PA0040046 076	LB008	319.0	61	513	0	10	1	49	572
93PA0040047 072	LB008	357.0	60	1116	0	22	1	35	1174
93PA0060004 089	LE438	328.0	60	4	0	1	0	13	18
STRATUM W1-4									
93PA0060006 079	LD436	498.5	60	5	0	14	49	15	82
93PA0060005 087	LE436	486.0	60	30	0	12	189	19	250
STRATUM W2-1									
93PA0040039 090	LF012	177.0	60	0	0	0	0	10	10
STRATUM W2-2									
93PA0040048 071	LB010	261.5	60	5	0	1	1	14	20
93PA0040049 080	LD013	269.0	60	1	0	0	1	5	7
93PA0040034 083	LD016	242.0	60	145	0	1	5	57	208
93PA0040035 085	LE013	282.5	60	154	0	2	2	16	173
STRATUM W2-3									
93PA0040031 060	KX015	335.0	60	1887	0	18	10	70	1985
93PA0040050 064	LA011	349.5	60	1008	0	14	3	53	1079
STRATUM W2-4									
93PA0040032 073	LB016	441.5	60	435	1	12	135	131	712
93PA0040033 082	LE017	491.5	52	900	0	14	28	23	965
STRATUM W3-1									
93PA0040027 040	KL007	152.5	60	0	0	0	0	3	3
93PA0060027 042	KM006	194.0	61	0	0	0	0	3	3
93PA0060020 047	KS006	159.0	60	0	0	0	0	3	3
STRATUM W3-2									
93PA0060032 039	KK006	273.5	60	17	0	0	0	1	17
93PA0060030 041	KL003	277.5	60	322	0	0	1	4	326
93PA0060029 043	KM002	238.0	60	0	0	0	0	4	4
93PA0060017 044	KN001	246.5	60	0	0	1	0	2	3
93PA0060028 046	KP005	207.5	60	0	0	0	0	1	1
93PA0060016 070	KP440	279.5	61	0	0	1	0	5	7
93PA0040055 052	KV006	261.5	60	37	0	1	0	5	42
STRATUM W3-3									
93PA0060019 049	KT003	341.0	60	471	0	2	17	39	528
93PA0040056 053	KX006	330.5	60	190	0	2	9	15	215
93PA0040054 058	KX009	371.5	60	808	0	10	13	18	849
93PA0040030 054	KX012	312.0	60	609	0	6	1	21	637
STRATUM W3-4									
93PA0060018 050	KV001	426.5	60	300	0	64	320	6	690
93PA0040053 061	KX011	529.0	62	82	0	70	35	12	199
93PA0040051 063	KZ009	494.0	60	49	0	82	42	8	182
93PA0040052 062	KZ009	521.5	60	64	0	97	16	16	193

TABLE 1c. List of trawl stations in strata between 60°15'N and 67°00'N in the Davis Strait survey, July-August 1993. Catches are given in kg.

STATION-IDENTIFICATION	AREA-CODE	DEPTH	TR-TIME	SHR	COD	GHL	RED	MIX	TOTAL
STRATUM W4-1									
93PA0040007 028	JZ010	180.0	60	1	0	0	1	2	3
93PA0040009 030	KA011	195.0	60	1	0	0	0	3	3
93PA0060042 151	KA013	150.5	60	0	0	0	0	3	4
93PA0040012 033	KE008	165.5	60	0	0	0	0	1	1
93PA0040013 037	KG008	171.5	60	0	0	0	0	1	2
93PA0040014 038	KG008	163.0	60	0	0	0	1	2	3
STRATUM W4-2									
93PA0040008 029	JZ010	211.5	60	0	0	0	0	1	1
93PA0040010 031	KB013	274.5	60	712	0	4	3	7	726
STRATUM W4-3									
93PA0040011 032	KD007	343.0	60	835	0	1	16	11	863
93PA0040016 035	KF016	352.0	60	463	0	13	9	41	525
STRATUM W4-4									
93PA0040015 034	KF016	473.0	60	808	0	100	23	78	1010
93PA0060031 036	KG006	554.0	61	1	0	3	3	4	10
STRATUM W5-1									
93PA0040021 024	JJ018	154.5	60	0	0	0	0	2	2
93PA0040024 025	JL015	166.5	60	0	0	0	0	1	1
STRATUM W5-2									
93PA0040004 018	JD018	276.0	60	320	0	0	28	1	350
93PA0040003 017	JD019	261.5	60	131	0	0	1	5	136
93PA0040005 019	JF016	227.0	61	2	0	0	1	0	3
93PA0040020 023	JJ020	266.0	60	1674	0	0	7	4	1685
STRATUM W5-3									
93PA0040022 022	JJ012	338.5	60	0	0	0	26	0	27
93PA0040025 026	JL014	332.0	60	51	0	1	7	2	62
STRATUM W5-4									
93PA0040006 020	JF020	447.0	61	374	2	36	37	37	486
93PA0040019 021	JF020	444.5	60	280	0	11	15	33	339
93PA0040026 027	JP012	533.5	60	0	0	2	5	3	10
STRATUM W6-2									
93PA0080013 010	HK030	280.5	60	1440	13	33	182	248	1915
93PA0080009 011	HP025	256.5	60	318	0	0	7	23	348
93PA0040001 014	HV025	216.0	63	2	0	0	0	0	2
STRATUM W6-3									
93PA0080008 012	HP025	342.0	60	1756	1	1	461	468	2687
93PA0080003 015	HV023	354.0	60	466	4	1	48	12	531
STRATUM W6-4									
93PA0080017 009	HF030	457.0	61	0	0	0	4	4	8
93PA0040002 016	HV025	454.0	60	1531	0	43	46	36	1656
STRATUM W7-1									
93PA0080025 003	GS036	164.5	60	0	0	0	1	27	28
93PA0080021 004	GV034	190.5	61	0	0	0	1	122	123
STRATUM W7-2									
93PA0080022 006	GV034	228.5	60	0	0	0	1	1	2
93PA0080020 007	HA033	267.5	60	1526	0	3	15	21	1564
STRATUM W7-3									
93PA0080027 002	GP037	335.0	60	3	0	0	33	22	58
STRATUM W7-4									
93PA0080019 008	HB030	440.5	34	0	0	0	1	4	5

TABLE 2a. Estimated trawlable biomass in strata west of the midline in the Davis Strait survey July-August 1993.

STRATUM	SQKM	BIOMASS IN STRATA					
		TONS	HAULS	STD	STDERR	MIN	MAX
AREA C1 300-400 M	655	378.9	1	.	.	379	379
AREA C1 400-600 M	312	309.3	1	.	.	309	309
AREA C3 200-300 M	660	21.5	1	.	.	21	21
AREA C3 300-400 M	1192	2172.2	4	3729.1	1864.6	14	7731
AREA C3 400-600 M	623	727.4	2	650.6	460.1	267	1187

TABLE 2b. Estimated trawlable biomass in strata north of 69°30'N in the Davis Strait survey July-August 1993.

STRATUM	SQKM	BIOMASS IN STRATA					
		TONS	HAULS	STD	STDERR	MIN	MAX
AREA N1	3649	3045.8	4	4367.9	2184.0	0	9320
AREA N2	11789	1369.7	3	2372.5	1369.7	0	4109
AREA N3	367	78.6	2	99.2	70.1	8	149
AREA N4	2249	3581.3	3	6141.1	3545.6	9	10672
AREA N5	5990	33.2	7	30.8	11.6	0	93
AREA N6	15926	946.8	2	1258.6	890.0	57	1837
AREA N7	1159	1.2	2	1.7	1.2	0	2

TABLE 2c. Estimated trawlable biomass in strata south of 69°30'N east of the midline in the Davis Strait survey July-August 1993.

STRATUM	SQKM	BIOMASS IN STRATA					
		TONS	HAULS	STD	STDERR	MIN	MAX
AREA W1 150-200 M	2416	0.0	3	0.0	0.0	0	0
AREA W1 200-300 M	5295	1298.4	5	2719.7	1216.3	0	6158
AREA W1 300-400 M	9239	55139.3	11	48694.5	14681.9	495	142983
AREA W1 400-600 M	752	121.8	2	125.0	88.4	33	210
AREA W2 150-200 M	1857	0.0	1	.	.	0	0
AREA W2 200-300 M	3026	2833.0	4	3190.0	1595.0	34	6043
AREA W2 300-400 M	2158	32268.8	2	12096.2	8553.3	23715	40822
AREA W2 400-600 M	1723	11495.2	2	6840.7	4837.1	6658	16332
AREA W3 150-200 M	2215	0.0	3	0.0	0.0	0	0
AREA W3 200-300 M	4810	2910.7	7	6615.9	2500.6	0	17842
AREA W3 300-400 M	2714	14696.7	4	7176.6	3588.3	5413	21090
AREA W3 400-600 M	3361	4284.4	4	4327.8	2163.9	1643	10753
AREA W4 150-200 M	4252	11.3	6	14.7	6.0	0	36
AREA W4 200-300 M	1791	6327.6	2	8946.0	6325.8	2	12653
AREA W4 300-400 M	812	5068.6	2	2048.5	1448.5	3620	6517
AREA W4 400-600 M	1967	8233.4	2	11631.1	8224.4	9	16458
AREA W5 150-200 M	1995	1.0	2	1.4	1.0	0	2
AREA W5 200-300 M	3454	17905.4	4	26736.9	13368.5	72	57525
AREA W5 300-400 M	1797	392.4	2	555.0	392.4	0	785
AREA W5 400-600 M	2806	6355.8	3	5658.9	3267.2	6	10866
AREA W6 200-300 M	1491	11365.0	3	14802.7	8546.4	39	28115
AREA W6 300-400 M	1300	15716.8	2	13534.9	9570.6	6146	25287
AREA W6 400-600 M	884	7589.8	2	10731.8	7588.5	1	15178
AREA W7 150-200 M	2419	0.0	2	0.0	0.0	0	0
AREA W7 200-300 M	985	7942.2	2	11230.5	7941.1	1	15883
AREA W7 300-400 M	239	7.4	1	.	.	7	7
AREA W7 400-600 M	273	0.9	1	.	.	1	1

TABLE 3. Sums of estimated biomasses in main regions 1988-93.

AREA	BIOMASS IN YEAR 1988	1989	1990	1991	1992	1993
WEST	140332	176525	151402	108406	141158	211966
CANADA	9305	3836	11425	4668	16764	3609
NORTH	21901	11342	11733	6032	21164	9057
TOTAL	171538	191703	174560	119106	179089	224632

TABLE 4. Relative distribution (%) of estimated biomasses 1988-93 in depth strata south of 69°30'N

YEAR	DEPTH STRATUM 150-200	200-300	300-400	400-600
1988	8.9	28.0	49.9	13.2
1989	5.3	55.6	32.1	7.0
1990	0.3	25.8	58.8	15.1
1991	0.5	19.9	60.6	19.0
1992	2.4	22.6	62.2	12.8
1993	0.0	23.5	58.4	18.1

TABLE 5. Numbers of shrimp (thousands) per length group (CL) in total biomass estimate in 1993, based on pooling of individual samples weighted by catch and stratum area.

CPL	Males	Prim. fem.	Mult. fem.	Total
5	0	0	0	0
5.5	1130	0	0	1130
6	0	0	0	0
6.5	1488	0	0	1488
7	0	0	0	0
7.5	14026	0	0	14026
8	25007	0	0	25007
8.5	68825	0	0	68825
9	84757	0	0	84757
9.5	109700	0	0	109700
10	110582	0	0	110582
10.5	155126	0	0	155126
11	244303	0	0	244303
11.5	324375	0	0	324375
12	474831	0	0	474831
12.5	583716	0	0	583716
13	614178	0	0	614178
13.5	696388	0	0	696388
14	676723	0	0	676723
14.5	734254	0	0	734254
15	709479	0	0	709479
15.5	774084	0	0	774084
16	915727	0	0	915727
16.5	1177927	0	0	1177927
17	1367461	3176	0	1370637
17.5	1612458	0	298	1612756
18	1906022	0	298	1906320
18.5	1972212	0	947	1973159
19	1891895	567	10	1892471
19.5	1812931	0	1319	1814250
20	2087910	1709	1326	2090944
20.5	2121091	7051	1746	2129888
21	1896254	2325	7774	1906354
21.5	1759834	10579	3504	1773917
22	1440649	18017	10045	1468711
22.5	1240718	54211	34467	1329396
23	1040592	174815	92909	1308315
23.5	616853	356118	200901	1173871
24	285761	524832	346303	1156896
24.5	137103	586819	559410	1283332
25	56088	465643	708043	1229775
25.5	22289	360329	695463	1078081
26	3562	192754	653610	849926
26.5	503	84459	520193	605155
27	2367	40342	413785	456494
27.5	126	20380	291723	312228
28	0	8412	168770	177182
28.5	0	12	129512	129524
29	0	452	72978	73430
29.5	0	0	46306	46306
30	0	0	15694	15694
30.5	0	0	11491	11491
31	0	0	1620	1620
31.5	0	0	635	635
32	0	0	288	288
32.5	0	0	153	153
33	0	0	153	153
33.5	0	0	0	0
34	0	0	153	153
34.5	0	0	0	0
35	0	0	0	0
35.5	0	0	0	0
36	0	0	0	0
36.5	0	0	0	0
Total	31771303	2913002	4991826	39676132

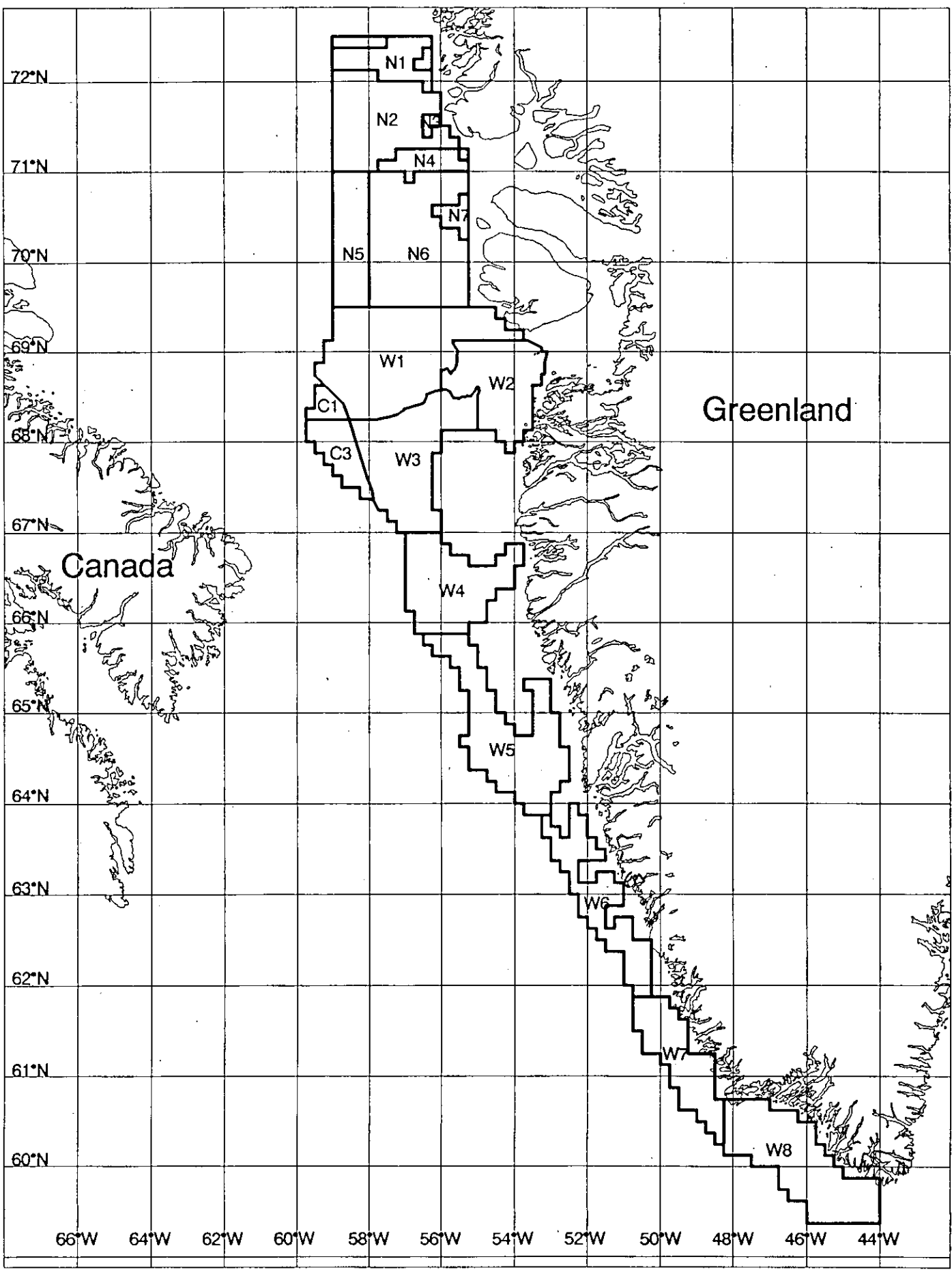

Figure 1. Stratification scheme for the West Greenland offshore shrimp surveys showing stratum numbering as used in the text.

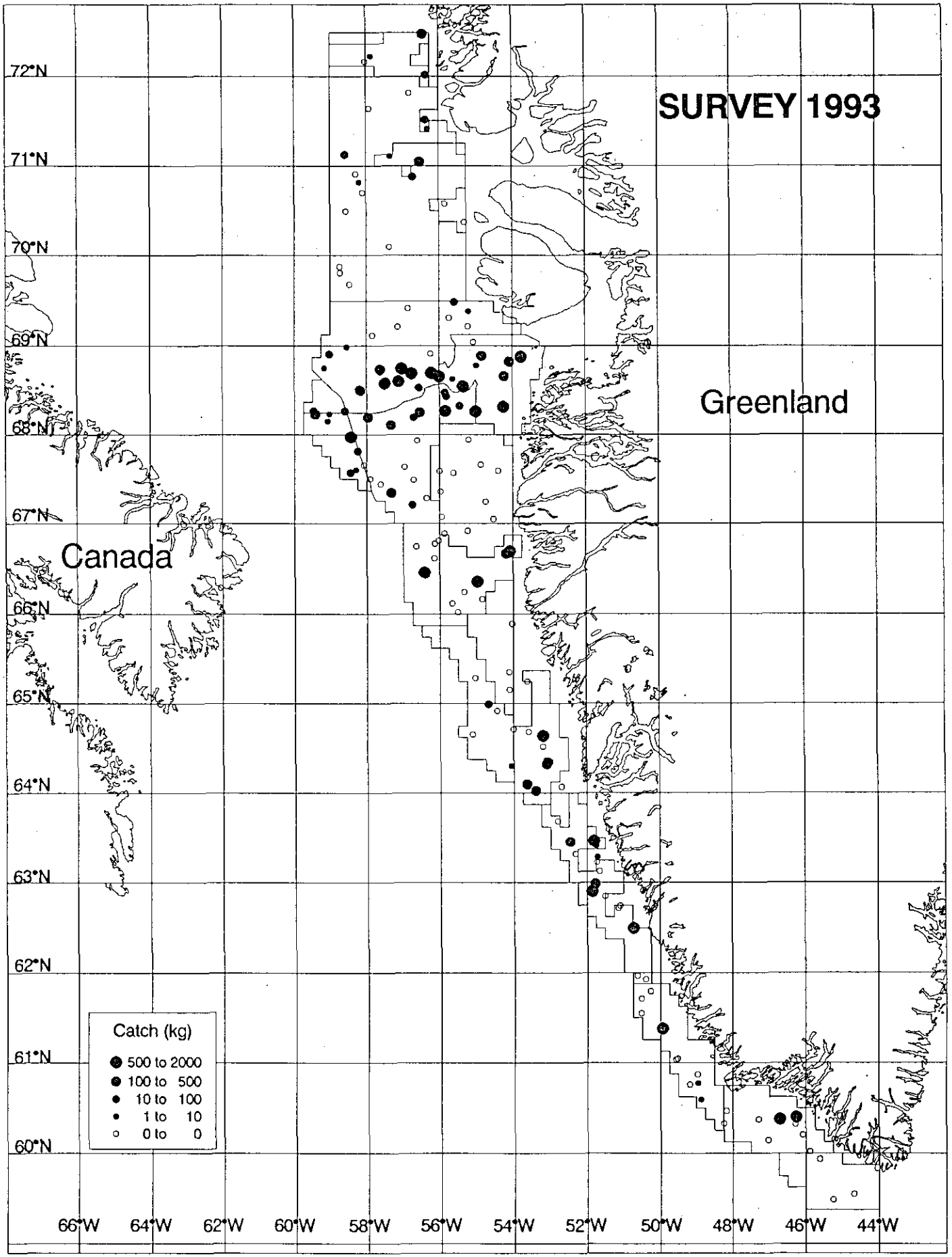

Figure 2. Sampling sites and catch of shrimp in the West Greenland offshore shrimp survey in 1993. Catches are given in kilos per hour trawled.

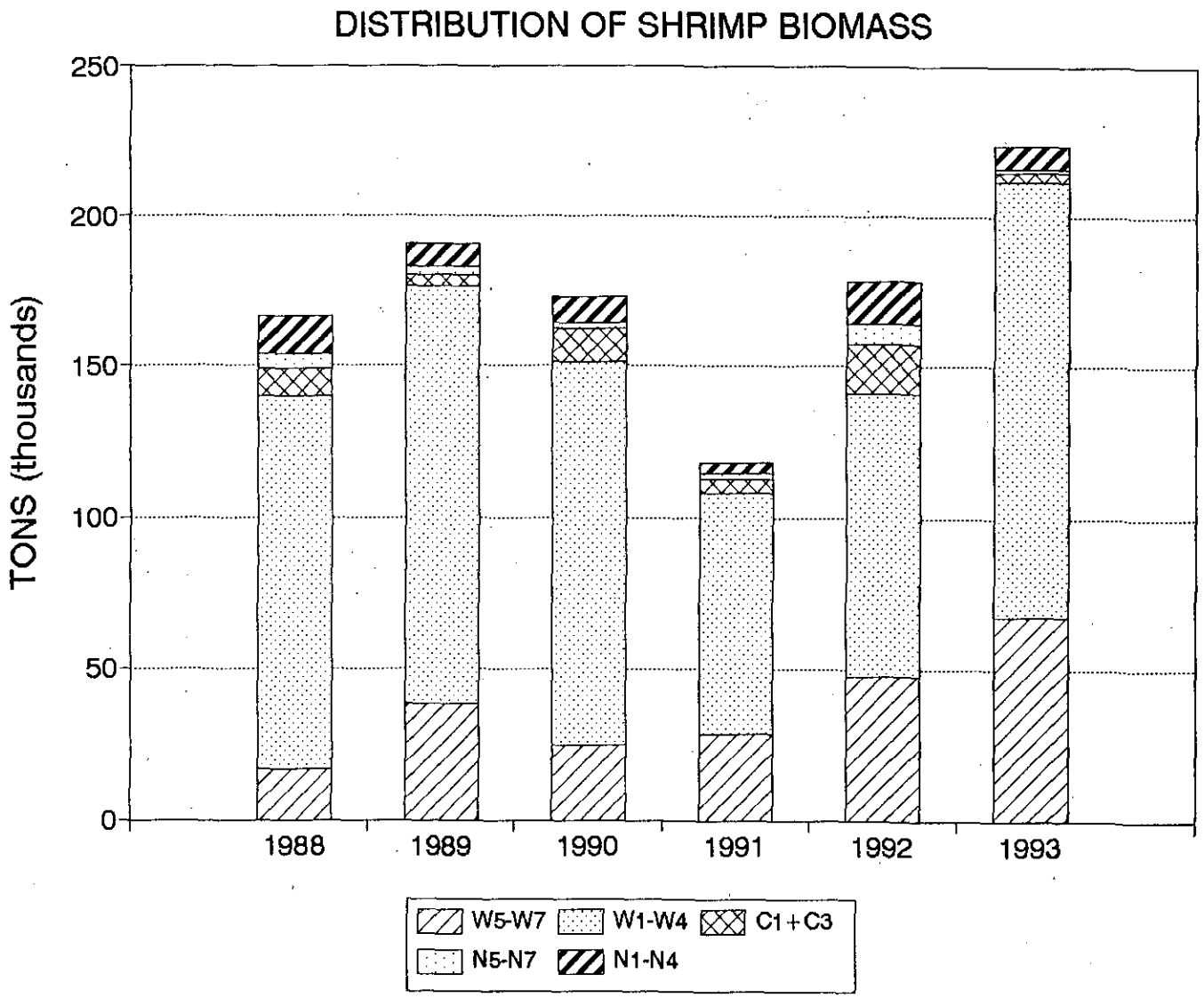

Figure 3. Estimated total biomass 1988-93 for groups of strata in Davis Strait.

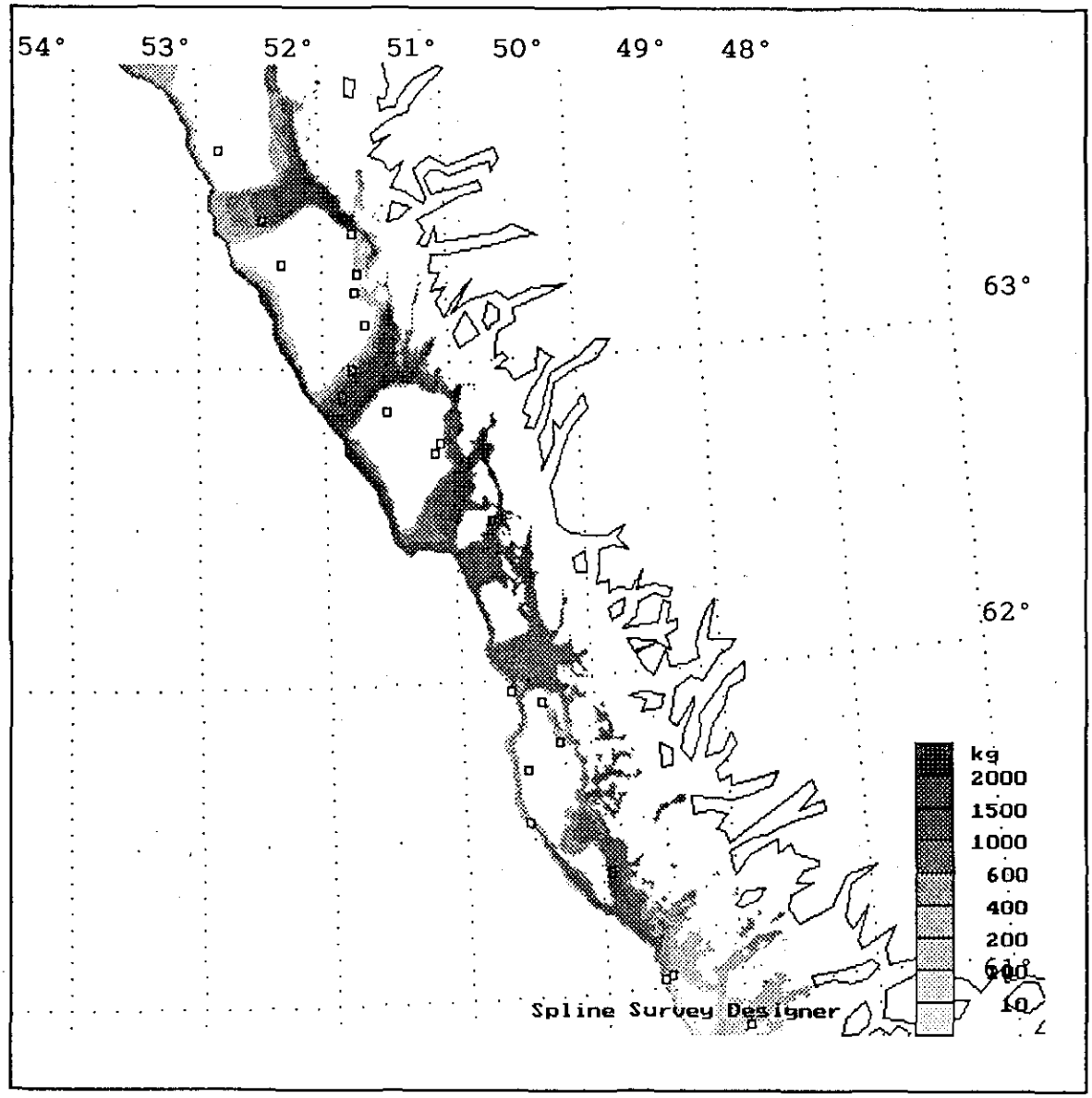

Figure 4a. Contour map with estimated shrimp densities 1993 for the area 61°N-64°N as calculated with the 'spline' method, based on survey data. Sampling sites are also given.

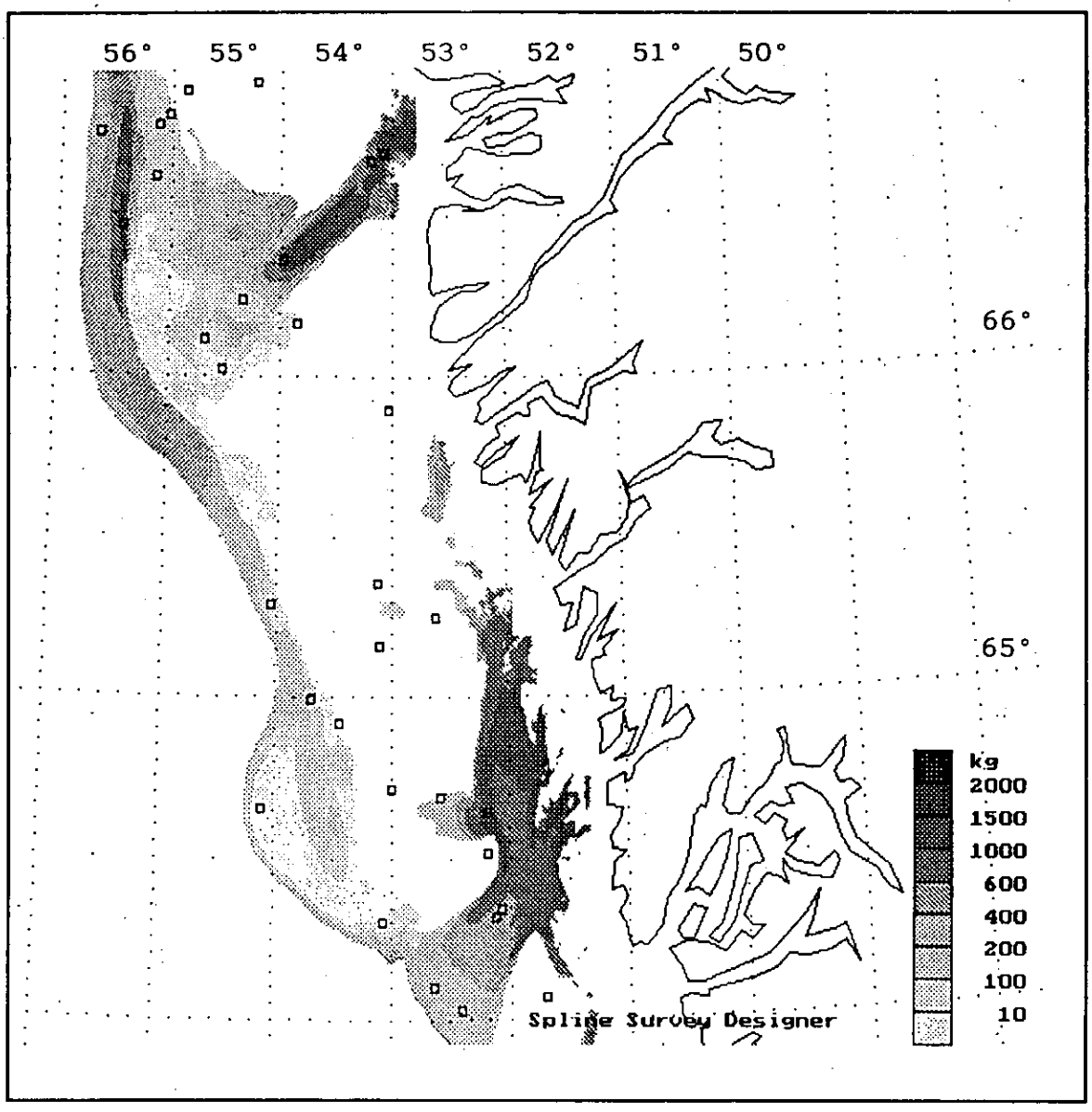

Figure 4b. Contour map with estimated shrimp densities 1993 for the area 64°N-67°N as calculated with the 'spline' method, based on survey data. Sampling sites are also given.

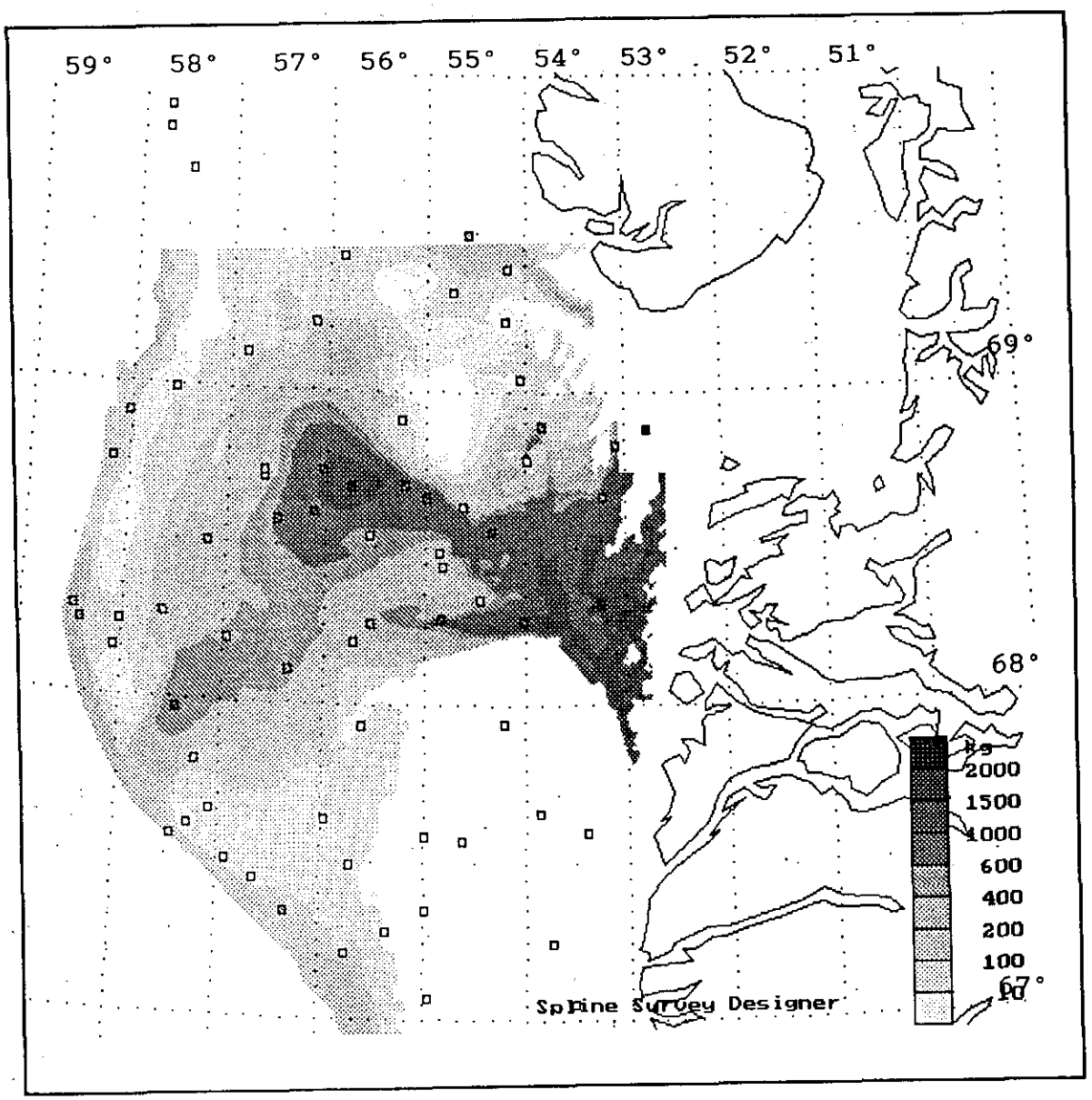

Figure 4c. Contour map with estimated shrimp densities 1993 for the area 67°N-70°N as calculated with the 'spline' method, based on survey data. Sampling sites are also given.

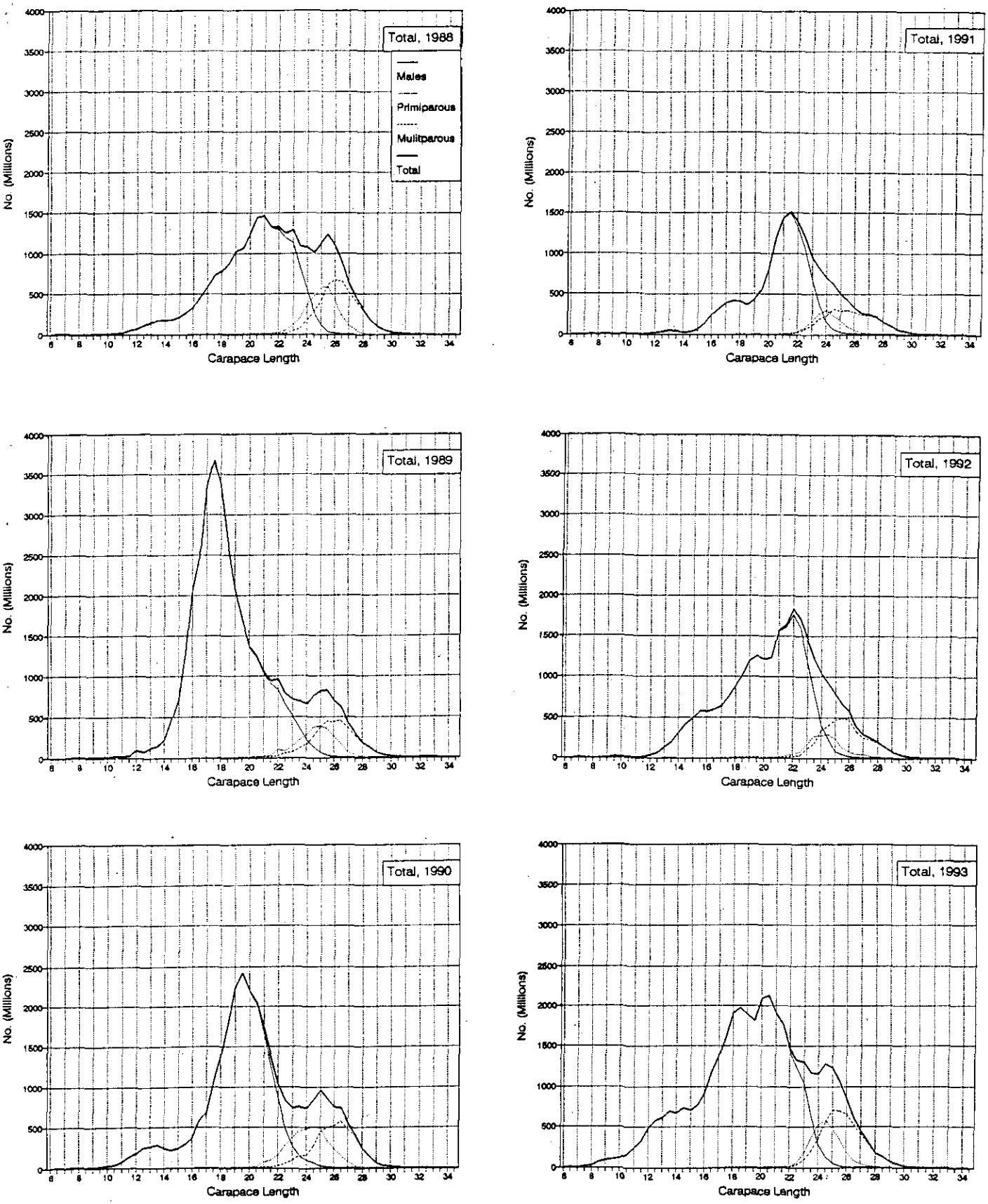

Figure 5. Numbers of shrimp by length group (CL) in the total survey area in 1988-93, based on pooling of samples weighted by catch and stratum area.

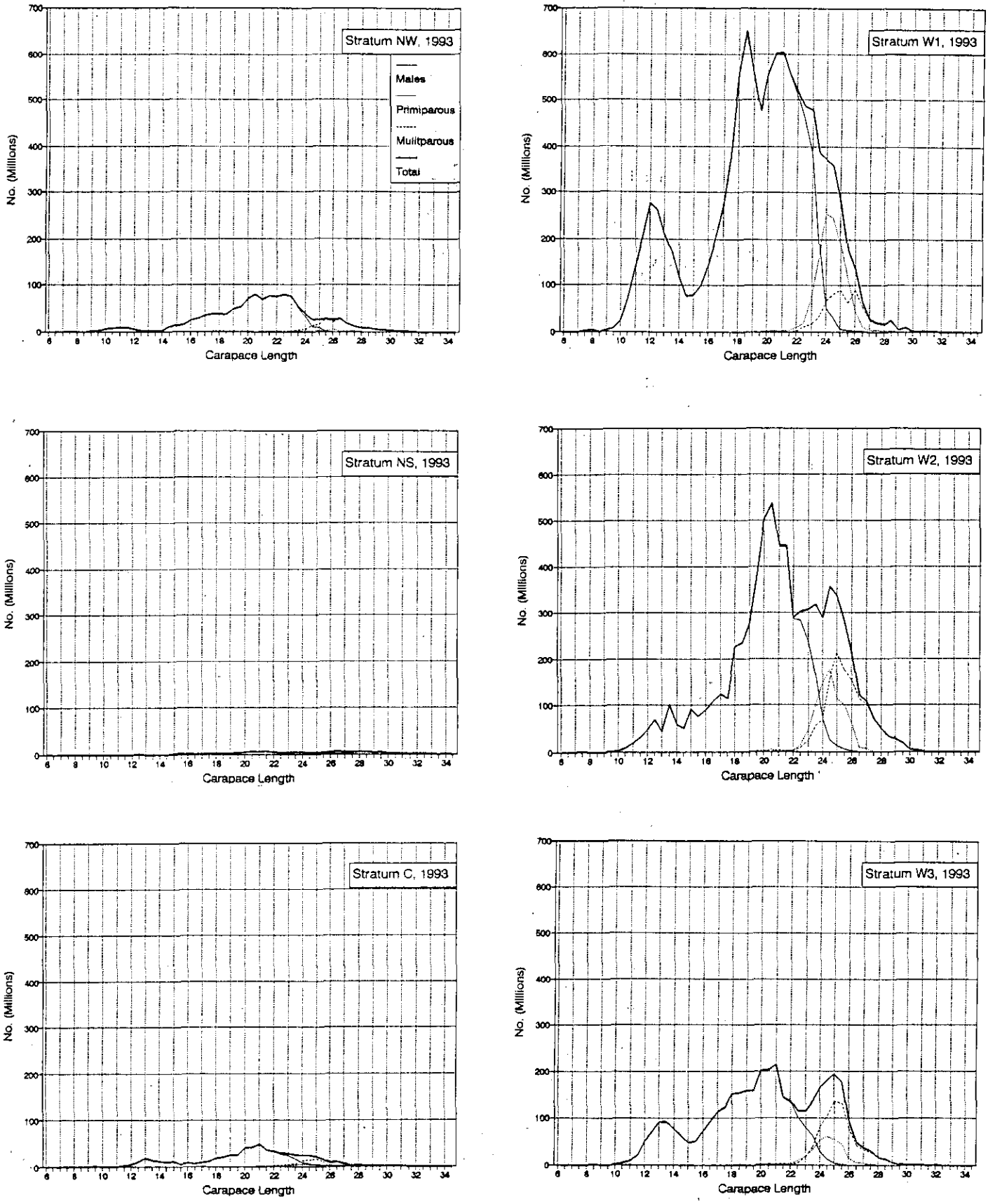

Figure 6a. Numbers of shrimp by length group (CL) in strata NW, NS, C and W1-W3 in 1993, based on pooling of samples weighted by catch and stratum area.

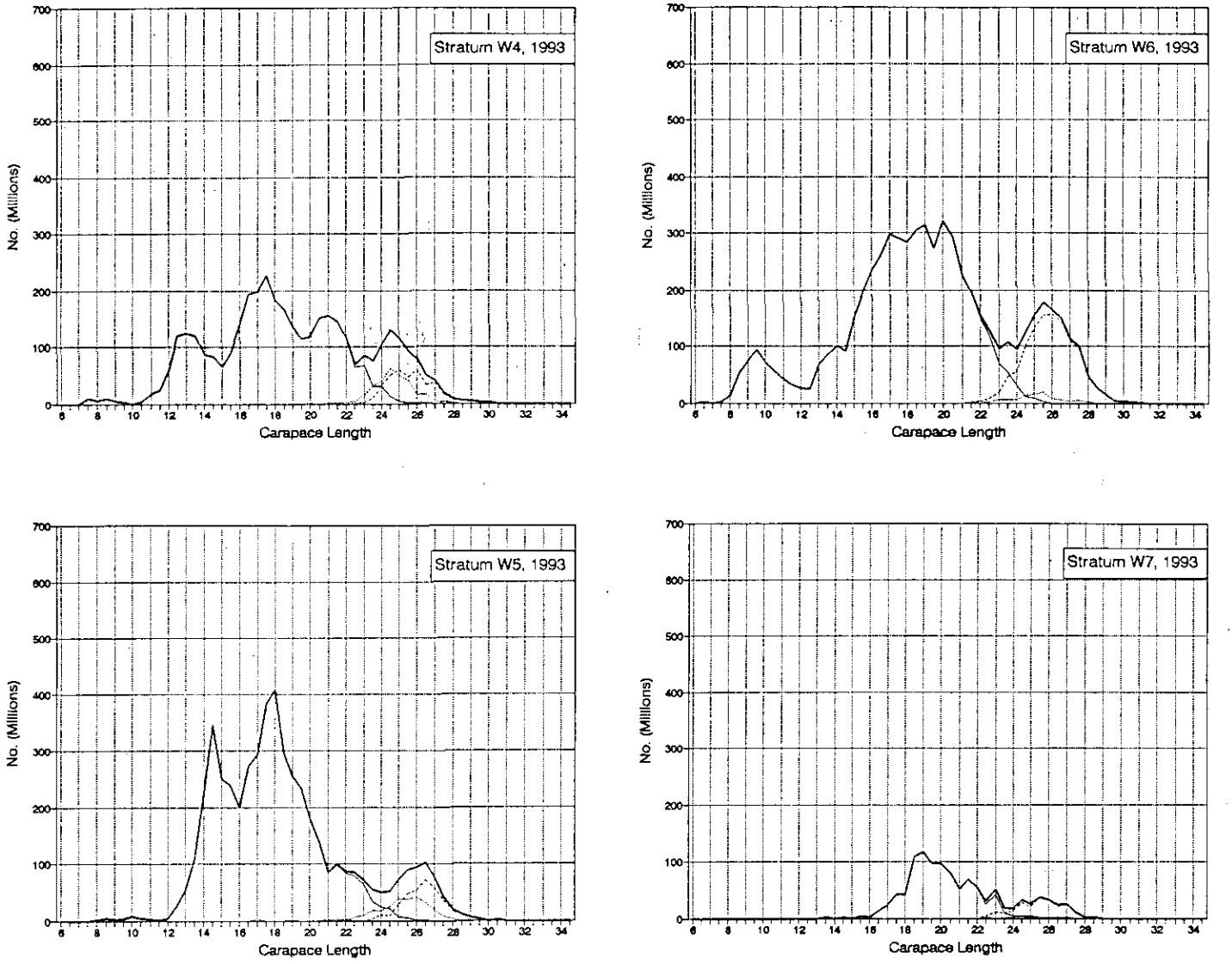

Figure 6b. Numbers of shrimp by length group (CL) in strata W4-W7 in 1993, based on pooling of samples weighted by catch and stratum area.