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A Stratified-random Trawl Survey for Shrimp (*Pandalus borealis*) in Inshore West Greenland Areas, 1991

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Abstract

In 1991, a stratified-random trawl survey was for the first time carried out in inshore areas of West Greenland, to assess the abundance of shrimp and obtain information on the size composition of this resource. A swept area calculation was used as a basis for estimating the minimum trawlable biomass. Mean shrimp density compared to the observed mean density in offshore areas suggested a much higher density inshore than offshore. Length distributions from catch samples were analyzed and compared to length distributions from the offshore area. The same size and age groups were identified in both areas, but while the offshore population was dominated by a few strong year-classes, several year-classes were significant in the inshore population.

Key words: Abundance, length distribution, shrimp, size composition, trawl survey W. Greenland

Introduction

Before the beginning of the offshore shrimp fishery in Subarea 1 around 1969, the inshore grounds in the Disko Bay (Div. 1A and 1B) were the most important shrimp fishing areas in Greenland. As the fishery in these areas was relatively stable during the period 1965–87, with catches from 5 000 to 8 000 tons of shrimp per year, the research effort of Greenland Fisheries Research Institute was concentrated on the offshore areas. In recent years, however, annual inshore catches have increased to about 14 000 tons, and it was therefore felt necessary to assess this resource in order to avoid overexploitation.

In September 1991, a stratified-random trawl survey was conducted in the inshore areas in Disko Bay and Vaigat (Fig. 1). The survey was the first stratified-random trawl survey in the inshore areas and was carried out as a continuation of the West Greenland offshore shrimp survey. The purpose of the inshore survey was to assess the minimum trawlable biomass and to collect biological samples for estimation of the size composition of the resource.

Material and Methods

The survey was carried out in the inshore area in the Disko Bay, Vaigat and Hareø area between 68°42'N and 70°38'N (Fig. 1), in depths between 150 and 600 m. As in the offshore survey the 722 GRT stern trawler M/TR *Paamiut* was used, with a SKJERVOY 3000/20 trawl, with bobbin gear and a double-bag of 44 mm mesh size (stretched) in the codend. The size of the trawl doors was 370 × 250 cm (and described as *Perfect Greenland*). Wing spread was calculated to be at an average of 24.8 m, based on data from tank experiments and from the use of a trawl positioning system (SCANMAR).

Lacking precise information on depths, the area was divided into nine strata (Fig. 1) based on the distribution of the commercial fishery. The available number of hauls was distributed relative to the size of each stratum, and trawl positions were selected at random. Considering the bottom topography in the survey area, the haul duration was set at 30 min. Trawling was carried out in day time only (0900–1900 hours) in order to minimize the influence of nocturnal vertical migrations of shrimp.

Based on the catch of shrimp from each haul, a biomass estimate for each stratum was calculated using the swept area method. Further, estimates of mean biomass by stratum and for all strata combined were calculated.

Shrimp samples were taken from the hauls if the catch was not too small or too damaged. The shrimp

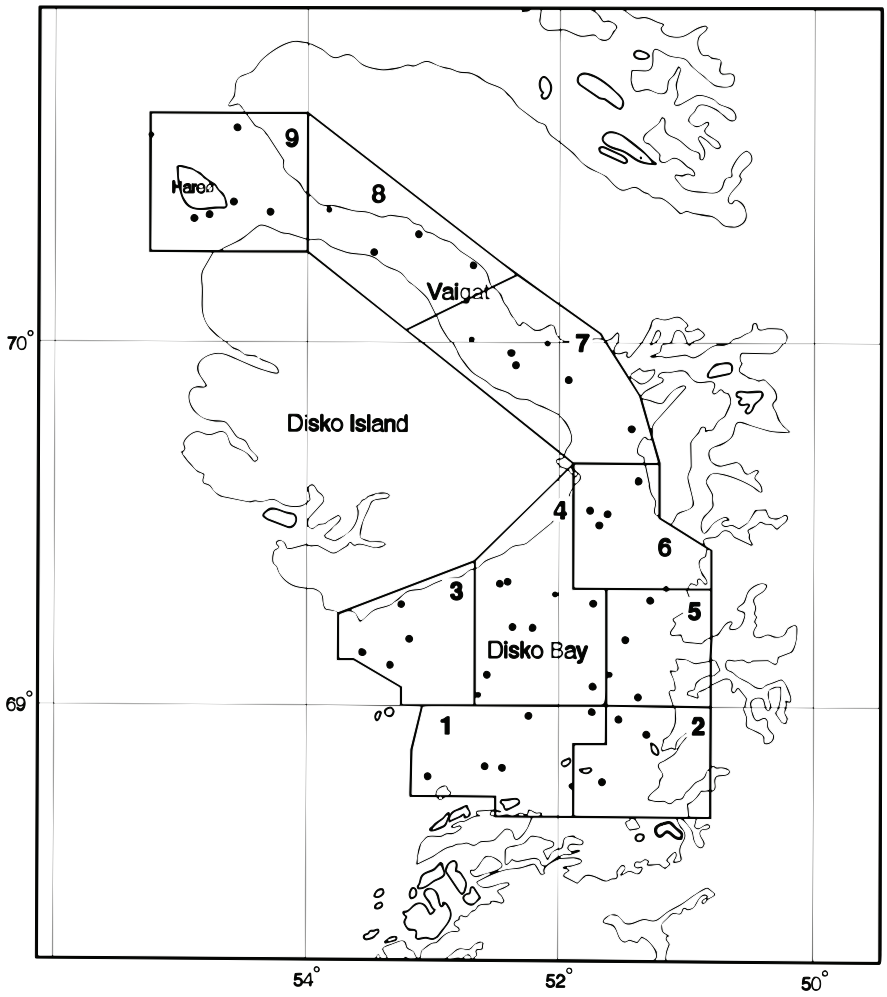

Fig. 1. Strata and fishing locations in survey area.

were sorted by sexual characteristics, and oblique carapace lengths were measured to the nearest 0.1 mm. The mean total number of shrimp by length was estimated for each stratum based on individual samples, catch per swept area and stratum area. An overall distribution for the total survey area was obtained by pooling of strata means.

Results and Discussion

A total of 47 hauls were taken, but by mistake a codend with a 20 mm mesh size was used during seven hauls. Results from these and from two hauls with a duration of less than 20 min were discarded, leaving 38 valid hauls. Catches from the valid hauls are shown in Table 1 and the estimated biomasses and densities by stratum in Tables 2 and 3.

A total biomass of shrimp of 50 304 (±2 × standard deviation: 22 080) tons was estimated for the area. The mean density of shrimp by weight in the Disko Bay and Vaigat area (5.4 tons/km^2) was more than double the mean density in the offshore area south of 69°30'N (1.8 tons/km^2) and much higher than in the offshore area north of 69°30'N (0.15 tons/km^2) (Carlsson and Kanneworff, MS 1994). Densities were highest in the southern part of Disko Bay (10–11 tons/km^2 in stratum 1 and 2) and lowest in the eastern part (1–3 tons/km^2), whereas the western part of Disko Bay and Vaigat had shrimp densities (4–6 tons/km^2) around the mean for the total area.

Table 4 shows the density of shrimp in numbers per km^2 in each stratum and overall. Except in stratum

TABLE 1. List of valid trawl hauls in the survey.

Station identification	Stratum	Area code	Depth (m)	Trawl time (min)	Shrimp catch (No.)
91PA0100014 999	1	LD020	537.0	33	6
91PA0100013 999	1	LD022	275.0	30	3 523
91PA0100012 999	1	LD023	328.0	32	6
91PA0100011 999	1	LD025	203.0	31	15
91PA0100007 999	1	LE024	209.0	32	10
91PA0100008 999	1	LE026	326.0	32	102
91PA0100010 999	2	LD026	307.0	31	233
91PA0100009 999	2	LE026	333.0	32	289
91PA0100047 999	2	LE027	309.0	30	1 012
91PA0100002 999	3	LF019	296.5	34	249
91PA0100001 999	3	LG018	329.5	32	428
91PA0100003 999	3	LG020	493.0	33	216
91PA0100004 999	3	LH019	259.5	30	292
91PA0100005 999	4	LF022	353.0	32	253
91PA0100006 999	4	LF022	340.0	29	342
91PA0100045 999	4	LF026	405.0	30	111
91PA0100019 999	4	LG023	498.5	33	259
91PA0100018 999	4	LG024	376.5	30	214
91PA0100021 999	4	LH023	395.5	30	301
91PA0100017 999	4	LH024	323.0	30	424
91PA0100016 999	4	LH026	393.0	31	313
91PA0100044 999	5	LF026	350.0	33	83
91PA0100046 999	5	LF027	341.5	30	94
91PA0100043 999	5	LG027	401.0	30	70
91PA0100015 999	5	LH027	391.0	30	73
91PA0100022 999	6	LJ026	256.5	31	215
91PA0100023 999	6	LK025	227.5	31	67
91PA0100024 999	7	LN023	379.5	30	368
91PA0100036 999	7	LN023	383.5	30	9
91PA0100025 999	7	LP022	372.0	30	419
91PA0100026 999	8	LR022	155.5	30	136
91PA0100028 999	8	LS019	173.5	31	197
91PA0100027 999	8	LS020	246.0	30	610
91PA0100031 999	9	LS013	209.5	31	14
91PA0100032 999	9	LS013	235.0	33	74
91PA0100030 999	9	LS015	347.5	30	1 200
91PA0100033 999	9	LT014	268.0	32	106
91PA0100034 999	9	LV014	482.5	30	293

TABLE 2. Estimated biomass of shrimp (tons) in strata.

Stratum		Biomass in strata					
Number	Area (km^2)	Tons	Hauls (No.)	S.D.	S.E.	Min	Max
1	819	9 396.2	6	22 054.2	9 003.6	73	54 401
2	566	5 868.8	3	5 565.2	3 213.0	2 484	12 292
3	1 124	5 765.6	4	1 842.2	921.1	3 947	8 003
4	1 834	9 181.7	8	3 273.9	1 157.5	3 199	13 892
5	612	911.6	4	224.7	112.3	769	1 246
6	1 014	2 799.5	2	2 141.6	1 514.4	1 285	4 314
7	1 447	6 201.0	3	5 228.9	3 018.9	174	9 523
8	652	3 628.0	3	3 075.1	1 775.4	1 477	7 150
9	1 296	6 551.8	5	8 286.6	3 705.9	290	20 417
Total	9 364	50 304.2					

TABLE 3. Estimated density of shrimp (kg per km^2) in strata.

Stratum		Biomass in strata					
Number	Area (km^2)	Tons	Hauls (No.)	S.D.	S.E.	Min	Max
1	819	11 472.8	6	26 928.2	10 993.4	90	66 424
2	566	10 368.9	3	9 832.4	5 676.8	4 389	21 717
3	1 124	5 129.5	4	1 639.0	819.5	3 511	7 120
4	1 834	5 006.4	8	1 785.1	631.1	1 744	7 575
5	612	1 489.5	4	367.1	183.6	1 256	2 035
6	1 014	2 760.9	2	2 112.1	1 493.4	1 267	4 254
7	1 447	4 285.4	3	3 613.6	2 086.3	120	6 581
8	652	5 564.4	3	4 716.4	2 723.0	2 265	10 966
9	1 296	5 055.4	5	6 394.0	2 859.5	224	15 754

TABLE 4. Density of shrimp (numbers ('000) per km^2) in strata.

Stratum	Area (km^2)	Males	Females	Total
1	819	1 089	519	1 608
2	566	2 085	203	2 288
3	1 124	795	151	946
4	1 834	513	202	714
5	612	187	49	236
6	1 014	450	50	500
7	1 447	217	236	453
8	652	486	216	703
9	1 296	269	255	523
Total	9 364	583	211	793

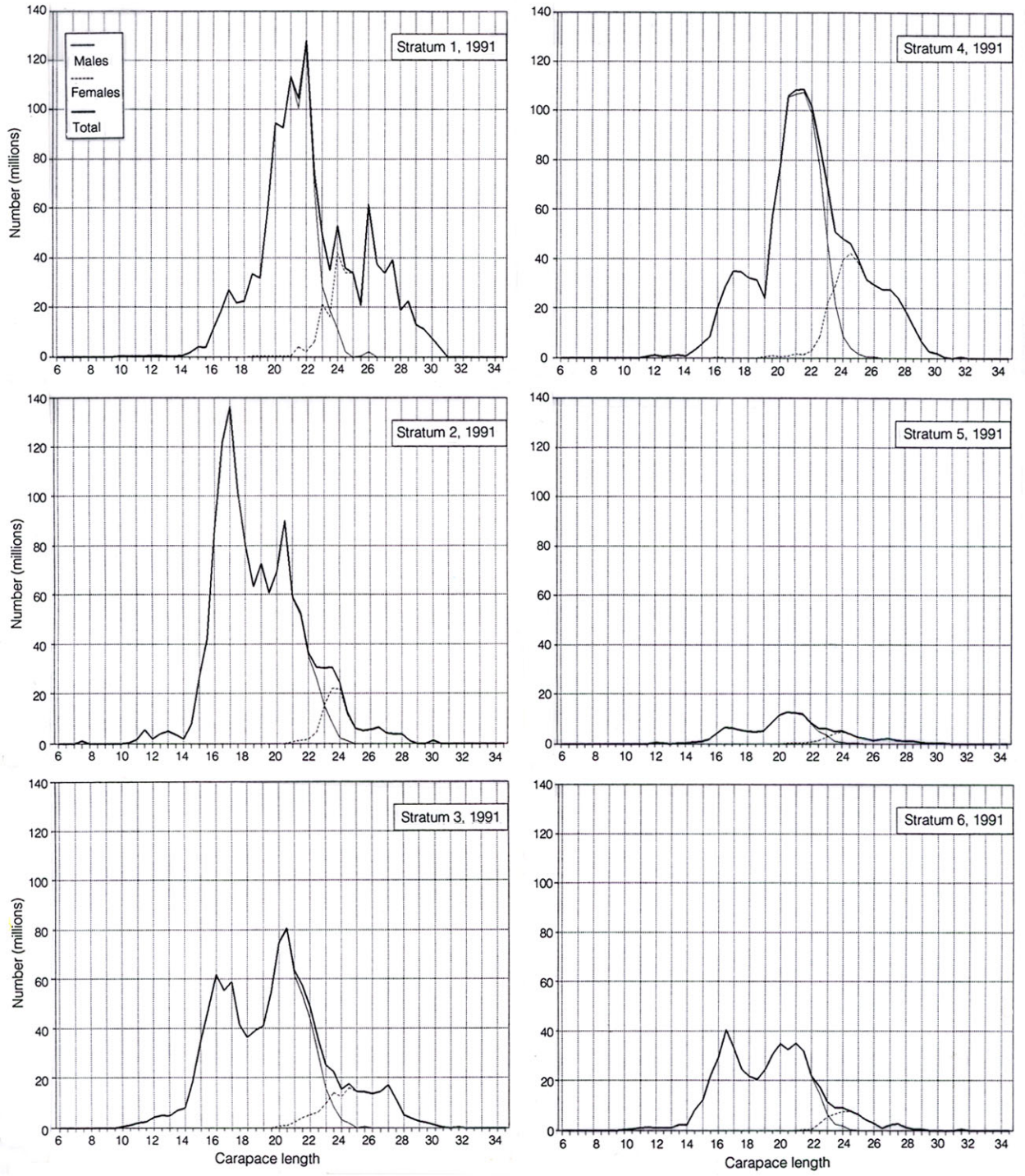

Fig. 2. Overall length-frequency distributions by strata (Stratum 1–9).

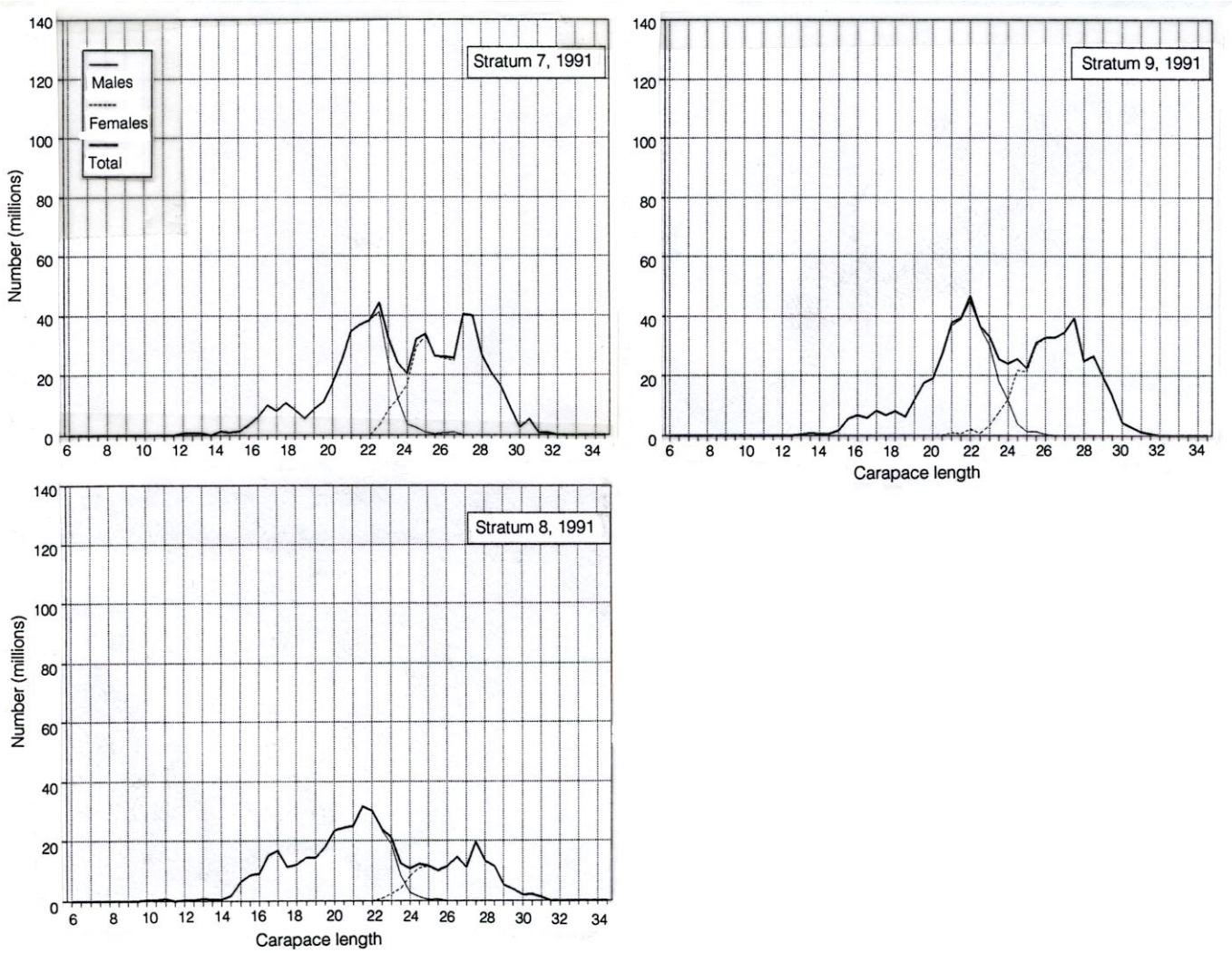

Fig. 2. (Continued). Overall length-frequency distributions by strata (Stratum 1–9).

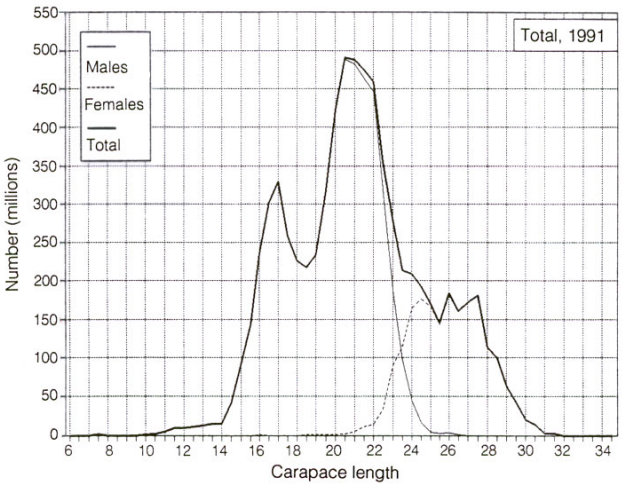

Fig. 3. Overall length-frequency distribution for total area.

7, males were more abundant than females in all strata. Highest abundance of males was found in the southern and southwestern part of Disko Bay (stratum 1, 2 and 3). Females were most abundant in stratum 1, but higher-than-mean concentrations were also found in stratum 7, 8 and 9 in the Vaigat area.

The overall length distribution pattern in Fig. 3 indicated the presence of several year-classes. The male distribution showed two significant peaks, one around 17 mm carapace length (CL) and a second from 20 to 22 mm CL. These two peaks were present in all pooled samples from individual strata (Fig. 2). While the 17 mm size group was most abundant and dominant in stratum 2, the larger group was significant in strata 1–4 and dominant in strata 1, 3 and 4. The distribution of females showed the occurrence of at least three size components, of which the one

around 24.5 mm CL probably represented females after first spawning.

Compared to the overall length distribution obtained in the offshore survey in 1991 (Carlsson and Kanneworff, MS 1992) the overall distribution in the Disko Bay was not dominated to the same degree by one or a few size groups. This, together with the higher densities inshore, indicates that the stock situation in the inshore areas in 1991 was much better than in the offshore areas.

References

CARLSSON, D. M., and P. KANNEWORFF. MS 1992. Report on a stratified-random trawl survey for shrimp (*Pandalus borealis*) in NAFO Subareas 0+1 in July–September 1991, and a comparison with earlier surveys. *NAFO SCR Doc.*, No. 67, Serial No. N2121, 27 p.

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