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Stock Biomass 1979 of Shrimp (*Pandalus borealis*) in NAFO Subarea 1 Estimated by Means of Bottom Photography

by

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ABSTRACT

Bottom photography has been used to study the density of shrimp *(Pandalus borealis)* in the offshore area of West Greenland during the years 1977-79.

This paper presents biomass estimates for certain parts of the shrimp areas in ICNAF Div. 1A and 1B based on photographic material from 1979. The estimates are compared to biomass estimates from the two earlier years (Kanneworff, 1978a) and to biomass estimates obtained from a trawl survey in 1976 (Horsted, 1978).

INTRODUCTION

During several years catch and effort data have been used to assess the distribution and size of the stock of shrimp *(Pandalus borealis)* in the West Greenland area, ICNAF Subarea 1 (Horsted, 1978; Hoydal, 1978). In 1977 bottom photography as a tool for estimating the shrimp density directly was introduced in the offshore area. In earlier papers (Kanneworff, 1978a; Kanneworff, 1978b) the use of the photographic method was discussed, and biomass estimates for the shrimp population in the area from 69°N to 66°N were given, the calculation being made on basis of material from a trawl survey in 1976, presented by Horsted (1978).

The present paper includes the 1979 material from a photographic survey and recalculates the earlier given figures for biomass estimates using the new stratum areas given by Carlsson & Kanneworff (1979b).

MATERIAL AND METHODS

The use of bottom photography as a method for determining the density of shrimp has been discussed earlier (Kanneworff, 1976). The sampling is made by means of a camera with fixed distance of exposing, so that a standard area of 3.39 square meters is examined.

The sampling sites for 1977-79 were chosen so as to cover the same areas in the three successing years and also to cover most of the shrimp distribution area in Div. 1A and 1B (Fig.1) on basis of a stratification scheme described by Carlsson & Kanneworff, 1979a.

The sampling in 1979 was heavily limited by bad weather conditions, and furthermore an uncontrollable malfunction of the flash reduced the amount of photographs from a normal of 100-200 per station down to a range between 5 and 49, so that the total amount of useable photos for 1979 is 158 as compared to 1544 in 1978 and 1067 in 1977.

During the reading of the photographs the shrimps were as previously classified by the three size categories: small (less than 18-20 mm carapace length, with an estimated mean weight of 3.5 g); large (greater than 28-30 mm carapace length, with an estimated mean weight of 13 g); and medium (all others, estimated mean weight of 7.5 g).

RESULTS AND DISCUSSION

The area covered by photographic sampling in the years 1977-79 is shown on Fig.1. Most of the basic strata relevant for shrimps have have been sampled during the three years, but only a few stations have been occupied more than once. These stations may, however, be compared directly on a year to year basis. One station, described by the area code KR004, has been occupied all three years. The area around this station has been one of the most heavily fished grounds by the commercial fleet during the whole period of shrimp fishing west of Store Hellefiskebanke.

Table 1 lists the stations in the offshore area tohether with the correspondig figures for shrimp density as read from the photographs. A mean weight and a simple calculation of the basic stratum biomass is also given for each station, using estimated average weights in the three size categories. The density figures in 1979 are considerably higher than in the two other years, but as the liability of the biomass estimates undoubtedly is not very great because of the very few stations and the small amount of photos, these figures should be used with great caution. The mean size of the shrimps is reduced during this period, the mean weight per shrimp being at least one gram lower in 1979 than in the foregoing years (Fig.2). The resulting biomass estimates are very much higher in 1979 than before, especially in the group of small shrimps. Large shrimp are, however, nearly absent in the 1979 material apart from one station in deeper water north of Store Hellefiskebanke.

As was the case in 1978 a large concentration of very small shrimp was found in 1979 in the area north of Store Hellefiskebanke (area codes KZ002 and LB005, respectively). Small shrimp in a fairly large amount were also found on two stations in Div. 1A. Unfortunately it was not possible this year to sample the same sites as in 1978, but if concentrations of small shrimp are found regularly in this region it is reasonable to assume that parts of the huge area northwest of Store Hellefiskebanke could be nursery areas for the younger year classes of shrimps.

Estimates of shrimp biomass by means of the photographic method was earlier calculated on basis of estimates from a trawl survey in 1976 (Horsted, 1978). Table 2 shows a more direct comparison between four different areas, one of them, however, being sampled only in 1977. The strata in this table correspond to those used earlier by the author (Kanneworff, 1978a), but the areas have been corrected according to new figures given by Carlsson & Kanneworff (1979b), the biomass values thus being somewhat altered as compared to earlier figures.

The tabel (Table 2) shows that in three strata which may be compared from year to year the estimates of biomass seem to have increased considerably if a direct comparison is being used. An increase is also noted from 1977 to 1978 which is in contrast to what was found by Kanneworff (1978b). In that paper the

change in estimated biomass over the years considered was studied by back calculation to estimates from the trawl survey in 1976 which had a reasonably good coverage of the different strata. This latter method may lead to a more safe estimate due to the more or less scattered sampling by the photo survey. It should be pointed out, that the 1979 estimates for stratum no. 7 in the table have been obtained by means of averages of four stations with very high variances, and that the very high values come from a station with only 16 photos .

The biomass of shrimp in the area west and northwest of Store Hellefiskebanke seems to have increased considerably from 1977 to 1979, if only density figures from bottom photography are used directly to establish an estimate of the stock biomass.

This interpretation of the photographic material is, however, somewhat doubtful, the increase from 1977 to 1978 not being in agreement with previous calculations, which were made with reference to a trawl survey with a good coverage of the area. The sampling by the photographic survey in 1979 was very scattered, and most of the sampling sites were in areas not visited before with the photographic equipment.

By using a size classification of shrimp during reading of the photographs it is shown that the mean size of shrimps has been reduced by at least one gram during the same period. The comparison of size distribution between the years is considered to be more reliable than the biomass estimates for 1979, the calculations of mean sizes being less dependant on the success of the sampling.

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Table. 1.

Biomass estimates of shrimp (Pandalus borealis) populations by means of bottom photography

The estimates are based on average weights in three size groups as follows:

small: 3.5 g (<18-20 mm carapace length)
medium: 7.5 g (between 18-20 and 26-28 mm carapace length)
large: 13.0 g (>26-28 mm carapace length)

Strata are defined by 100 m depth intervals within the blocks

Div	Stratum No.	Stratum Area	Date	No.of Phot.	Density (no/sqm) Small	Medm.	Large	All	Mean Weight	Biomass Estimate Small	Medm.	Large	All
1B	12414090	690	770724	54	0.000	0.104	0.082	0.186	9.9	0	537	735	1274
1B	12414090	690	770724	35	0.000	0.084	0.101	0.185	10.5	0	435	905	1339
1B	12416070	1542	770725	17	0.017	0.190	0.000	0.207	7.2	93	2193	0	2286
1B	12317050	631	770726	82	0.000	0.363	0.004	0.367	7.6	0	1719	30	1750
1B	12317070	1543	770726	64	0.000	0.207	0.000	0.207	7.5	0	2400	0	2403
1B	12316050	1822	770727	116	0.031	0.674	0.003	0.707	7.3	195	9214	60	9472
1B	12015090	122	770804	282	0.001	0.111	0.000	0.112	7.5	0	101	0	102
1B	12115110	358	770805	23	0.000	0.038	0.000	0.038	7.7	0	103	0	106
1B	12415090	727	770805	204	0.014	0.129	0.010	0.153	7.5	37	701	96	834
1B	12417070	1662	770806	190	0.000	0.107	0.002	0.109	7.6	0	1336	34	1370
1B	12316050	1822	780721	154	0.061	0.511	0.006	0.579	7.1	391	6990	136	7518
1B	12216090	209	780722	162	0.000	0.113	0.000	0.113	7.5	0	177	0	177
1B	12215030	1395	780724	126	0.000	0.000	0.000	0.000	****	0	0	0	0
1B	12215050	643	780724	107	0.006	0.069	0.000	0.074	7.2	12	332	0	345
1B	12115070	234	780724	172	0.000	0.005	0.000	0.005	7.7	0	9	0	9
1B	12115030	850	780725	174	0.005	0.097	0.002	0.103	7.4	15	616	19	650
1C	13414050	250	780725	3	0.100	0.400	0.000	0.500	6.8	88	750	0	850
1B	12015110	260	780725	21	0.014	0.085	0.014	0.113	7.8	13	165	48	227
1C	13414050	250	780726	178	0.106	0.363	0.003	0.473	6.6	93	681	11	785
1C	13012070	120	780727	181	0.205	0.391	0.002	0.598	6.1	86	352	3	441
1B	12416090	517	780802	59	0.000	0.155	0.005	0.160	7.7	0	601	34	636
1B	12416070	1542	780802	169	0.832	0.640	0.009	1.482	5.3	4493	7407	175	12075
1B	12516070	1396	780803	38	0.070	0.178	0.008	0.256	6.6	341	1867	141	2348
1B	12415050	590	790723	6	0.000	0.500	0.000	0.500	7.5	0	2213	0	2213
1A	11214050	919	790730	49	1.096	0.849	0.000	1.946	5.2	3527	5854	0	9384
1A	11115050	185	790731	11	0.865	0.676	0.027	1.568	5.4	560	938	65	1565
1B	12316050	1822	790801	36	0.008	0.123	0.000	0.131	7.3	52	1680	0	1732
1B	12316050	1822	790801	16	1.222	2.093	0.000	3.315	6.0	7794	28595	0	36406
1B	12413050	627	790805	7	0.083	0.917	0.000	1.000	7.2	183	4311	0	4494
1B	12414090	690	790805	16	0.019	0.241	0.074	0.333	8.5	45	1246	664	1955
1B	12515070	994	790810	12	0.927	0.293	0.000	1.220	4.5	3224	2182	0	5406
1B	12417070	1662	790810	5	0.059	0.235	0.000	0.294	6.8	342	2933	0	3324

Table 2. Calculated biomass estimates for various strata by photographic method in 1977-1979. Compared with estimates from a trawl survey in 1976 as reported by Horsted (1978).

STRATUM NO.	STRATUM area km^2	BIOMASS EST. 1976	BIOMASS EST. 1977 small	1977 med+large	BIOMASS EST. 1978 small	1978 med+large	BIOMASS EST. 1979 small	1979 med+large
2	9259	11921	0	7740	2268+	13307+	1912+	16319+
3	2722	1875	44	4429	0	3354	181	7540
5	3437	3416	103	5117	-	-	-	-
7	4086	11964	222	16066	872	15973	4694++	27833++

+ 2 stations with exceptionally high values for small shrimp have been omitted in the biomass calculation.

++ The biomass estimates are averages of 4 stations with very high variance.

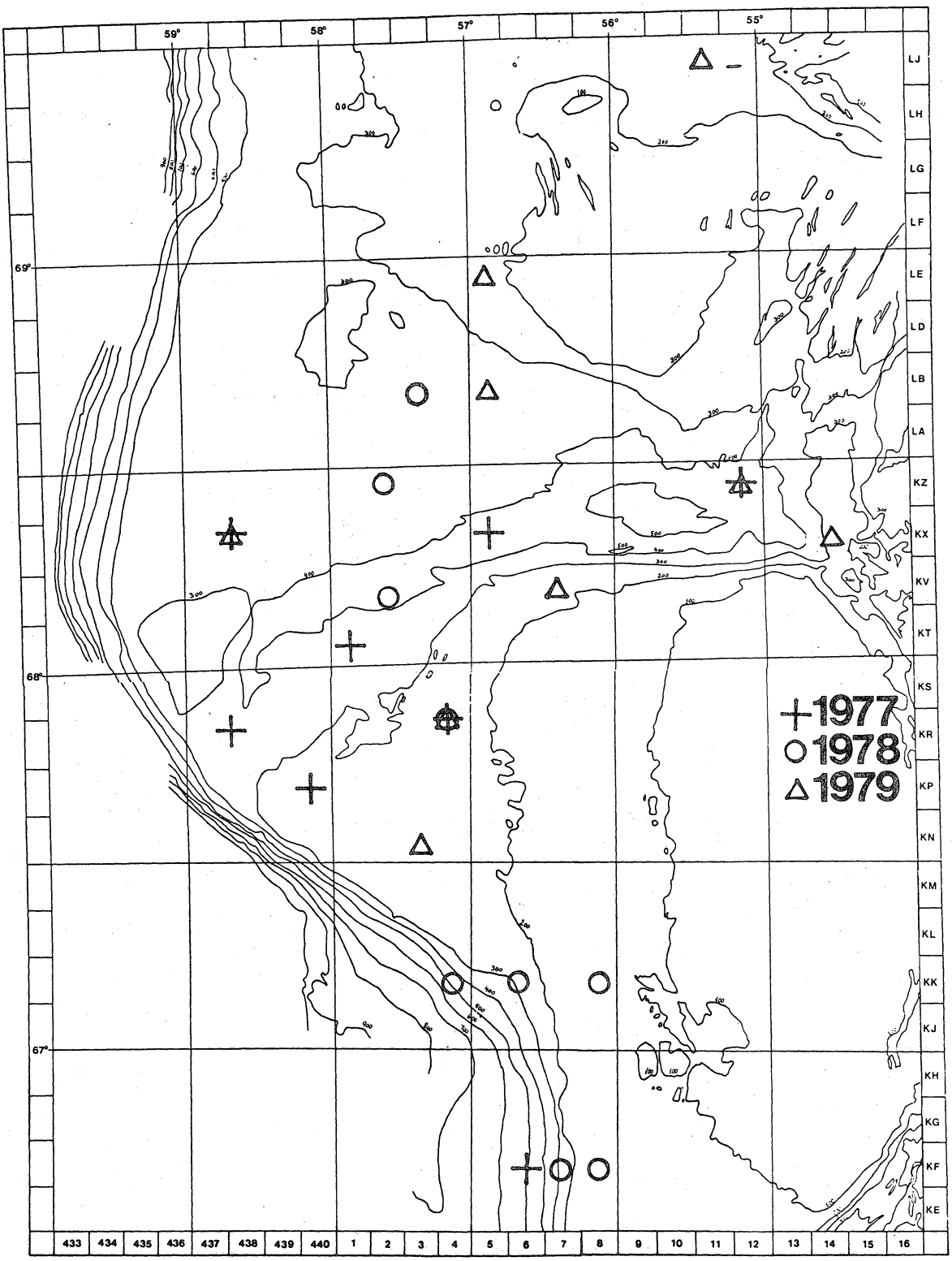

Fig. 1. Survey area for photographic sampling in 1977-79. One station from 1977 and three stations from 1978 are in Div. 1C and thus not shown on this map.

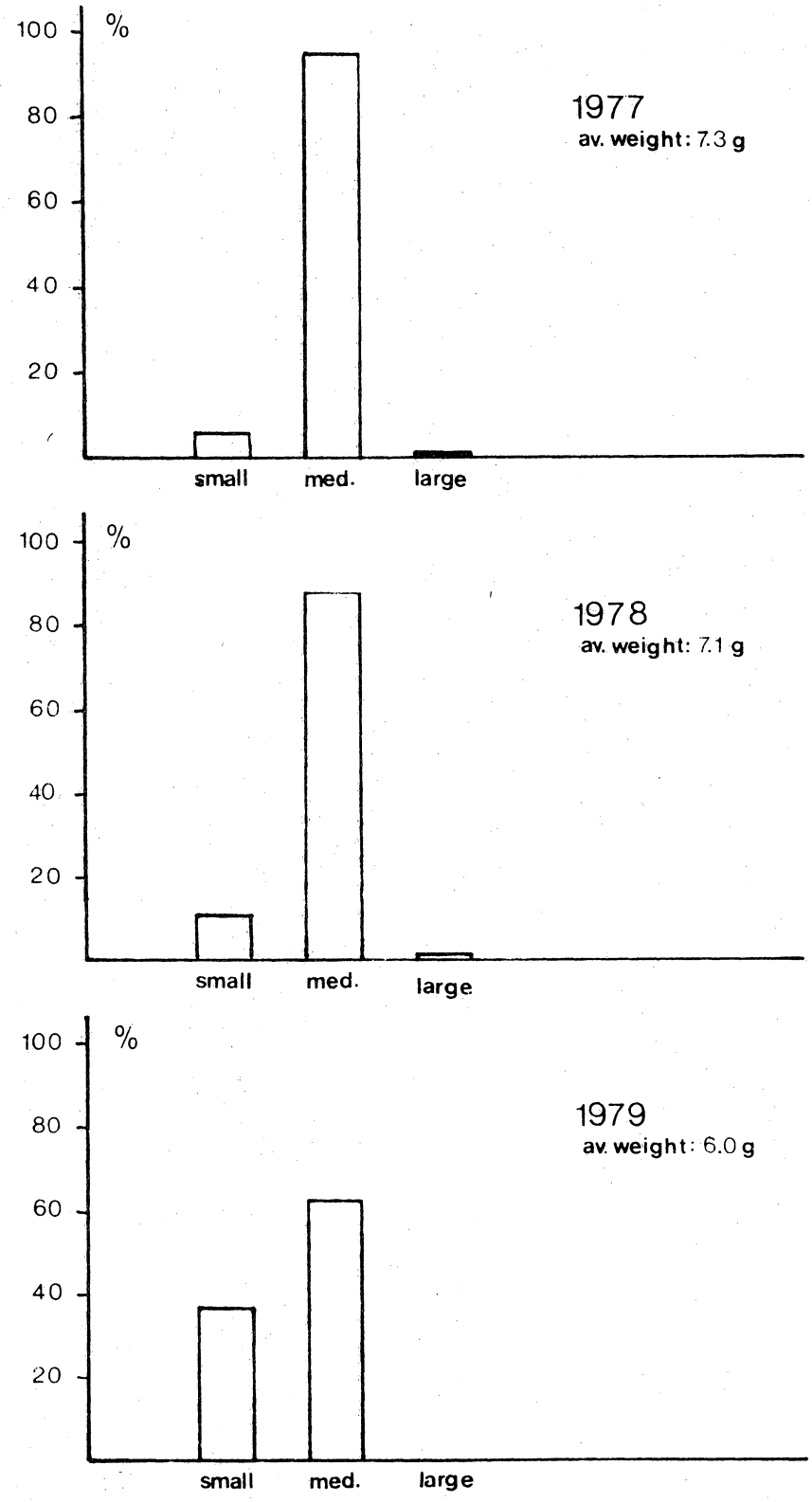

Fig. 2. Size distribution of shrimps as read from photographs from the same site (KR004) in 1977-1979.