



Serial No. 5305

ICNAF Res. Doc. 78/XI/89

SPECIAL MEETING OF STACRES - NOVEMBER 1978

Density of Shrimp (*Pandalus borealis*) in 1978 in ICNAF Subarea 1
Based on Bottom Photography

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ABSTRACT

During the years 1975-78 bottom photography has been used to estimate the biomass of shrimp (*Pandalus borealis*) on various fishing grounds at West Greenland. This paper gives the results from the photographic work carried out in 1978 in terms of density and size distribution. The biomass estimates for different areas as compared with those from 1977 and with a biomass estimate obtained from a trawl survey in 1976 leads to a lower biomass estimate by 1978 than that estimated for 1977.

INTRODUCTION

In 1977 and 1978 the density of shrimp, *Pandalus borealis*, was assessed by means of bottom photography in part of the offshore area at West Greenland, ICNAF Subarea 1. A biomass estimate based on the 1977 material was given by Kannevorff (1978). The present paper presents the data collected in 1978 and the resultant biomass estimate.

MATERIAL AND METHODS

The equipment and the method has been described earlier by Kannevorff (MS 1976; 1978), and no change in technique has been made since.

Some of the sampling sites in 1978 were chosen so as to cover the same areas as in the year before in order to enable a direct comparison, while other stations were chosen to examine areas not previously covered.

To ensure the best possible comparison with the 1977 material the 1978 sampling was carried out at the same time of the year and during daytime as before. In total 11 stations were occupied, and 1544 photographs were taken.

During the reading of the photographs the shrimps were classified into three size categories: small (less than 18-20 mm carapace length), large (greater than 26-28 mm), and medium (all others).

The biomass calculation for 1977 as earlier reported by Kannevorff (1978) was based on a mean weight per shrimp of 7.71 g. In the present paper the biomass estimates for both 1977 and 1978 are based on mean

weights calculated for each stratum from the observed size distribution in the two years (Table 1) estimating the mean weight in each of the aforementioned size groups to be as follows: small shrimp 3.5 g, medium 7.5 g, and large shrimp 13 g, which is in good agreement with the length-weight relationship used by Minet et al. (1978) for ICNAF Stat. Area 0. For the 1977 material the resultant biomass estimate (for areas covered in 1977) changed little, viz. from 31963 tons to 31167 tons.

RESULTS AND DISCUSSION

The survey area between 66° and 69°N and the location and area codes of the sampling stations in 1977 and 1978 are shown in Fig.1 together with the various strata used for estimating the biomass (numbered 1-23) being the same as used by Kanneworff (1978). The stations fall within a depth range of 120 to 570. Two of the sites (KRO04 and KBO06) were sampled in both years for a direct year to year comparison. In both years the area around KRO04 was heavily fished by the commercial fleet at the time of the photographic survey while no commercial fishing took place around KBO06 during the sampling time.

The area around KRO04 (in stratum no.7 on Fig1) shows a decrease in density from .71 shrimps/m² in 1977 to .58 shrimps/m² in 1978, while the station in KBO06 showed a very low density of .11 shrimps/m² in both years (Table 1).

An exceptionally high density (1.48 shrimps/m²) was observed in 1978 on one of the northernmost stations, in the area KZ002, but the population here consisted of much smaller individuals than seen before on photos and in samples from the offshore area. Even in the size group "small" the mean size occurred to be below that in other samples.

A fairly high density (.47 shrimps/m²) was also found in the outer part of the Holsteinsborg Dyb (KA011), where a large part of the commercial fishing took place when the offshore shrimp fishery started some years ago. This year one sampling (181 photographs) was carried out in Sukkertoppen Dyb (JFO19, Table 1), showing a density of .60 shrimps/m². This area which is one of the most important offshore fishing grounds for shrimps has been fished commercially for a long period. Variations in the research catches for this area have been described by Carlsson, Horsted and Kanneworff (1978).

The distribution of the shrimps in the three size categories (Table 1) shows a pronounced reduction in average shrimp size from 1977 to 1978, both in the majority of the samples and in the overall average figures. Using the aforementioned average weight of shrimps in the three size groups of 3.5, 7.5 and 13 g, respectively, a rough estimate for the overall average weight per shrimp in each of the strata can be achieved (Table 1, last column). This gives a better basis for estimating the biomass than by using the average overall weight of 7.71 g, obtained from samples in 1976 (Kanneworff, 1978). By means of this method a biomass estimate is calculated as shown in Table 2 for those areas for which photographic material is available for 1977 and 1978. The biomass estimates are in this table compared with the

estimates obtained from a trawl survey in 1976 (Horsted, 1978). The areas for which a direct comparison can be made between years, i.e. in which sampling has taken place in both years, show little variation in numbers per squaremeter between the two years, apart from one of the stations in the northernmost area (KZ002 in stratum no.2). This station has been excluded from the biomass calculations because the high density and the large amount of small shrimps here is considered as a local phenomenon not representing the vast stratum as a whole. However, for other areas covered in one or the other of the two years the data indicate some decrease in stock from 1977 to 1978, when the figures for these areas are compared to the 1976 estimates based on trawl survey.

The material from the areas covered by the photo survey in 1977 gives a revised biomass estimate around 17% higher than the 1976 biomass estimated from trawl hauls, using average weights in the different strata as shown in Table 1. (The difference between results from photographic surveys and trawl surveys was discussed by Kanneworff (1978)). The 1978 photo data leads to an estimate 5% below the 1976 trawl survey estimates, for areas covered in 1976 and 1978.

It could be discussed whether this decrease in the biomass estimates from 1977 to 1978 is indicating a real decrease in stock biomass or whether the 1977 estimate was an overestimate (due to some important strata not being covered), and that the biomass estimate for 1978 in fact is a better estimate than the earlier, due to the better coverage of the more important of the strata. Data for c.p.u.e. in the commercial fishery in the two years may throw some light over the reliability of these biomass estimates.

REFERENCES

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- Kanneworff, Per, 1978. Estimated Density of Shrimp, Pandalus borealis, in Greenland Waters and Calculation of Biomass on the Offshore Grounds Based on Bottom Photography. Ibid., pp 61-65.
- Carlsson, D.M., Sv.Aa.Horsted, and P.Kanneworff. Danish Trawl Surveys on the Offshore West Greenland Shrimp Grounds in 1977 and Previous Years. Ibid., pp 67-74.

TABLE 1. List of stations with photographic sampling in 1977-78. The columns small, medium and large show the size distribution in the three size categories as mentioned in the text, and the last column gives the calculated average weight per shrimp on the different stations.

DATE	AREA CODE	DEPTH RANGE m	NO.OF PHOTOS	DENSITY no./m ²	VARIANCE	SMALL %	MEDIUM %	LARGE %	MEAN WEIGHT g
770806	KX438	344-344	190	.11	.04	0	99	1	7.6
770805	KX005	420-403	204	.15	.06	9	84	7	7.5
770724	KZ012	465-465	35	.19	.08	0	46	55	10.6
770724	KZ012	455-479	54	.19	.04	0	56	44	9.9
770725	KT001	350-350	17	.21	.08	8	92	0	7.2
770726	KR438	388-390	64	.21	.12	0	100	0	7.5
770726	KP440	278-278	82	.37	.12	0	99	1	7.6
770727	KR004	211-210	116	.71	.18	4	95	+	7.3
770805	KF006	571-574	23	.04	.01	0	100	0	7.5
770804	KB006	468-474	282	.11	.03	1	99	0	7.5
780803	LB003	323-339	38	.26	.12	27	70	3	6.6
780802	KZ002	327-324	169	1.48	.72	56	43	1	x)
780802	KV002	426-419	59	.16	.04	0	97	3	7.7
780721	KR004	229-258	154	.58	.26	11	88	1	7.1
780722	KK004	412-378	162	.11	.04	0	100	0	7.5
780724	KK006	250-260	107	.07	.03	7	93	0	7.2
780724	KK008	121-120	126	.00	.00	-	-	-	-
780724	KF007	351-345	172	.01	.00	0	100	0	7.5
780725	KF008	173-170	174	.10	.04	5	93	2	7.4
780725	KB006	509-506	21	.11	.03	13	75	13	7.8
780725	KA011	228-228	3	.49	.12	20	80	0	6.7
780726	KA011	229-226	178	.47	.19	23	77	1	6.7
780727	JFO19	358-351	181	.60	.22	34	65	+	6.1

x) Overall mean weight not estimated because mean weight of "small" occur lower than in other samples.

TABLE 2. Calculated biomass estimates in different strata from photographic surveys in 1977 and 1978, compared with a biomass estimate from trawl survey in 1976 (Horsted, 1978).

STRATUM No.	STRATUM AREA km ²	BIOMASS ESTIMATE 1976	OBSERVED	BIOMASS ESTIMATE 1977	OBSERVED	BIOMASS ESTIMATE 1978
			SHRIMP DENSITY 1977		SHRIMP DENSITY 1978	
2	7705	9920	.11	6441	1.26	x)
3	3000	2066	.16	3984	.16	3696
5	2930	2912	.21	4430	-	-
7	3665	10731	.57	15459	.58	15092
10	1565	4658	-	-	.07	789
12	450	2546	-	-	.11	371
13	520	894	.04	156	-	-
14	520	1149	-	-	.01	39
16	1270	2000	-	-	.10	940
17, 18	845	82	.11	697	.11	725
21	1155	3534	-	-	.47	3637
Total strata 3,7,17,18:		12879		20140		19513
Total strata 2,3,5,7,13,17,18:		26605		31167		
Total strata 3,7,10,12,14, 16,17,18,21:		26686				25289

x) The calculation of a biomass estimate is not realistic due to the very large proportion of small shrimps.

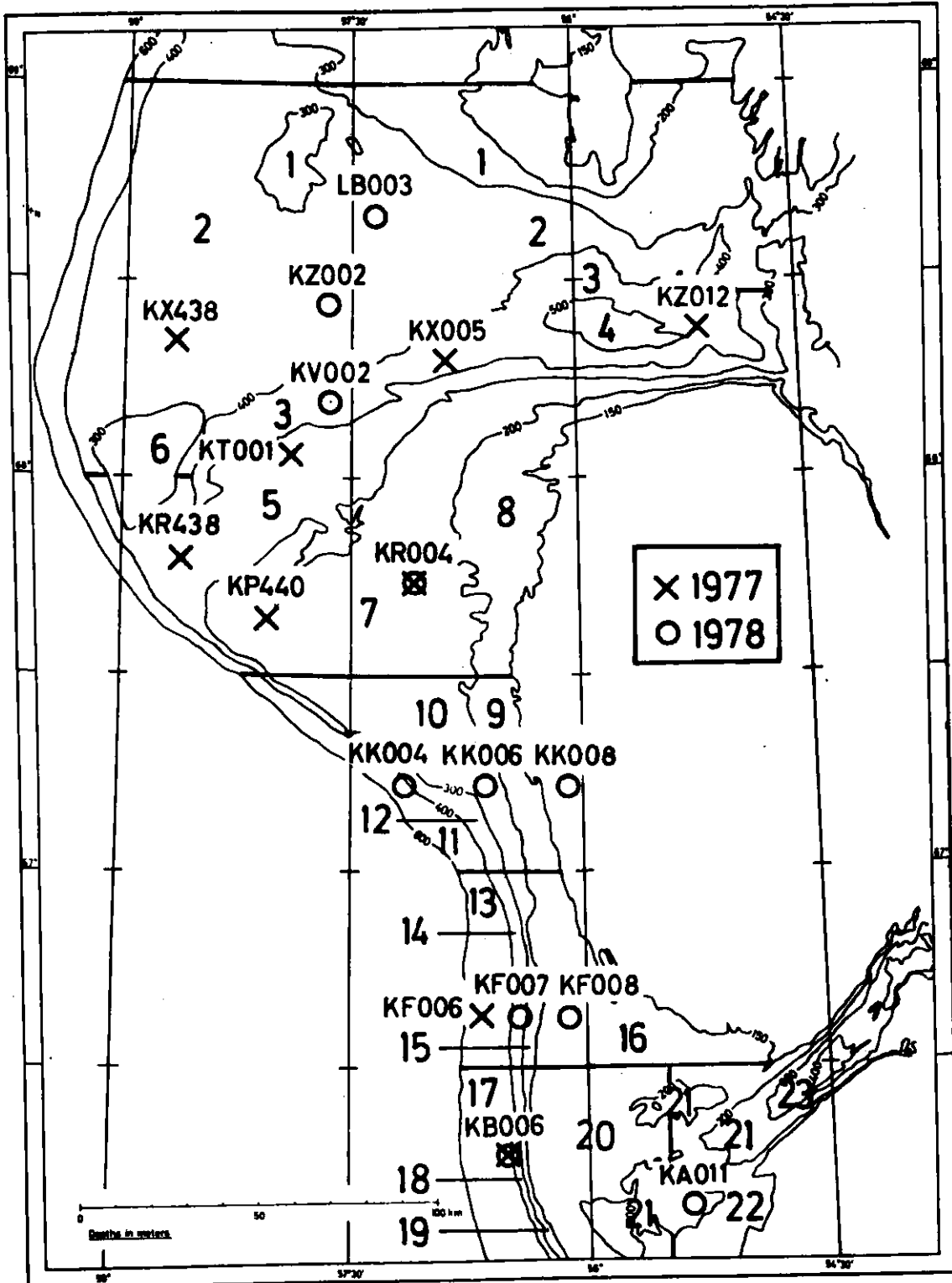


Figure 1. The map shows the photo stations in 1977 and 1978 in the offshore area at West Greenland between 66° and 69°N. The stratification scheme and the numbering is the same as used by Kanneworff (1978). One station in Sukkertoppen Dyb (JFO19) from 1978 is not shown on this map.