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ESTIMATED DENSITY OF SHRIMP (PANDALUS BOREALIS) IN GREENLAND WATERS 1975-77
AND CALCULATION OF BIOMASS ON THE OFFSHORE FISHING GROUNDS, DIVS. 1A-1B
BASED ON BOTTOM PHOTOGRAPHY

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ABSTRACT

Bottom photography has been used during the years 1975, -76 and -77 in West Greenland to obtain estimates of the density of the Pandalus borealis population. In 1975 and 1976 photographs from 8 shrimp grounds in the Disko Bay, ICNAF Div. 1A, were sampled, and in 1977 10 different sites west and north of Store Hellefiskebanke, Divs. 1A and 1B, were visited in June-July.

The density in terms of number per squaremeter is given for the different localities, and the calculation of the size of the biomass in the offshore area concerned is carried out on the basis of a stratification scheme previously used in a biomass calculation from a trawl survey in 1976.

A variance analysis model for testing the uncertainties of the density figures is considered.

INTRODUCTION

Population assessments of the shrimp Pandalus borealis has many complications, lacking methods of determining directly the age of individual shrimps (Carlsson, 1976). The growth rate and the natural mortality and thereby the basis for production models is still not well known. It has been tried to assess the stock size and distribution pattern from the catch-effort data by the swept area method (Horsted, 1976; Hoydal, 1976), and recently a photographic registration technique has been introduced to give data for the population density (Kannevorff, 1976a). Density estimates for two of the shrimp grounds in the Disko Bay in 1975 and 1976 were given and discussed in Kannevorff (1976b), this material is also included in the present paper.

MATERIAL AND METHODS

The equipment and handling technique was described in the paper mentioned above (Kannevorff, 1976a). The same equipment was used in 1977, but with a

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high speed colour film (diapositive) throughout, apart from a few short series with black-and-white film to check the system function.

The various trawling grounds in Disko Bay and the photographic stations in the offshore area together with the stratification scheme used in the biomass calculations are shown in Figs. 1-3. The material considered in this paper consists of 1521 bottom photographs, mostly from Disko Bay and 1 station offshore in Div. 1F, in September-October 1975, 955 photographs from Disko Bay in May 1976, and 2177 photographs from the offshore grounds in Divs. 1A and 1B in July-August 1977.

Due to the more rough weather conditions the number of photographs per station in the 1977 material is much lower than on the inshore stations in the previous years, but the sampling is still considered to be fairly adequate.

A technical fault caused that long series of photographs were taken a few (4 to 5) meters above the bottom on many of the stations in 1977, but this gave an opportunity to check whether shrimps were swimming above the bottom, at any rate in so far as this water layer is concerned.

RESULTS AND DISCUSSION

In Table 1, which is a list of all the stations, the material has been grouped in 30 minutes periods in order to show a possible diurnal variation. Density figures in terms of number of shrimps per observation (photograph) and per squaremeter are given both for each time period and as average for each station.

It is noticeable that the density figures from Disko Bay are at average nearly 10 times greater than the offshore figures. A minor difference consists between the 1975 and 1976 figures from Disko Bay, where the 1976 values are at average between 25 and 100 percent higher than the 1975 figures from the same grounds. This difference may be explained by the long winter period 1975-76 of about 7 months with ice cover and no fishing, giving time for the overall shrimp stock to recover and redistribute on the fishing grounds before the 1976 season started. The photographs of 1975 were taken shortly before the fishing season was closed by the ice cover, and as soon as the winter ice broke during May 1976 the same grounds as the year before were visited, sampling that year's material. The difference in density between the 1975 and 1976 material could thus reflect the influence of such a closed season.

During the reading of the photographs the shrimps have been separated into 3 size groups giving a rough estimate of the size distribution. The group "small" includes shrimps below 18-20 mm carapace length, the size group "large" includes shrimps above 26-28 mm carapace length, and all the other shrimps are counted to the "medium" size group. The table below shows the size distribution of shrimps as measured on the photographs from Disko Bay 1975 and 1976, and from the offshore stations in 1977.

	small %	medium %	large %
Disko Bay 1975	27.9	69.8	2.4
" " 1976	41.3	57.4	1.3
Offshore 1977	3.1	92.2	4.7

Unfortunately it is still not possible to test statistically the density differences between stations and time periods. Only trends and probable differences in the density figures can thus be pointed out, and also the calculations of biomass can only be taken as fairly rough estimates. It has been tried to establish a simple mathematical model (Mr. K.P.Andersen, Danish Institute for Fisheries and Marine Research, personal communication) on which a two-way analysis of variances could be based taking into account both the differences between stations and between time periods. The model

$$d_{i,j} = D + a_i + t_j + E_{i,j}$$

(where $d_{i,j}$ is a density at a given site, i , and time of the day, j ,

D is the overall mean density,

a is an area dependent variable,

t is a time dependent variable, and

E is an uncertainty variable)

showed not to satisfy the material with respect to one area dependent and one time dependent variable alone. The analysis showed that there must be one or more variables as well, which at the same time are dependent of both site and time. Further, the analysis showed that the distribution of observations with 0, 1, 2 etc. shrimps per observation does not follow - contrary to what was expected - a Poisson distribution; the Poisson distribution was one of the assumptions underlying the model. A usable model should thus accept another distribution and include other possibilities of interaction between parameters.

On basis of a stratification scheme used by Horsted (1976) a calculation of the biomass can be carried out for those strata which are covered by the photographic sampling. If it is assumed that the photo countings from each station are representing the overall density of the whole stratum in which it is placed, the figures in Table 2 can be taken as adequate minimum estimates of the stock biomass. The trawl survey in 1976 and the photo survey in 1977 were carried out at the same time of the year (July-August), this might exclude some of the seasonal fluctuations, which seem to be of a considerable importance. The migration pattern is, however, still not known very well, but the catch statistics from the trawler fleet might offer some information on the most important areas in the different seasons of the year.

The biomass figures from the photo countings are calculated from an average shrimp weight of 7.71 g and an observation area of 3.39 squaremeter per photograph (see Kanneworff, 1976a). The average shrimp weight was calculated from 41 biological samples from the trawl survey in 1976, in all 11,198 shrimps with a total weight of 86.37 kg. The average weight used is an unweighted overall mean.

Compared to the estimates by Horsted (l.c.) from the same strata, based on trawl catches, it is seen that the figures obtained by the photo method are as a whole somewhat higher (about 17%). This is, however, to be expected, because the trawl method excludes both those length groups which are entering but not retained by the trawl and the shrimps above the swept area which avoid

entering the trawl. A biomass estimate for the total area dealt with in the paper by Horsted (l.c.), i.e. from 66°N to 69°N inside the depth range of 150 to 600 m and not further west than 59°W, may now be raised by the 17% to a magnitude of 63 800 tons, using the mentioned biomass estimate from the trawling method, but including size groups not retained by the trawl. The previous minimum estimate by Horsted was 54 000 tons from the size groups retained by the trawl.

The photographic method used still gives minimum estimates since it takes into consideration only that part of the shrimp stock which is on the bottom at the time of the photo sampling. However, 1110 photographs which by accident were taken with the camera 4-5 m above the bottom (Table 1) showed no shrimps at all. Shrimps would have been recognized in the interval about 130-180 cm from the camera if they had been present. Very few of the shrimps on the bottom photographs were not in direct contact with the bottom material. Thus the free swimming shrimps are not considered to account for a significant amount of the stock at the time of the photographic sampling, which in 1977 was carried out during daytime only. However, at the time when the problems concerning the before mentioned mathematical model are solved, so that a statistical comparison can be carried out with a known uncertainty, it will be necessary to correct the figures for the diurnal variations.

Although the method has its natural limitations earlier described (Kannevorff, l.c.), a.o. the possible influence of the equipment on the observed shrimps and the resolution limitations for the smallest recognizable shrimps, it is considered to be reliable in giving absolute values of the density of that part of the stock which is actually situated on the bottom.

ACKNOWLEDGEMENT

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REFERENCES

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Table 1. List of photo stations 1975-77. The area code corresponds to the grid shown on Figs. 1 and 2.

STATION NO. 05122/0 DATE: 750917
 SITE SAVIK AREA CODE: LD027 DEPTH: 390 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
700 - 729	1	1	1.00	0.29	0.00
730 - 759	29	71	2.45	0.72	0.23
800 - 829	20	62	3.10	0.91	0.26
TOTALS AND AVERAGES	50	134	2.68	0.79	0.22

STATION NO 05123/0 DATE: 750917
 SITE SAVIK AREA CODE: LD027 DEPTH: 375 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1400 - 1429	12	19	1.58	0.47	0.09
TOTALS AND AVERAGES	12	19	1.58	0.47	0.15

STATION NO 05124/0 DATE: 750917
 SITE CLASHAVN AREA CODE LF027 DEPTH: 295 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1600 - 1629	1	16	16.00	4.72	1.39
1630 - 1659	28	193	6.89	2.03	0.59
1700 - 1729	22	196	8.91	2.63	0.82
TOTALS AND AVERAGES	51	405	7.94	2.34	0.15

Table 1 continued.

STATION NO. 05125/0 DATE: 750918
 SITE CLAUDHAVN AREA CODE: LF027 DEPTH: 290 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
700 - 729	21	143	6.81	2.01	0.65
TOTALS AND AVERAGES	21	143	6.81	2.01	0.20

STATION NO. 05133/0 DATE: 751002
 SITE JHB-BUGT AREA CODE: GN047 DEPTH: 475 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1630 - 1659	14	5	0.36	0.11	0.09
1700 - 1729	30	16	0.53	0.16	0.03
1730 - 1759	1	0	0.00	0.00	0.00
TOTALS AND AVERAGES	45	21	0.47	0.14	0.12

STATION NO. 05141/0 DATE: 751015
 SITE GODHAVNFELT AREA CODE: LH019 DEPTH: 390 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1400 - 1429	13	105	8.08	2.38	0.80
1430 - 1459	16	133	8.31	2.45	0.72
1500 - 1529	20	118	5.90	1.74	0.54
1530 - 1559	30	185	6.17	1.82	0.51
1600 - 1629	30	134	4.47	1.32	0.37
1630 - 1659	28	111	3.96	1.17	0.37
1700 - 1729	2	5	2.50	0.74	0.17
TOTALS AND AVERAGES	139	791	5.69	1.68	0.23

STATION NO. 05142/0 DATE: 751016
 SITE: GODHAVNFELT AREA CODE: LH020 DEPTH: 380 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
930 - 959	3	28	9.33	2.75	0.76
1000 - 1029	25	180	7.20	2.12	0.78
1030 - 1059	21	137	6.52	1.92	0.59
1100 - 1129	29	141	4.86	1.43	0.42
1130 - 1159	30	135	4.50	1.33	0.39
1200 - 1229	29	136	4.69	1.38	0.40
1230 - 1259	28	123	4.39	1.30	0.43
1300 - 1329	13	36	2.77	0.82	0.27
TOTALS AND AVERAGES	178	916	5.15	1.52	0.24

Table 1 continued.

STATION NO. 05143/0 DATE: 751016
 SITE FORSILD GR. N AREA CODE: LJ026 DEPTH: 330 M.

TIME PERIOD	NO OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
2030 - 2059	2	10	5.00	1.47	0.39
2100 - 2129	30	120	4.00	1.18	0.37
2130 - 2159	29	84	2.90	0.85	0.24
2200 - 2229	30	80	2.67	0.79	0.22
2230 - 2259	7	15	2.14	0.63	0.22
TOTALS AND AVERAGES	98	309	3.15	0.93	0.23

STATION NO. 05144/0 DATE: 751017
 SITE KLOKKERHUK AREA CODE: LJ028 DEPTH: 285 M.

TIME PERIOD	NO. OBS	NO SHRIMPS	AV NO. SHRIMPS/OBS	AV NO SHRIMPS/SQM	VARIANCE
1200 - 1229	3	21	7.00	2.06	0.56
1230 - 1259	5	50	10.00	2.95	0.87
1530 - 1559	22	257	11.68	3.45	1.06
1600 - 1629	14	141	10.07	2.97	0.87
TOTALS AND AVERAGES	44	469	10.66	3.14	0.04

STATION NO. 05145/0 DATE: 751018
 SITE KLOKKERHUK AREA CODE: LJ028 DEPTH: 295 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
730 - 759	24	383	15.96	4.71	1.38
800 - 829	30	398	13.27	3.91	1.23
830 - 859	30	257	8.57	2.53	0.75
900 - 929	27	212	7.85	2.32	0.68
930 - 959	30	229	7.63	2.25	0.68
1000 - 1029	30	239	7.97	2.35	0.71
1030 - 1059	25	226	9.04	2.67	0.80
TOTALS AND AVERAGES	196	1944	9.92	2.93	0.04

Table 1 continued.

STATION NO. 05146/0 DATE: 751019
 SITE FORSILD GR N AREA CODE: LH025 DEPTH: 310 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1130 - 1159	12	58	4.83	1.43	0.39
1200 - 1229	30	148	4.93	1.46	0.42
1230 - 1259	30	146	4.87	1.44	0.40
1300 - 1329	30	124	4.13	1.22	0.37
1330 - 1359	30	178	5.93	1.75	0.56
1400 - 1429	30	118	3.93	1.16	0.35
1430 - 1459	31	120	3.87	1.14	0.34
1500 - 1529	30	115	3.83	1.13	0.35
1530 - 1559	30	114	3.80	1.12	0.43
1600 - 1629	29	115	3.97	1.17	0.40
1630 - 1659	17	71	4.18	1.23	0.31
TOTALS AND AVERAGES	299	1307	4.37	1.29	0.25

STATION NO. 05147/0 DATE: 751020
 SITE FORSILD GR S AREA CODE: LH025 DEPTH: 430 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
630 - 659	4	0	0.00	0.00	0.00
700 - 729	30	12	0.40	0.12	0.05
730 - 759	30	13	0.43	0.13	0.06
800 - 829	20	14	0.70	0.21	0.08
830 - 859	9	9	1.00	0.29	0.11
900 - 929	31	33	1.06	0.31	0.13
930 - 959	30	17	0.57	0.17	0.07
1000 - 1029	30	22	0.73	0.22	0.09
1030 - 1059	25	21	0.84	0.25	0.16
1100 - 1129	14	17	1.21	0.36	0.11
TOTALS AND AVERAGES	223	158	0.71	0.21	0.15

STATION NO. 05147/2 DATE: 751020
 SITE FORSILD GR S AREA CODE: LH025 DEPTH: 435 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1330 - 1359	8	28	3.50	1.03	0.34
1400 - 1429	29	56	1.93	0.57	0.16
1430 - 1459	27	43	1.59	0.47	0.12
1500 - 1529	30	18	0.60	0.18	0.06
1530 - 1559	2	3	1.50	0.44	0.09
1600 - 1629	23	26	1.13	0.33	0.13
1630 - 1659	30	25	0.83	0.25	0.07
1700 - 1729	16	13	0.81	0.24	0.07
TOTALS AND AVERAGES	165	212	1.28	0.38	0.18

Table 1 continued.

STATION NO. : 05196/0 DATE: 760513
 SITE PORSILD GR. N AREA CODE: LH025 DEPTH: 305 M.

TIME PERIOD	NO OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1900 - 1929	25	208	8.32	2.45	0.71
1930 - 1959	30	222	7.40	2.18	0.62
2000 - 2029	28	139	4.96	1.46	0.49
2030 - 2059	29	81	2.79	0.82	0.24
2100 - 2129	30	115	3.83	1.13	0.34
2130 - 2159	30	134	4.47	1.32	0.39
2200 - 2229	29	127	4.38	1.29	0.35
2230 - 2259	30	142	4.73	1.40	0.54
2300 - 2329	30	142	4.73	1.40	0.44
2330 - 2359	21	147	7.00	2.06	0.70
TOTALS AND AVERAGES	282	1457	5.17	1.52	0.24

STATION NO. : 05196/0 DATE: 760514
 SITE PORSILD GR. N AREA CODE: LH026 DEPTH: 330 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
630 - 659	9	57	6.33	1.87	0.53
700 - 729	27	127	4.70	1.39	0.43
730 - 759	30	120	4.00	1.18	0.35
800 - 829	30	168	5.60	1.65	0.48
830 - 859	3	23	7.67	2.26	0.74
TOTALS AND AVERAGES	99	495	5.00	1.47	0.25

STATION NO. : 05197/0 DATE: 760514
 SITE PORSILD GR. S AREA CODE: LH025 DEPTH: 435 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1500 - 1529	21	38	1.81	0.53	0.16
1530 - 1559	12	30	2.50	0.74	0.21
1600 - 1629	3	3	1.00	0.29	0.09
1630 - 1659	11	11	1.00	0.29	0.09
1700 - 1729	29	33	1.14	0.34	0.10
1730 - 1759	30	33	1.10	0.32	0.12
1800 - 1829	18	13	0.72	0.21	0.04
1830 - 1859	30	32	1.07	0.31	0.10
1900 - 1929	11	13	1.18	0.35	0.16
1930 - 1959	8	2	0.25	0.07	0.17
TOTALS AND AVERAGES	173	208	1.20	0.35	0.17

Table 1 continued.

STATION NO. : 05195/0 DATE: 760512
 SITE GODHAVNFELT AREA CODE: LG019 DEPTH: 401 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1400 - 1429	3	11	3.67	1.08	0.33
1430 - 1459	30	209	6.97	2.06	0.68
1500 - 1529	27	218	8.07	2.38	0.76
1530 - 1559	30	258	8.60	2.54	0.82
1600 - 1629	24	355	14.79	4.36	1.37
1630 - 1659	27	551	20.41	6.02	1.80
1700 - 1729	30	573	19.10	5.63	1.75
1730 - 1759	4	76	19.00	5.60	1.71
TOTALS AND AVERAGES	175	2251	12.86	3.79	0.70

STATION NO. : 05195/0 DATE: 760513
 SITE GODHAVNFELT AREA CODE: LH020 DEPTH: 400 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
800 - 829	19	135	7.11	2.10	0.63
830 - 859	29	188	6.48	1.91	0.68
900 - 929	26	183	7.04	2.08	0.63
930 - 959	30	269	8.97	2.65	0.83
1000 - 1029	29	291	10.03	2.96	0.99
1030 - 1059	30	341	11.37	3.35	1.02
1100 - 1129	27	399	14.78	4.36	1.29
1130 - 1159	11	151	13.73	4.05	1.16
TOTALS AND AVERAGES	201	1957	9.74	2.87	0.05

STATION NO. : 05202/+ DATE: 760521
 SITE AKUNAP AVANGNA AREA CODE: LD024 DEPTH: 225 M.

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
630 - 659	1	26	26.00	7.67	2.26
900 - 929	1	6	6.00	1.77	0.52
1000 - 1029	5	95	19.00	5.60	1.67
1030 - 1059	1	33	33.00	9.73	2.87
1200 - 1229	1	49	49.00	14.45	4.26
1330 - 1359	3	132	44.00	12.98	4.45
1500 - 1529	8	152	19.00	5.60	1.62
1530 - 1559	3	49	16.33	4.82	1.53
1630 - 1659	2	24	12.00	3.54	1.01
TOTALS AND AVERAGES	25	566	22.64	6.68	4.28

Table 1 continued.

STATION NO. 05444/1 DATE 770724
 SITE N. F. ST. HFB AREA CODE KZ012 DEPTH: 465 M.
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS 38

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
600 - 629	14	9	0.64	0.19	0.07
630 - 659	21	13	0.62	0.18	0.12
TOTALS AND AVERAGES	35	22	0.63	0.19	0.15

STATION NO. 05444/0 DATE 770724
 SITE N. F. ST. HFB AREA CODE KZ012 DEPTH: 465 M.
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS 0

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
730 - 759	37	22	0.59	0.18	0.03
830 - 859	1	0	0.00	0.00	0.00
900 - 929	6	4	0.67	0.20	0.06
930 - 959	10	8	0.80	0.24	0.05
TOTALS AND AVERAGES	54	34	0.63	0.19	0.11

STATION NO. 05446/0 DATE 770725
 SITE W. F. ST. HFB AREA CODE KT001 DEPTH: 350 M.
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS 333

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
900 - 929	1	0	0.00	0.00	0.00
930 - 959	2	1	0.50	0.15	0.00
1030 - 1059	11	10	0.91	0.27	0.12
1100 - 1129	2	1	0.50	0.15	0.00
1130 - 1159	1	0	0.00	0.00	0.00
TOTALS AND AVERAGES	17	12	0.71	0.21	0.16

Table 1 continued.

STATION NO. : 05447/0 DATE: 770726
 SITE: W. F. ST. HFB AREA CODE: KP440 DEPTH: 278 M
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS: 216

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
500 - 529	7	7	1.00	0.29	0.03
530 - 559	17	21	1.24	0.36	0.12
600 - 629	17	31	1.82	0.54	0.14
630 - 659	16	17	1.06	0.31	0.09
700 - 729	14	16	1.14	0.34	0.15
730 - 759	11	10	0.91	0.27	0.14
TOTALS AND AVERAGES	82	102	1.24	0.37	0.16

STATION NO. : 05448/0 DATE: 770726
 SITE: W. F. ST. HFB AREA CODE: KR438 DEPTH: 390 M
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS: 351

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1400 - 1429	9	5	0.56	0.16	0.13
1430 - 1459	25	26	1.04	0.31	0.14
1500 - 1529	13	10	0.77	0.23	0.21
1530 - 1559	9	2	0.22	0.07	0.17
1600 - 1629	7	1	0.14	0.04	0.00
1630 - 1659	1	1	1.00	0.29	0.00
TOTALS AND AVERAGES	64	45	0.70	0.21	0.18

STATION NO. : 05449/0 DATE: 770727
 SITE: W. F. ST. HFB AREA CODE: KR004 DEPTH: 210 M
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS: 151

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
500 - 529	3	10	3.33	0.98	0.27
530 - 559	23	66	2.87	0.85	0.22
600 - 629	17	45	2.65	0.78	0.19
630 - 659	19	39	2.05	0.61	0.14
700 - 729	18	43	2.39	0.70	0.24
730 - 759	36	75	2.08	0.61	0.18
TOTALS AND AVERAGES	116	278	2.40	0.71	0.20

Table 1 continued.

STATION NO. : 05453/0 DATE 770804
 SITE: W. F. HBG DYB AREA CODE KB006 DEPTH: 470 M.
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS 10

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1330 - 1359	2	0	0.00	0.00	0.00
1400 - 1429	53	25	0.47	0.14	0.03
1430 - 1459	57	17	0.30	0.09	0.04
1500 - 1529	55	27	0.49	0.14	0.04
1530 - 1559	57	14	0.25	0.07	0.04
1600 - 1629	58	24	0.41	0.12	0.02
TOTALS AND AVERAGES	282	107	0.38	0.11	0.11

STATION NO. : 05454/0 DATE 770805
 SITE: W. F. ST. HFB. AREA CODE: KF006 DEPTH: 572 M.
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS: 1

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
530 - 559	10	0	0.00	0.00	0.00
700 - 729	6	0	0.00	0.00	0.00
730 - 759	7	3	0.43	0.13	0.00
TOTALS AND AVERAGES	23	3	0.13	0.04	0.12

STATION NO. : 05455/0 DATE: 770805
 SITE N. F. ST. HFB. AREA CODE: KX005 DEPTH: 410 M.
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS: 5

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1900 - 1929	40	30	0.75	0.22	0.12
1930 - 1959	58	30	0.52	0.15	0.03
2000 - 2029	59	25	0.42	0.12	0.05
2030 - 2059	38	20	0.53	0.16	0.08
2100 - 2129	9	1	0.11	0.03	0.00
TOTALS AND AVERAGES	204	106	0.52	0.15	0.13

Table 1 continued.

STATION NO.: 05456/0 DATE: 770806
 SITE: N. F. ST. HFB. AREA CODE: KX438 DEPTH: 344 M.
 NO. OF 'OFF BOTTOM' PHOTOGRAPHS: 5

TIME PERIOD	NO. OBS	NO. SHRIMPS	AV NO. SHRIMPS/OBS	AV NO. SHRIMPS/SQM	VARIANCE
1430 - 1459	30	14	0.47	0.14	0.01
1500 - 1529	51	19	0.37	0.11	0.03
1530 - 1559	57	21	0.37	0.11	0.05
1600 - 1629	36	10	0.28	0.08	0.08
1630 - 1659	16	6	0.38	0.11	0.07
TOTALS AND AVERAGES	190	70	0.37	0.11	0.11

TABLE 2. Calculated biomass for the various strata in 1977 compared to the figures from Horsted (1976).

STRATUM NO.	AREA KM ²	DENSITY SHRIMPS/M ²	BIOMASS (tons)		ST.NO.
			TRAWLING (Horsted, 1976)	PHOTO	
1	2475	-	7751	-	
2	7705	.11	9920	6458	5456
3	3000	.16	2066	3704	5444, 5455
4	355	-	478	-	
5	2930	.21	2912	4691	5446, 5448
6	515	-	1477	-	
7	3665	.57	10731	16004	5447, 5449
8	1615	-	1460	-	
9	450	-	73	-	
10	1565	-	4658	-	
11	300	-	513	-	
12	450	-	2546	-	
13	520	.039	894	154	5454
14	520	-	1149	-	
15	300	-	122	-	
16	1270	-	2000	-	
17	615	-	2	-	
18	230	.11	80	199	5453
19	310	-	11	-	
20	2470	-	74	-	
21	1155	-	3534	-	
22	1545	-	1720	-	
23	230	-	397	-	
TOTAL	34 190	54	54 568	31 210	

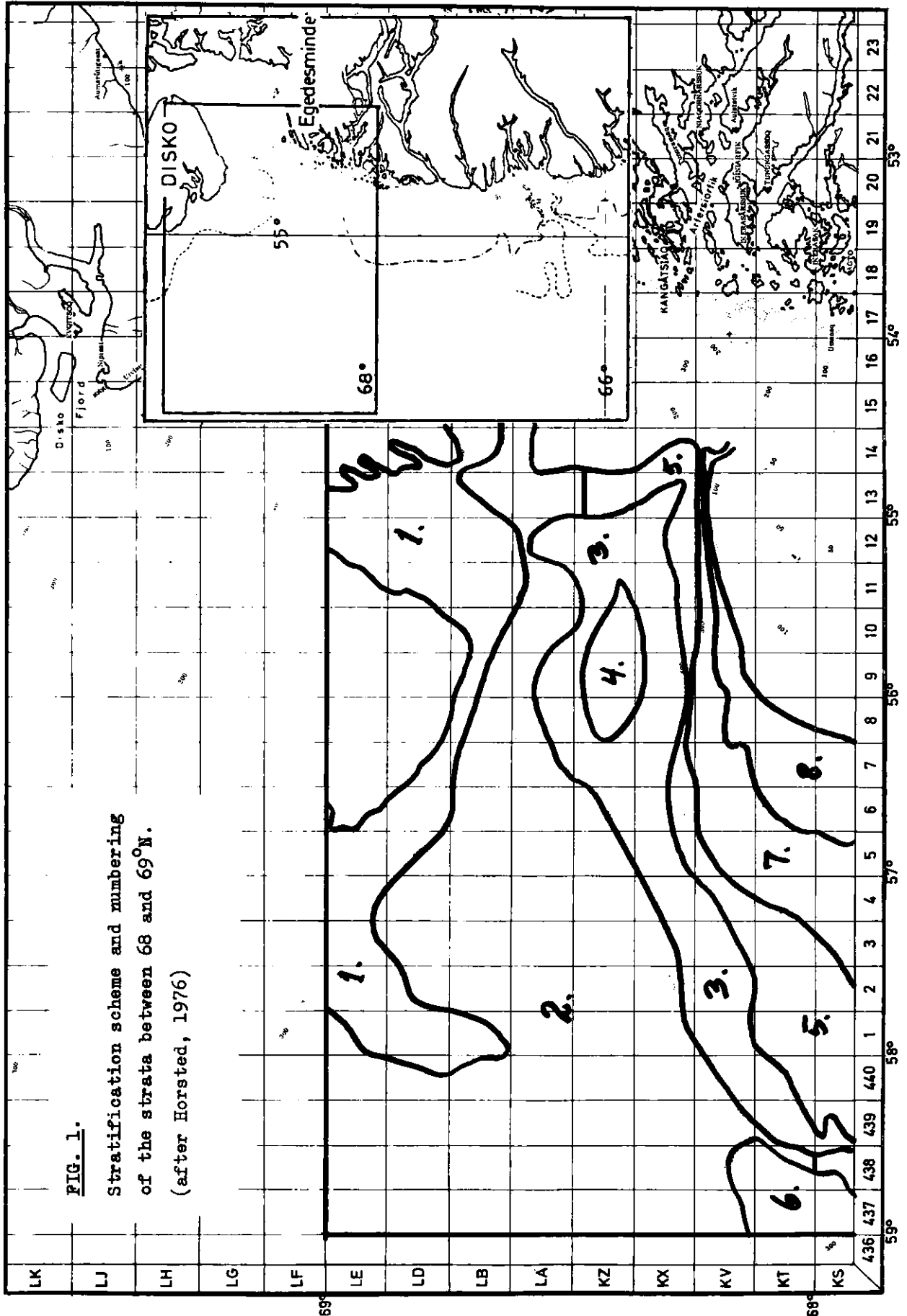


FIG. 1.

Stratification scheme and numbering
of the strata between 68 and 69°N.
(after Horsted, 1976)

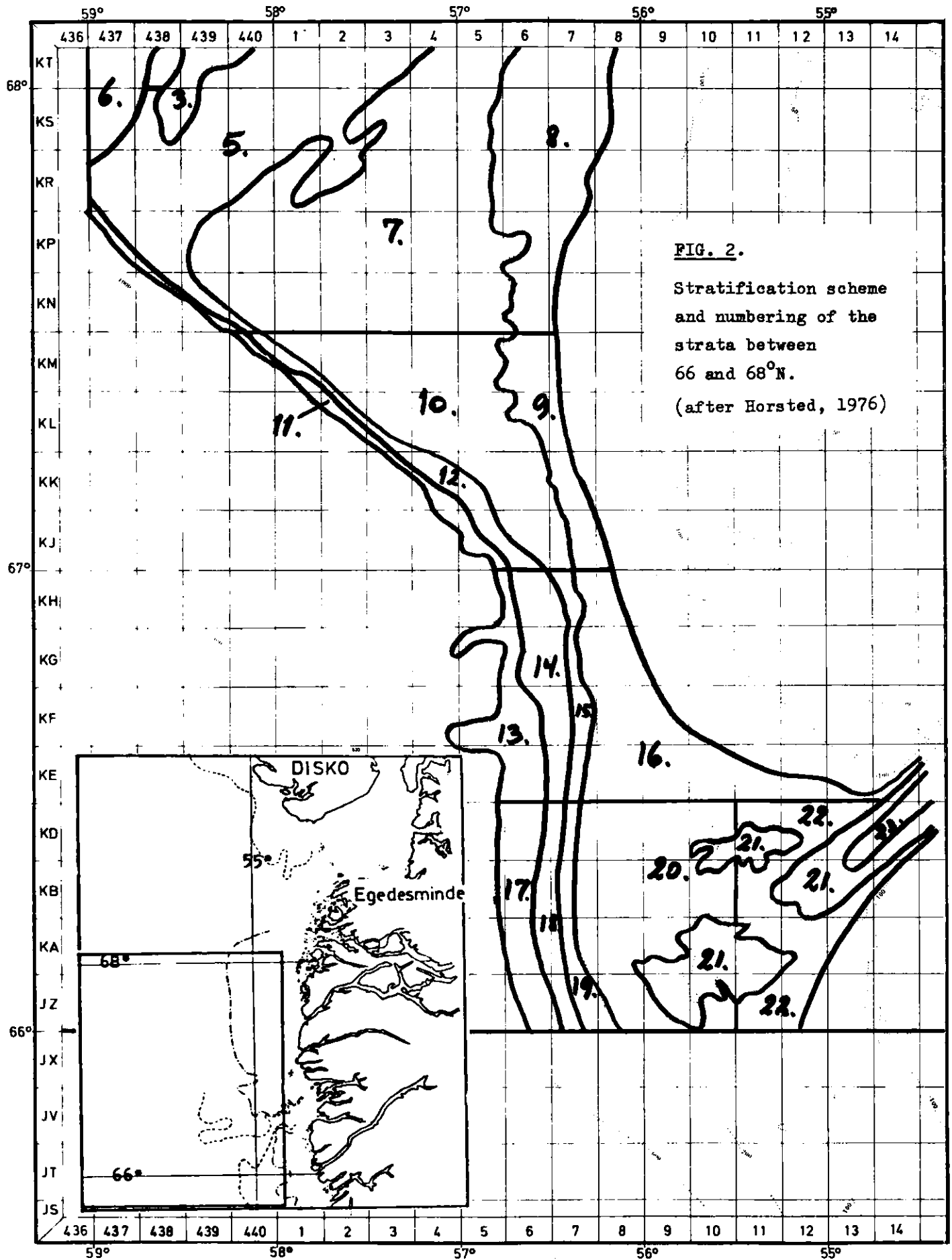


FIG. 2.
Stratification scheme
and numbering of the
strata between
66 and 68°N.
(after Horsted, 1976)

FIG. 3.

Names and places of the different shrimp grounds
in Disko Bay.

