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Biomass of shrimp (Pandalus borealis) in Subarea 1 in 1981-85 estimated by means of bottom photography

by

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ABSTRACT

Data from photographic surveys in 1977-85 have been analysed to produce biomass estimates of shrimp in part of NAFO Subarea 1. The observed variations in shrimp density and their relations to geographical and environmental parameters are discussed, and estimates of total biomass for different size groups in the area examined are presented.

INTRODUCTION

Since 1977 photographic surveys have been carried out in the offshore shrimp distribution area in NAFO Subarea 1. The amount of shrimp on the photographs and the observed size distribution have been used for estimating the level of total biomass and distributional fluctuations of the stock since introduction of a regression model in 1980.

MATERIAL AND METHODS

Data from the photographic surveys in the area 66°00´N-69°30´N has been used to describe shrimp density and distribution and to estimate the level of total biomass in different years. The planned station grid for the surveys has been the same throughout the years, but the success of sampling has varied much from year to year with an almost complete coverage in the last three years only (Fig. 1). The 1985 survey occupied 26 sampling sites in the area 66°00´N to 69°30´N, and in all 3,309 photographs from this survey have been examined and added to the database used in the present work. The amount of photographs now used for estimating the shrimp stock in the area in question totals to 21,626. Some stations north and south of the area have been occupied during the later years, but the material is still too small for estimating the biomass in these areas.

A repeated reading of the older material has now been completed. At present the whole photographic material classifies the shrimp into five size groups as described by Kanneworff (1985). The numbers of shrimp in each of the size groups have been counted, and the corresponding biomass calculated on basis of mean weights in the groups estimated for each sampling site. The new reading has also included a registration of the bottom type. It has been possible to distinguish between four types:

A: Even structure with clay or sand only;
B: Clay or sand with gravel and some small stones;
C: Gravel with stones, a few boulders;
D: Stones and boulders.

On each sampling station fairly long series of photographs have been taken in order to level out the sampling errors due to the uneven distribution of shrimp on the bottom. Mean densities and size distributions have been calculated as averages for each station as basis for most of the analyses, but as the bottom structure frequently changes along the sampling track it has not yet been possible to include the bottom type in those analyses. However, as the character of the bottom very likely has an influence on the distribution of shrimp, special analyses have been carried out to elucidate such relations.

RESULTS AND DISCUSSION

Distribution of shrimp.

The counted number and corresponding biomass per squaremeter of shrimp in the five size groups as well as the estimated mean weight are given for all sampling sites for the years 1977-85 in Table 1. Selected stations which have been sampled frequently during the years are shown on Figure 2. This figure shows the observed biomass of shrimp per size group for each of the sites. It is a striking feature that very high concentrations (mostly of all size groups together) occur on different locations from year to year. The figure also indicates that this feature is less pronounced in 1985 than in the other years. Only a few of the sites show a higher degree of stability in the total biomass; low densities are found in the southern and western slopes of the area (area codes KF007, KP440 and KX438), densities of average values are found in the central flats northwest of Store Hellefiskebanke (KV007, KZ002, KZ012, LB005 and LH004), while constantly higher densities are found in Godhavn Rende (LH014-LJ011) only.

To facilitate an analysis of the distribution of the size groups on the different sampling sites the 'station effect' has been tested by means of a simple linear regression analysis (Tables 2-6). Only the period 1981-85 has been included here because of the more complete coverage of the sampling sites during these years. The results from this analysis shows firstly, that sampling sites with low mean biomass exhibit constantly low biomass figures in all size groups and secondly, that only large shrimp (groups four and five) seem to inhabit the same areas with roughly the same degree of preference from year to year.

On basis of this analysis and the study of the original distributions (Fig. 2) it is concluded that preferred or non-preferred areas exist, but that on the other hand concentrations of shrimp of all sizes move round in the area from year to year. To find possible explanations for such movements of the stock is the purpose of developing descriptive models including parameters which might have an effect on the migrations of the stock.

Part of the mentioned 'station effect' could possibly be assigned to the bottom material or structure. As stated earlier a classification of bottom types has been carried out during the reading of photographs. An analysis in which all 17,704 photographs from the years 1981-85 have been used as separate observations (in contrast to the station averages

normally used) has been made specially to illustrate the effect of the bottom type in combination with the effects from the hour of sampling, temperature, latitude and longitude (Tables 7-11). This analysis indicates, that some of the variation in the shrimp biomass is actually correlated with the type of bottom. It is also indicated that the five size groups to a certain degree react differently to the bottom types. Because of the uneven distribution of the shrimp on the bottom, an analysis of this kind naturally involves high variations in the dependent variable; thus low correlation coefficients can be accepted for this model.

Development of the model.

In order to find a shape of the descriptive model (i.e. a set of parameters which explains resonable parts of the variations in the observed biomasses), which is suitable for estimating a total biomass, a basic model including the following parameters has been used:

Depth (DE), ranges from 162 to 506 meters;
Latitude (LA), the area between 66°00´N and 69°30´N has been sampled within the depth range;
Longitude (LO), the area between 54°30´W and 59°15´W has been sampled within the depth range;
Hour of sampling (KL), only sampling in daylight-hours has occurred;
Bottom temperature at the time of sampling (T0);
Bottom temperature in the sampling stratum one year earlier (T1);
Bottom temperature in the sampling stratum two years earlier (T2);
Temperature four years earlier in the 0-50 m layer West of Fylla Bank (T4).

The primary runs of the basic model also include the squared values of the parameters and the crossproducts in order to analyse the total response surface of the parameters (Table 12).

A logarithmic transformation has been applied to the dependent variable (biomass per squaremeter), because the distribution of the shrimp on the bottom is assumed to be contagious with a clumping size of roughly the same size as the counted (photographed) area.

The bottom temperatures have been recorded during a hydrographic cruise in July and during the photographic survey in July-August 1985. Isolines for for the bottom temperature in this period is shown in Fig. 3.

The basic model has been optimized by means of different starting points and by using different procedures for choosing or discarding elements of the basic model. In order to avoid too much ´noise´ in crossproduct effects all crossproducts, which involve correlated parameters, have been removed before the filtering processes. To find usable combinations of elements in the model the ´Stepwise´ procedure from the ´Statistical Analysis System´ computer package has been applied. This procedure saves much time, but naturally the combination of remaining elements from such a process is only to be regarded as one of many possible solutions. It has been the aim to find fairly simple models, in which both the correlation coefficient for the model is acceptable and all the parameters significantly explain the variations of the dependant variable.

As in earlier works (e.g. Kanneworff, 1985) one model describing the total biomass (i.e. all size groups combined) has initially been developed. However, after the repeated reading of all photographs, in which five size groups have been established (in stead of the earlier three groups), it has now been possible to investigate how the various parameters act on the biomass of the different size groups. Tables 13-18 show the elements in the final models for the five size groups and for the combined material. From Table 19, which sums up the various models it is clearly seen, that the degree of latitude (and its square) is of importance for the distribution of all size groups, while the depth seems to influence the biomass of the middle groups of shrimp mainly. Fluctuations in east-west distribution (degree of longitude) is only significant for groups one and five. The effects of the temperature show an interesting pattern, where group one seems to be connected with variations in T0, group two with T1, group three with T2 (and to a lesser degree with T0), group four with T4 (and T1), and group five with T2. This could be interpreted so, that the size groups are more or less connected with age groups, eventually as an indirect effect. The hour of sampling seems to have a certain effect on the large shrimp only, but as the sampling has only occurred during hours with daylight, possible fluctuations especially in the amount of shrimp of the other size groups might be hidden by this sampling pattern.

Only half of the variations in the observed biomasses are explained by these models. An inclusion of e.g. bottom type and hour of sampling in the model used for estimating the biomass would certainly raise the correlation coefficient, but an explanation of the observed ´moving concentrations´ would still not be satisfactory. A further adjustment of the model is thus needed, and other parameters have to be tested for their possible connection with the movements of the shrimp biomass.

Biomass estimates.

For all strata accordant to the stratum system defined by Carlsson & Kanneworff (1979) biomass indices have been calculated by inserting the parameter estimates from the regression analyses together with relevant values for the elements of the models into the equations for the five size groups (Tables 14-18). Biomass estimates for the investigated area, $66^{\circ}00'N$ - $69^{\circ}30'N$, within the depth range 100-600 meters were calculated and summed up to produce estimated levels of the total biomass for the years 1981-85. The calculated biomass estimates for the period are as follows:

year	1981	1982	1983	1984	1985
tons	154892	188230	171196	184758	160238

Fig. 4 shows these estimates broken down into the five size groups. The trends in the figures are in good agreement with trends in the corresponding July-September CPUE-figures for Subarea 1B for the years 1981-83, but not for the last two years (Carlsson, 1986).

As only half of the variations observed in the biomass figures is explained by the model a fairly large disagreement with other measures of shrimp density (e.g. CPUE) is to be expected. However, also the differences in sampling periods (normally from the last part of July to the end of August) and sampling sites compared to those occupied for the CPUE-figures might give rise to larger disagreements.

No large variation in the contributions of the five size groups to the

total biomass can be seen in Fig. 4, apart from the decrease from 1982 to 1983. This decrease is mainly due to a lower value of the biomass of group five in 1983.

In order to visualize the effect of the different parameters in the five models separate maps for each of the size groups and for each year have been drawn with isolines for different levels of biomass per squaremeter (Figs. 5-9). The five size groups exhibit very different distribution patterns, the small shrimp (groups one and two) being concentrated in the northeastern part, while the large shrimp seem to inhabit a fairly broad belt north and northwest of Store Hellefiske-banke. The distribution pattern of the larger shrimp corresponds on the whole with the distribution of the commercial fishery in the areas (Carlsson, 1986).

Small shrimp seem to have been fairly constant through the years, while larger shrimp exhibit some displacements. For the area west of Store Hellefiskebanke it is indicated, that shrimp of middle size (group three) were of less density in 1981 than in the other years. This area shows, however, a decreasing density of larger shrimp (groups four and five) through the five year period.

CONCLUSION

Analysis of the distribution of shrimp in the photographic material has shown that special areas exist, which exhibit more or less constant densities of shrimp from year to year. It is also shown, however, that high concentrations of all sizes of shrimp occur on differrent locations in different years.

By means of a regression model biomass estimates of different size groups of shrimp have been calculated for the total area examined for the years 1981-85. The total biomass seem to have been fairly constant through the years, however, large shrimp seem to have been less abundant in all areas in 1983 and 1985, while in part of the area a somewhat lower biomass of middle sized shrimp is indicated for 1981.

REFERENCES

Carlsson, D. M., 1986. Data on the shrimp fisheries in NAFO Subarea 1 in 1984 and 1985. NAFO SCR Doc. 86/10.

Carlsson, D.M. & P. Kanneworff, 1979. Areas of basic strata in West Greenland, ICNAF/NAFO Subarea 1. ICNAF Res. Doc. 79/XI/11.

Kanneworff, P., 1985. Biomass of shrimp (Pandalus borealis) in NAFO Subarea 1 in 1981-84 estimated by means of bottom photography. NAFO SCR Doc. 85/I/8.

Table 1a. List of stations occupied in 1977-80 with numbers and biomass per squaremeter. The estimated mean weight of shrimp per station is also given.

STATIONLIST WITH SHRIMP DENSITIES AND BIOMASS PER SQUAREMETER

YEAR=1977

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
1	5453	KB006	810.21	0.28	1.58	0.127	0.010	0.024	0.098	0.023	0.53	0.04	0.15	0.82	0.23	5.58
2	5454	KF006	67.80	0.15	0.88	0.074	0.018	0.000	0.000	0.055	0.19	0.07	0.00	0.00	0.63	6.00
3	5447	KP440	183.06	0.38	3.40	0.013	0.007	0.074	0.094	0.198	0.04	0.03	0.44	0.80	2.09	9.03
4	5449	KR004	306.10	0.94	6.27	0.045	0.098	0.436	0.289	0.076	0.14	0.40	2.57	2.37	0.78	6.64
5	5448	KR438	101.70	0.27	2.06	0.000	0.000	0.133	0.061	0.071	0.00	0.00	0.78	0.51	0.77	7.77
6	5446	KT001	27.12	0.41	2.68	0.074	0.000	0.147	0.147	0.037	0.19	0.00	0.88	1.23	0.38	6.61
7	5455	KX005	606.81	0.43	1.89	0.262	0.033	0.042	0.082	0.014	0.68	0.12	0.26	0.69	0.14	4.37
8	5456	KX438	549.18	0.15	0.77	0.064	0.005	0.044	0.036	0.003	0.17	0.02	0.26	0.30	0.03	5.10
9	5444	KZ012	135.60	0.41	2.75	0.164	0.017	0.000	0.086	0.138	0.43	0.06	0.00	0.74	1.52	6.77

YEAR=1978

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
10	5610	JF019	603.42	0.47	2.95	0.067	0.104	0.069	0.192	0.034	0.18	0.42	0.41	1.59	0.35	6.33
11	5609	KA011	586.47	0.54	2.85	0.197	0.033	0.160	0.125	0.022	0.31	0.13	0.94	1.03	0.23	5.30
12	5605	KF007	623.76	0.00	0.06	0.000	0.000	0.000	0.000	0.005	0.00	0.00	0.00	0.00	0.06	11.50
13	5606	KF008	552.57	0.10	0.61	0.005	0.011	0.043	0.019	0.003	0.02	0.04	0.37	0.16	0.03	6.03
14	5602	KK004	440.70	0.16	1.03	0.000	0.012	0.028	0.064	0.000	0.00	0.07	0.24	0.71	0.03	9.85
15	5604	KK006	389.85	0.07	0.56	0.000	0.003	0.024	0.044	0.003	0.00	0.02	0.14	0.36	0.03	7.48
16	5603	KK008	427.14	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	.
17	5601	KR004	542.40	0.62	4.08	0.019	0.008	0.290	0.173	0.054	0.06	0.36	1.68	1.42	0.56	6.54
18	5612	KV002	193.23	0.20	1.31	0.045	0.006	0.056	0.073	0.022	0.12	0.02	0.34	0.60	0.23	6.51
19	5613	KZ002	549.18	1.38	6.38	0.559	0.293	0.268	0.225	0.033	1.91	1.14	1.55	1.84	0.34	4.64
20	5614	LB003	111.87	0.21	1.46	0.012	0.024	0.083	0.072	0.024	0.04	0.10	0.49	0.59	0.25	6.81

YEAR=1979

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
21	5739	KN003	111.87	0.16	0.95	0.000	0.021	0.021	0.063	0.021	0.00	0.09	0.13	0.52	0.22	7.60
22	5740	KR004	47.46	3.65	16.95	0.895	1.292	1.060	0.398	0.000	2.60	5.17	6.04	3.14	0.00	4.65
23	5734	KV007	20.34	0.49	3.01	0.000	0.055	0.328	0.109	0.000	0.00	0.22	1.90	0.88	0.00	6.12
24	5741	KX014	10.17	0.79	5.77	0.131	0.000	0.262	0.131	0.262	0.33	0.00	1.60	1.09	2.75	7.33
25	5744	KX438	16.95	0.12	0.50	0.059	0.000	0.059	0.000	0.000	0.16	0.00	0.34	0.00	0.00	4.25
26	5742	KZ012	37.29	0.32	2.45	0.029	0.029	0.029	0.176	0.059	0.07	0.13	0.18	1.46	0.61	7.63
27	5743	LB005	33.90	1.33	4.21	1.032	0.118	0.147	0.029	0.000	2.68	0.44	0.84	0.25	0.00	3.17
28	5738	LE005	30.51	1.44	7.51	0.401	0.320	0.320	0.401	0.000	1.08	1.28	1.86	3.29	0.00	5.21
29	5737	LJ011	152.55	1.64	8.09	0.282	0.690	0.376	0.275	0.014	0.85	2.78	2.15	2.17	0.17	4.94

YEAR=1980

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
30	5855	KP440	105.09	0.18	1.08	0.000	0.045	0.113	0.000	0.023	0.00	0.19	0.63	0.00	0.26	5.95
31	5856	KR004	549.18	0.45	2.15	0.152	0.098	0.123	0.072	0.005	0.41	0.39	0.72	0.58	0.05	4.78
32	5867	KT001	135.60	4.40	27.61	0.246	0.655	2.078	1.220	0.205	0.76	2.68	12.06	10.00	2.11	6.27
33	5868	KV002	366.12	1.00	4.31	0.369	0.320	0.198	0.093	0.020	1.00	1.25	1.11	0.74	0.22	4.31
34	5857	KV007	159.33	0.24	0.83	0.166	0.035	0.035	0.009	0.000	0.43	0.13	0.20	0.07	0.00	3.40
35	5872	KZ002	511.89	2.13	7.09	1.433	0.459	0.160	0.097	0.000	3.73	1.67	0.88	0.82	0.00	3.33
36	5860	KZ012	603.42	0.16	0.89	0.037	0.015	0.056	0.048	0.002	0.10	0.05	0.33	0.39	0.02	5.72
37	5859	KZ014	359.34	1.04	6.21	0.175	0.160	0.441	0.273	0.039	0.38	0.66	2.56	2.24	0.48	5.99
38	5866	LA438	566.13	0.06	0.55	0.000	0.000	0.003	0.035	0.022	0.00	0.02	0.30	0.23	0.03	9.14
39	5858	LB005	125.43	1.16	5.22	0.596	0.198	0.108	0.208	0.054	1.55	0.75	0.64	1.72	0.56	4.49
40	5861	LD012	206.79	0.82	5.26	0.064	0.085	0.351	0.326	0.011	0.17	0.35	1.95	2.67	0.11	6.43
41	5871	LD439	305.10	0.05	0.31	0.005	0.005	0.031	0.010	0.000	0.02	0.02	0.18	0.08	0.00	5.82
42	5862	LE005	277.98	1.91	9.34	0.538	0.606	0.360	0.351	0.055	1.45	2.43	2.05	2.84	0.57	4.89
43	5870	LH004	101.70	0.44	3.03	0.000	0.032	0.237	0.126	0.047	0.00	0.13	1.37	1.04	0.49	6.86
44	5863	LH014	379.68	2.55	14.40	0.057	0.674	1.363	0.423	0.030	0.18	2.76	7.77	3.38	0.30	5.65
45	5869	LH440	203.91	1.28	8.56	0.000	0.005	0.855	0.402	0.022	0.00	0.02	5.03	3.36	0.22	6.69
46	5865	LJ011	644.10	3.24	14.19	0.988	1.270	0.663	0.282	0.039	2.77	5.08	3.71	2.18	0.45	4.37

Table 1b. List of stations occupied in 1981-83 with numbers and biomass per squaremeter. The estimated mean weight of shrimp per station is also given.

YEAR=1981

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
47	6022	JL020	284.76	1.98	11.01	0.034	0.666	0.973	0.242	0.044	0.11	2.73	5.55	1.92	0.70	5.56
48	6023	KA011	610.20	0.59	3.11	0.047	0.183	0.292	0.068	0.003	0.15	0.73	1.67	0.54	0.03	5.34
49	6021	KF007	610.20	0.11	0.75	0.003	0.005	0.058	0.036	0.008	0.01	0.02	0.34	0.29	0.08	6.82
50	6020	KL006	352.56	0.17	0.64	0.064	0.079	0.023	0.004	0.000	0.18	0.31	0.12	0.03	0.00	3.77
51	6019	KP440	342.39	0.48	2.87	0.089	0.084	0.129	0.129	0.049	0.24	0.34	0.75	1.05	0.51	6.06
52	6024	KR004	616.98	2.02	8.30	0.740	0.804	0.311	0.134	0.034	2.07	3.14	1.74	1.02	0.34	4.11
53	6031	KT001	650.88	0.96	6.15	0.057	0.129	0.409	0.362	0.007	0.17	0.53	2.41	2.97	0.08	6.38
54	6030	KT436	661.05	0.58	4.82	0.000	0.000	0.026	0.536	0.020	0.00	0.00	0.16	4.45	0.20	8.28
55	6033	KV002	583.08	0.84	5.31	0.553	0.045	0.137	0.098	0.005	1.44	0.17	0.82	0.82	0.05	3.94
56	6029	KX438	501.72	0.25	1.64	0.092	0.038	0.117	0.077	0.017	0.01	0.16	0.68	0.63	0.17	6.55
57	6034	KZ003	572.91	1.13	6.25	0.228	0.216	0.371	0.286	0.029	0.62	0.86	2.15	2.32	0.30	5.54
58	6028	KZ012	630.54	0.38	2.74	0.013	0.062	0.082	0.179	0.046	0.03	0.26	0.48	1.49	0.48	7.18
59	6025	KZ015	579.69	2.92	12.80	1.193	0.858	0.707	0.322	0.037	3.22	2.57	4.03	2.61	0.37	4.39
60	6026	LB005	537.01	0.94	4.41	0.306	0.310	0.156	0.147	0.029	0.82	1.21	0.87	1.19	0.31	4.67
61	6027	LE005	616.98	2.63	9.90	1.160	1.001	0.349	0.107	0.015	3.13	3.90	1.92	0.79	0.15	3.76
62	6036	LH014	373.38	1.49	7.31	0.363	0.336	0.601	0.182	0.007	1.02	1.34	3.43	1.45	0.07	4.91
63	6037	LJ011	216.96	2.75	12.44	0.560	1.147	0.881	0.158	0.008	1.60	4.59	4.93	1.18	0.06	4.52
64	6038	LS014	644.10	0.91	4.13	0.197	0.350	0.311	0.043	0.005	0.59	1.40	1.74	0.34	0.05	4.54

YEAR=1982

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
65	6232	KA011	464.43	0.29	1.44	0.043	0.093	0.142	0.014	0.004	0.13	0.37	0.79	0.11	0.03	4.89
66	6231	KF007	572.91	0.04	0.31	0.005	0.007	0.005	0.012	0.012	0.01	0.03	0.03	0.10	0.14	7.42
67	6216	KL006	257.64	0.59	2.57	0.502	0.114	0.127	0.047	0.000	0.81	0.44	0.73	0.38	0.00	4.02
68	6217	KN003	352.56	3.05	16.77	0.170	0.950	1.512	0.527	0.070	0.38	3.90	8.62	3.13	0.74	5.50
69	6229	KP440	315.28	0.65	2.87	0.216	0.214	0.166	0.051	0.008	0.61	0.85	0.93	0.40	0.09	4.37
70	6218	KR004	539.01	1.05	6.85	0.068	0.165	0.504	0.302	0.073	0.03	0.67	2.93	2.48	0.75	6.51
71	6219	KR006	606.81	4.02	14.75	1.963	1.331	0.610	0.106	0.011	5.30	5.19	3.35	0.79	0.11	3.67
72	6228	KT001	437.31	1.43	6.60	0.470	0.334	0.428	0.146	0.005	1.32	1.34	2.72	1.17	0.05	4.60
73	6223	KT436	596.64	0.56	3.95	0.008	0.025	0.258	0.217	0.051	0.02	0.11	1.52	1.78	0.52	7.08
74	6227	KV002	644.10	0.27	1.60	0.034	0.023	0.132	0.072	0.004	0.10	0.10	0.78	0.59	0.04	6.02
75	6221	KV007	647.49	0.90	4.91	0.259	0.175	0.210	0.106	0.013	0.70	0.70	1.22	1.53	0.77	5.44
76	6224	KX007	667.83	0.78	5.37	0.058	0.042	0.336	0.250	0.096	0.17	0.17	1.98	2.05	1.00	6.87
77	6222	KX438	555.96	0.28	1.72	0.005	0.028	0.176	0.041	0.007	0.01	0.12	1.02	0.49	0.07	6.20
78	6226	KZ003	576.30	0.77	5.87	0.160	0.115	0.291	0.140	0.014	0.45	0.46	1.69	1.14	0.14	5.38
79	6235	KZ012	667.83	0.41	2.93	0.019	0.029	0.130	0.195	0.035	0.05	0.12	0.78	1.62	0.36	7.17
80	6234	KZ014	281.37	0.48	2.98	0.009	0.083	0.250	0.132	0.009	0.03	0.34	1.45	1.07	0.09	6.16
81	6235	LB005	485.14	1.04	5.58	0.211	0.289	0.292	0.211	0.068	0.59	1.16	1.66	1.71	0.38	5.29
82	6236	LD012	498.33	0.85	4.11	0.193	0.267	0.279	0.098	0.011	0.55	1.07	1.59	0.78	0.12	4.85
83	6237	LE005	434.92	1.18	4.59	0.557	0.308	0.272	0.042	0.003	1.50	1.20	1.53	0.43	0.03	3.88
84	6239	LH004	400.02	0.53	2.76	0.046	0.177	0.244	0.057	0.007	0.14	0.71	1.39	0.45	0.07	5.21
85	6249	LH014	539.85	1.75	7.66	0.241	0.961	0.510	0.031	0.004	0.75	3.84	2.81	0.22	0.04	4.38
86	6238	LH440	322.05	0.72	4.61	0.000	0.035	0.487	0.181	0.017	0.00	0.14	2.83	1.47	0.18	6.40
87	6246	LM002	430.53	0.63	3.41	0.019	0.211	0.301	0.090	0.006	0.06	0.87	1.71	0.71	0.07	5.45
88	6247	LM006	355.95	1.06	4.68	0.206	0.514	0.312	0.027	0.007	0.62	2.06	1.75	0.19	0.02	4.39
89	6241	LR008	176.28	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	
90	6240	LS014	462.28	1.63	10.31	0.086	0.444	0.479	0.467	0.153	0.27	1.82	2.78	3.83	1.62	6.33
91	6244	LT001	508.50	0.05	0.25	0.006	0.019	0.000	0.019	0.000	0.02	0.08	0.00	0.16	0.00	5.61
92	6245	LT004	457.65	0.25	1.90	0.003	0.010	0.081	0.129	0.029	0.01	0.04	0.48	1.07	0.30	7.57
93	6242	LV011	467.82	1.94	12.00	0.010	0.287	1.176	0.395	0.075	0.03	1.18	6.82	3.20	0.77	6.17
94	6243	LX008	481.38	0.10	0.74	0.000	0.027	0.064	0.038	0.027	0.00	0.11	0.02	0.32	0.29	7.78

YEAR=1983

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
95	6435	KA011	452.00	0.99	5.65	0.022	0.186	0.645	0.130	0.009	0.07	0.76	3.68	1.04	0.09	5.69
96	6437	KR007	453.60	0.02	0.10	0.000	0.000	0.012	0.005	0.000	0.00	0.00	0.07	0.03	0.00	6.26
97	6436	KR008	475.20	0.29	1.61	0.000	0.053	0.225	0.014	0.000	0.00	0.22	1.28	0.11	0.00	5.51
98	6439	KF007	453.60	0.03	0.23	0.000	0.008	0.008	0.039	0.003	0.00	0.00	0.04	0.16	0.03	8.03
99	6438	KF008	507.60	0.01	0.03	0.002	0.000	0.004	0.000	0.000	0.01	0.00	0.02	0.00	0.00	4.73
100	6441	KJ005	630.54	0.02	0.19	0.048	0.015	0.062	0.000	0.000	0.12	0.06	0.01	0.00	0.00	2.93
101	6440	KL006	583.40	0.08	0.39	0.018	0.036	0.018	0.008	0.003	0.05	0.15	0.10	0.06	0.03	4.69
102	6442	KN004	600.03	2.99	12.47	0.434	1.899	0.588	0.087	0.002	1.34	7.59	3.23	0.27	0.02	4.17
103	6428	KP440	504.90	0.21	1.49	0.000	0.008	0.110	0.089	0.008	0.00	0.03	0.65	0.73	0.08	6.95
104	6444	KR004	481.38	1.10	5.52	0.044	0.461	0.516	0.073	0.009	0.14	1.84	2.89	0.56	0.09	5.00
105	6443	KR006	511.89	1.91	7.80	0.341	1.021	0.319	0.028	0.000	1.57	4.09	1.75	0.20	0.00	3.98
106	6445	KT001	515.28	0.75	3.98	0.105	0.225	0.276	0.133	0.013	0.31	0.98	1.57	1.06	0.13	5.30
107	6436	KT436	569.52	1.01	6.38	0.002	0.045	0.719	0.237	0.010	0.01	0.19	4.17	1.92	0.10	6.30
108	6459	KV002	572.91	0.35	1.94	0.041	0.056	0.161	0.075	0.008	0.18	0.28	0.93	0.61	0.00	5.50
109	6461	KV007	569.52	0.57	2.82	0.050	0.209	0.282	0.033	0.000	0.16	0.84	1.58	0.25	0.00	4.92
110	6460	KX007	572.91	0.40	2.15	0.122	0.018	0.163	0.094	0.003	0.32	0.07	0.96	0.77	0.03	5.38
111	6457	KX438	569.52	0.42	2.29	0.026	0.140	0.182	0.067	0.007	0.09	0.56	1.03	0.53	0.08	5.40
112	6458	KZ002	569.52	0.85	4.15	0.170	0.275	0.413	0.077	0.014	0.31	1.10	1.78	0.61	0.15	4.89
113	6462	KZ012	447.48	0.39	2.56	0.000	0.015	0.241	0.103	0.015	0.00	0.06	1.52	0.83	0.15	6.50
114	6454	LB005	402.30	1.28	5.94	0.372	0.317	0.487	0.094	0.010	1.04	1.27	2.78	0.75	0.11	4.64
115	6429	LD012	448.20	1.33	7.34	0.068	0.329	0.641	0.208	0.017	0.21	1.64	3.66	1.67	0.17	5.50
116	6455	LD439	552.57	0.30	1.86	0.006	0.026	0.108	0.066	0.010	0.02	0.11	1.09	0.54	0.10	6.26
117	6453	LE005	572.93	1.40	5.91	0.571	0.482	0.308	0.039	0.002	1.60	1.88	1.72	0.29	0.02	3.93
118	6452	LH004	542.79	0.41	2.13	0.024	0.167	0.153	0.062	0.002	0.07	0.67	0.87	0.48	0.03	5.20
119	6430	LH014	494.10	0.28	2.07	0.686	1.158	0.379	0.054	0.000	1.99	4.63	2.08	0.38	0.00	3.99
120	6424	LH440	270.00	0.43	3.32	0.000	0.000	0.165	0.184	0.076	0.00	0.00	0.99	1.53	0.80	7.80
121	6446	LJ011	54.24	2.18	9.99	0.257	1.127	0.672	0.099	0.020	0.80	4.51	3.77	0.72	0.20	4.59
122	6448	LM002	376.29	0.41	2.12	0.024	0.157	0.175	0.051	0.003	0.07	0.63	0.99	0.34	0.04	5.19
123	6447	LM006	485.75	0.59	2.34	0.167	0.344	0.074	0.007	0.002	0.49	1.38	0.41	0.05	0.02	3.94
124	6431	LS014	491.40	0.91	4.19	0.228	0.341	0.218	0.092	0.012	0.66	1.45	1.22	0.72	0.14	4.59
125	6451	LT001	518.67	0.03	0.22	0.005	0.000	0.011	0.016	0.000	0.01	0.00	0.07	0.14	0.00	6.60
126	6450	LT004	582.97	0.24	1.64	0.000	0.018	0.145	0.057	0.028	0.00	0.07	0.84	0.46	0.26	6.70
127	6432	LV012	507.60	0.58	3.96	0.007	0.047	0.785	0.226	0.025	0.02	0.15	1.68	1.85	0.25	6.84
128	6433	LX008	18.90	0.05	0.60	0.000	0.000	0.000	0.000	0.053	0.00	0.00	0.00	0.00	0.60	11.30
129	6449	LX008	562.74	0.08	0.54	0.013	0.009	0.021	0.038	0.004	0.03	0.04	0.13	0.30	0.04	6.51

Table 1c. List of stations occupied in 1984-85 with numbers and biomass per squaremeter. The estimated mean weight of shrimp per station is also given.

YEAR=1984

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
130	6713	KA010	294.93	0.43	2.57	0.000	0.107	0.209	0.102	0.009	0.00	0.44	1.21	0.83	0.09	6.02
131	6715	KB006	518.67	0.03	0.12	0.009	0.023	0.000	0.000	0.000	0.03	0.09	0.00	0.00	0.00	3.69
132	6714	KB009	593.25	0.01	0.05	0.000	0.000	0.006	0.002	0.000	0.00	0.00	0.04	0.02	0.00	6.38
133	6717	KF007	566.13	0.23	1.64	0.019	0.005	0.088	0.064	0.033	0.05	0.02	0.53	0.69	0.35	7.16
134	6716	KF008	572.91	0.01	0.04	0.000	0.000	0.007	0.000	0.000	0.00	0.00	0.04	0.00	0.00	5.70
135	6718	KJ006	566.13	0.01	0.00	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	.
136	6723	KL006	535.62	0.06	0.33	0.007	0.004	0.040	0.004	0.004	0.02	0.01	0.23	0.03	0.04	5.71
137	6721	KN003	410.19	0.64	2.46	0.262	0.257	0.097	0.014	0.009	0.73	1.00	0.53	0.10	0.09	3.85
138	6722	KP440	603.42	0.39	2.40	0.018	0.050	0.212	0.090	0.018	0.06	0.21	1.23	0.73	0.18	6.20
139	6720	KR004	552.57	1.12	5.41	0.089	0.496	0.464	0.058	0.012	0.28	1.98	2.60	0.43	0.12	4.83
140	6719	KR006	505.11	2.50	7.62	1.801	0.560	0.127	0.011	0.005	4.68	2.13	0.66	0.10	0.05	3.04
141	6724	KS002	552.57	2.04	11.23	0.107	0.465	1.229	0.229	0.014	0.34	1.91	7.00	1.83	0.14	5.49
142	6725	KT437	555.96	0.47	2.69	0.002	0.070	0.335	0.058	0.002	0.01	0.29	1.91	0.47	0.02	5.75
143	6727	KV002	444.09	0.42	2.44	0.061	0.051	0.191	0.107	0.008	0.17	0.21	1.10	0.87	0.08	5.85
144	6735	KV007	596.64	1.02	5.72	0.026	0.242	0.611	0.134	0.008	0.08	0.99	3.48	1.07	0.08	5.59
145	6734	KX007	593.24	0.45	3.02	0.004	0.031	0.236	0.147	0.027	0.01	0.13	1.39	1.21	0.28	6.78
146	6726	KX437	532.23	0.25	1.39	0.000	0.053	0.190	0.011	0.000	0.00	0.22	1.03	0.09	0.00	5.47
147	6728	KZ002	511.89	1.22	6.74	0.135	0.266	0.594	0.216	0.012	0.42	1.06	3.38	1.75	0.13	5.51
148	6737	KZ012	572.91	2.18	8.34	1.476	0.159	0.300	0.234	0.014	3.84	0.59	1.80	1.97	0.14	3.82
149	6736	KZ014	535.62	0.99	5.80	0.000	0.189	0.617	0.173	0.006	0.00	0.78	3.58	1.39	0.06	5.89
150	6729	LB005	342.90	0.86	3.87	0.252	0.323	0.221	0.084	0.004	0.65	1.29	1.24	0.65	0.04	4.49
151	6738	LD012	464.43	4.38	16.12	2.550	0.833	0.836	0.159	0.000	6.88	3.25	4.68	1.30	0.00	3.68
152	6733	LD439	559.35	0.23	1.24	0.050	0.029	0.101	0.040	0.007	0.14	0.12	0.59	0.32	0.07	5.45
153	6730	LE005	569.52	2.08	8.34	0.645	1.002	0.396	0.030	0.007	1.87	4.01	2.18	0.21	0.07	4.01
154	6731	LH004	393.24	0.39	2.24	0.000	0.097	0.217	0.063	0.010	0.00	0.40	1.24	0.50	0.10	5.79
155	6740	LH014	471.21	5.46	26.73	1.363	2.160	1.864	0.075	0.000	4.09	8.64	10.44	0.56	0.00	4.34
156	6732	LH440	532.23	0.61	4.03	0.000	0.058	0.341	0.190	0.025	0.00	0.24	1.98	1.56	0.25	6.56
157	6749	LJ011	545.79	1.55	9.85	0.471	0.952	0.125	0.000	0.000	1.36	3.63	0.68	0.00	0.00	3.78
158	6741	LM002	396.63	0.68	2.64	0.314	0.182	0.165	0.020	0.000	0.85	0.71	0.93	0.15	0.00	3.87
159	6742	LM006	535.62	0.21	1.06	0.017	0.086	0.094	0.017	0.000	0.05	0.35	0.53	0.13	0.00	4.92
160	6743	LR008	511.89	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	.
161	6746	LS014	398.37	2.63	11.38	0.455	1.442	0.627	0.186	0.003	1.36	5.77	3.45	0.76	0.03	4.32
162	6744	LT001	498.33	0.25	1.68	0.005	0.020	0.117	0.102	0.005	0.02	0.08	0.69	0.84	0.05	6.75
163	6745	LT004	420.36	0.41	2.27	0.012	0.110	0.240	0.041	0.009	0.04	0.45	1.37	0.33	0.09	5.52
164	6747	LV012	359.34	2.34	11.35	0.255	0.882	1.047	0.153	0.000	0.79	3.53	5.86	1.16	0.00	4.85
165	6748	LX008	539.01	0.43	1.31	0.351	0.035	0.038	0.006	0.000	0.91	0.13	0.21	0.05	0.00	3.03

YEAR=1985

OBS	STNO	ARCODE	T_AR	T_DEN	T_BSQ	DEN1	DEN2	DEN3	DEN4	DEN5	BSQ1	BSQ2	BSQ3	BSQ4	BSQ5	WBAR
166	1	KA011	369.51	1.79	10.23	0.016	0.303	1.243	0.222	0.008	0.05	1.24	7.08	1.78	0.08	5.71
167	2	KB007	515.28	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	.
168	3	KB008	440.70	0.04	0.23	0.000	0.007	0.025	0.007	0.000	0.00	0.03	0.14	0.05	0.00	5.89
169	5	KF007	539.01	0.15	1.05	0.000	0.006	0.082	0.056	0.009	0.00	0.02	0.48	0.46	0.09	6.92
170	4	KF008	450.87	0.01	0.03	0.000	0.003	0.003	0.000	0.000	0.00	0.01	0.02	0.00	0.00	4.95
171	6	KJ006	427.14	0.00	0.03	0.000	0.000	0.005	0.000	0.000	0.00	0.00	0.03	0.00	0.00	5.70
172	7	KL006	474.60	0.00	0.02	0.000	0.004	0.000	0.000	0.000	0.00	0.02	0.09	0.00	0.00	4.00
173	8	KN003	461.04	0.57	1.92	0.385	0.091	0.084	0.012	0.000	1.00	0.35	0.47	0.10	0.00	3.35
174	9	KP440	501.72	0.22	1.50	0.004	0.004	0.138	0.071	0.007	0.01	0.02	0.81	0.58	0.08	6.70
175	19	KR004	481.38	1.27	6.77	0.023	0.407	0.725	0.105	0.007	0.07	1.67	4.13	0.82	0.08	5.44
176	20	KR006	368.30	8.76	23.93	7.539	1.123	0.037	0.000	0.000	19.60	4.16	0.18	0.00	0.00	2.75
177	14	KT001	379.68	1.30	5.45	0.536	0.303	0.379	0.073	0.007	1.45	1.18	2.16	0.58	0.07	4.20
178	10	KT436	464.43	0.24	1.58	0.000	0.029	0.136	0.061	0.017	0.00	0.12	0.79	0.49	0.18	6.49
179	15	KV002	403.41	1.23	6.51	0.269	0.219	0.530	0.180	0.034	0.75	0.88	3.07	1.46	0.35	5.29
180	18	KV007	525.45	0.88	4.78	0.089	0.183	0.501	0.109	0.008	0.28	0.75	2.85	0.82	0.08	5.41
181	17	KX007	525.45	2.23	14.40	0.125	0.198	1.115	0.730	0.062	0.39	0.81	6.58	5.98	0.64	6.46
182	11	KX436	511.89	0.23	1.27	0.000	0.081	0.130	0.017	0.006	0.00	0.33	0.74	0.13	0.06	5.40
183	16	KZ002	369.51	1.79	7.54	0.625	0.566	0.525	0.072	0.003	1.75	2.27	2.94	0.55	0.03	4.21
184	22	KZ012	586.47	0.66	4.14	0.033	0.129	0.306	0.198	0.013	0.10	0.53	1.77	1.60	0.13	6.10
185	21	KZ014	196.62	0.95	5.73	0.000	0.085	0.700	0.154	0.008	0.00	0.35	4.06	1.25	0.08	6.06
186	13	LB006	369.51	1.11	5.68	0.168	0.401	0.371	0.170	0.013	0.48	1.68	2.11	1.35	0.14	5.09
187	23	LD012	254.25	3.88	15.95	1.112	1.795	0.877	0.092	0.005	3.23	7.18	4.83	0.66	0.05	4.11
188	12	LD439	430.53	0.34	1.93	0.003	0.088	0.181	0.063	0.003	0.01	0.36	1.03	0.50	0.03	5.73
189	24	LE005	420.36	1.41	5.54	0.546	0.554	0.268	0.038	0.000	1.58	2.22	1.47	0.27	0.00	3.94
190	25	LH003	284.76	1.02	4.48	0.270	0.384	0.319	0.049	0.000	0.78	1.54	1.79	0.37	0.00	4.38
191	26	LH440	342.69	0.12	0.56	0.032	0.024	0.048	0.012	0.000	0.09	0.10	0.28	0.10	0.00	4.79
192	27	LS014	437.31	1.02	4.57	0.192	0.456	0.315	0.054	0.000	0.58	1.82	1.77	0.40	0.00	4.49
193	28	LV012	379.68	2.71	14.14	0.244	0.786	1.411	0.228	0.038	0.76	3.14	8.05	1.80	0.39	5.22

Table 2. Linear regression analysis of the 'station effect' on the biomass density of group one for the years 1981-85.

SUKIAP PHOTO, BIOMASS 1981 - 1985
STATION EFFECT

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB11
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	371058.61732506	12795.12473535	8.05	0.0001	0.723882	1471.8354
ERROR	89	141537.12471589	1590.30477209		ROOT MSE		LNB11 MEAN
CORRECTED TOTAL	118	512595.74204096			39.87862550		-2.70944876

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ARCODE	29	371058.61732506	8.05	0.0001	29	371058.61732506	8.05	0.0001

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		0.32853251 B	0.24	0.8144	1.39517650
ARCODE	KA010	-3.27598788 B	-2.00	0.0484	1.63677709
	KB006	-3.83509541 B	-1.71	0.0901	2.23845673
	KB007	-7.23629279 B	-3.82	0.0002	1.89412219
	KB008	-7.23629279 B	-4.18	0.0001	1.73216551
	KF007	-6.42877820 B	-4.04	0.0001	1.58949594
	KF008	-7.23629279 B	-4.19	0.0001	1.72759237
	KJ005	-2.44880105 B	-1.16	0.2497	2.11348298
	KJ006	-7.23629279 B	-3.84	0.0002	1.88362227
	KL006	-3.86369322 B	-2.36	0.0203	1.63534270
	KN003	-0.49026273 B	-0.29	0.7709	1.67880764
	KP440	-4.13690096 B	-2.57	0.0118	1.60970448
	KR004	-1.96458828 B	-1.23	0.2211	1.59433818
	KR006	1.23652734 B	0.75	0.4574	1.65676288
	KT001	-1.15297192 B	-0.72	0.4742	1.60424726
	KT436	-6.60832504 B	-4.18	0.0001	1.58269106
	KV002	-1.52065768 B	-0.95	0.3433	1.59603027
	KV007	-1.80417116 B	-1.11	0.2686	1.62062502
	KX007	-2.66557101 B	-1.63	0.1072	1.63802036
	KX438	-6.27637830 B	-3.94	0.0002	1.59426830
	KZ002	-0.84940018 B	-0.53	0.5967	1.59935549
	KZ012	-3.04107211 B	-1.93	0.0573	1.57922594
	KZ014	-3.69772584 B	-2.16	0.0339	1.71586691
	LB005	-0.68684857 B	-0.42	0.6764	1.64012133
	LD012	-0.21134466 B	-0.12	0.9015	1.70359311
	LD439	-4.37237960 B	-2.53	0.0130	1.72544925
	LE005	0.32111996 B	0.20	0.8412	1.59840460
	LH004	-3.42210921 B	-2.00	0.0485	1.71048799
	LH014	0.12694771 B	0.08	0.9396	1.67132436
	LH440	-6.18654183 B	-3.55	0.0006	1.74106555
	LJ011	0.00000000 B	.	.	.

Table 3. Linear regression analysis of the 'station effect' on the biomass density of group two for the years 1981-85.

SHRIMP PROJ0, BIOMASS 1981 - 1985
STATION EFFECT

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB12
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	284181.72736721	9799.36990921	10.99	0.0001	0.781652	2245.9007
ERROR	89	79383.79126652	891.95271086		ROOT MSE		LNB12 MEAN
CORRECTED TOTAL	118	363565.51863374			29.86557736		-1.32978174

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ARCODE	29	284181.72736721	10.99	0.0001	29	284181.72736721	10.99	0.0001

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		1.39824669 B	1.34	0.1842	1.04486429
ARCODE	KA010	-1.82867570 B	-1.49	0.1393	1.22580185
	KB006	-3.80619230 B	-2.27	0.0256	1.67640689
	KB007	-8.30600197 B	-5.86	0.0001	1.41853065
	KB008	-5.61421859 B	-4.33	0.0001	1.29723937
	KF007	-6.33992521 B	-5.33	0.0001	1.19039243
	KF008	-8.30600197 B	-6.42	0.0001	1.29381449
	KJ005	-4.21165741 B	-2.66	0.0092	1.58281256
	KJ006	-8.30600197 B	-5.89	0.0001	1.41066714
	KL006	-5.36944107 B	-4.38	0.0001	1.22472761
	KN003	-0.73346636 B	-0.58	0.5611	1.25727902
	KP440	-4.08662352 B	-3.39	0.0010	1.20552685
	KR004	-0.87116095 B	-0.73	0.4675	1.19401884
	KR006	-0.07938448 B	-0.06	0.9491	1.24076944
	KT001	-1.36627754 B	-1.14	0.2585	1.20143987
	KT436	-4.38365631 B	-3.70	0.0004	1.18529618
	KV002	-2.94810858 B	-2.47	0.0156	1.19528607
	KV007	-1.60653368 B	-1.32	0.1890	1.21370537
	KX007	-3.07488333 B	-2.51	0.0140	1.22673295
	KX438	-2.82132685 B	-2.36	0.0203	1.19396651
	KZ002	-1.45446472 B	-1.21	0.2278	1.19777637
	KZ012	-2.84344681 B	-2.40	0.0183	1.18270111
	KZ014	-1.45826573 B	-1.13	0.2595	1.28503316
	LB005	-1.14950593 B	-0.94	0.3519	1.22830638
	LD012	-0.61523955 B	-0.48	0.6308	1.27584116
	LD439	-3.24282351 B	-2.51	0.0139	1.29220949
	LE005	-0.47738485 B	-0.40	0.6910	1.19706423
	LH004	-1.76321045 B	-1.38	0.1721	1.28100482
	LH014	-0.00928527 B	-0.01	0.9941	1.25167471
	LH440	-4.15738194 B	-3.19	0.0020	1.30390472
	LJ011	0.00000000 B	.	.	.

Table 4. Linear regression analysis of the 'station effect' on the biomass density of group three for the years 1981-85.

SHRIMP PHOTO, BIOMASS 1981 - 1985
STATION EFFECT

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB13
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	224034.40599806	7725.32434476	12.02	0.0001	0.796627	8435.9504
ERROR	89	57194.23631821	642.63186074		ROOT MSE		LNB13 MEAN
CORRECTED TOTAL	118	281228.64231626			25.35018479		-0.30050182

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ARCODE	29	224034.40599806	12.02	0.0001	29	224034.40599806	12.02	0.0001

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		0.25370734 B	0.29	0.7755	0.88689070
ARCODE	KA010	0.45874310 B	0.44	0.6604	1.04047221
	KB006	-7.16146262 B	-5.03	0.0001	1.42295004
	KB007	-5.17093956 B	-4.29	0.0001	1.20406225
	KB008	-2.01553013 B	-1.83	0.0705	1.10110706
	KF007	-2.74551543 B	-2.72	0.0079	1.01041636
	KF008	-5.78174465 B	-5.26	0.0001	1.09820199
	KJ005	-7.16146262 B	-5.33	0.0001	1.34350629
	KJ006	-7.16146262 B	-5.98	0.0001	1.19738767
	KL006	-3.08891736 B	-2.97	0.0038	1.03956039
	KN003	0.21532545 B	0.20	0.8408	1.06719034
	KP440	-0.38919942 B	-0.38	0.7046	1.02326260
	KR004	0.73552031 B	0.73	0.4699	1.01349450
	KR006	-0.16360639 B	-0.16	0.8769	1.05317685
	KT001	0.77584571 B	0.76	0.4488	1.01979353
	KT436	-0.21755562 B	-0.22	0.8293	1.00609062
	KV002	-0.18681472 B	-0.18	0.8543	1.01457013
	KV007	0.46613423 B	0.45	0.6520	1.03020461
	KX007	0.46489030 B	0.45	0.6563	1.04126254
	KX438	-0.35811090 B	-0.35	0.7247	1.01345007
	KZ002	0.55063339 B	0.54	0.5894	1.01668392
	KZ012	-0.17472195 B	-0.17	0.8622	1.00308789
	KZ014	0.92096102 B	0.84	0.4007	1.09074831
	LB005	0.18192953 B	0.17	0.8619	1.04359809
	LD012	0.90512941 B	0.84	0.4055	1.08294605
	LD439	-0.40571600 B	-0.37	0.7123	1.09683965
	LE005	0.32159031 B	0.32	0.7524	1.01607945
	LH004	-0.06518848 B	-0.06	0.9523	1.08732902
	LH014	1.06911105 B	1.01	0.3170	1.06243334
	LH440	-0.07614338 B	-0.07	0.9453	1.10676667
	LJ011	0.00000000 B	.	.	.

Table 5. Linear regression analysis of the 'station effect' on the biomass density of group four for the years 1981-85.

SUKOMP PHOTO, BIOMASS 1981 - 1985
STATION EFFECT

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB14
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	267003.40044170	9207.01380833	14.14	0.0001	0.821623	2063.6166
ERROR	89	57967.19728554	651.31682343		ROOT MSE		LNB14 MEAN
CORRECTED TOTAL	118	324970.59772724			25.52090953		-1.23670792

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ARCODE	29	267003.40044170	14.14	0.0001	29	267003.40044170	14.14	0.0001

PARAMETER		ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-4.59419450 B	-5.15	0.0001	0.89286360
ARCODE	KA010	4.03006466 B	3.85	0.0002	1.04747243
	KB006	-2.31356070 B	-1.62	0.1098	1.43253311
	KB007	-2.31356070 B	-1.91	0.0595	1.21217119
	KB008	0.30932221 B	0.28	0.7809	1.10852465
	KF007	3.30497223 B	3.25	0.0016	1.01722117
	KF008	-2.31356070 B	-2.09	0.0392	1.10589800
	KJ005	-2.31356070 B	-1.71	0.0907	1.35255434
	KJ006	-2.31356070 B	-1.92	0.0582	1.20545161
	KL006	-0.55718534 B	-0.53	0.5958	1.04656147
	KN003	3.29674591 B	3.07	0.0029	1.07437750
	KP440	4.15748763 B	4.04	0.0001	1.03015392
	KR004	4.46716595 B	4.38	0.0001	1.02032003
	KR006	2.24882556 B	2.12	0.0367	1.06026963
	KT001	4.96267382 B	4.83	0.0001	1.02666149
	KT436	4.92849452 B	4.87	0.0001	1.01286629
	KV002	4.34937151 B	4.26	0.0001	1.02140291
	KV007	4.34909814 B	4.19	0.0001	1.03714268
	KX007	5.21651490 B	4.98	0.0001	1.04827508
	KX438	3.35315226 B	3.29	0.0015	1.02027531
	KZ002	4.72539987 B	4.62	0.0001	1.02353093
	KZ012	4.99162467 B	4.94	0.0001	1.01064873
	KZ014	5.09350530 B	4.64	0.0001	1.09809412
	LB005	4.68715444 B	4.47	0.0001	1.04761963
	LD012	4.66763648 B	4.28	0.0001	1.09023932
	LD439	3.76694822 B	3.41	0.0010	1.10422648
	LE005	3.53245338 B	3.45	0.0008	1.02292240
	LH004	3.80853017 B	3.48	0.0008	1.09465180
	LH014	3.83268404 B	3.58	0.0006	1.06958846
	LH440	4.38134706 B	3.93	0.0002	1.11422036
	LJ011	0.00000000 B	.	.	.

Table 6. Linear regression analysis of the 'station effect' on the biomass density of group five for the years 1981-85.

SHRIMP PHOTO, BIOMASS 1981 - 1985
STATION EFFECT

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB15
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	29	177358.35270138	6115.80526556	2.87	0.0001	0.483200	1213.4090
ERROR	89	189691.27149782	2131.36260110		ROOT MSE		LNB15 MEAN
CORRECTED TOTAL	118	367049.62419920			46.16668280		-3.80470920

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
ARCODE	29	177358.35270138	2.87	0.0001	29	177358.35270138	2.87	0.0001

PARAMETER		ESTIMATE		T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-5.47007853	B	-3.39	0.0011	1.61516778
ARCODE	KA010	0.81599044	B	0.43	0.6678	1.89486392
	KB006	-1.43767675	B	-0.55	0.5804	2.59141634
	KB007	-1.43767675	B	-0.66	0.5137	2.19278717
	KB008	-1.43767675	B	-0.72	0.4753	2.00529318
	KF007	2.66355772	B	1.45	0.1513	1.84012748
	KF008	-1.43767675	B	-0.72	0.4741	1.99999095
	KJ005	-1.43767675	B	-0.59	0.5583	2.44673674
	KJ006	-1.43767675	B	-0.66	0.5114	2.18063162
	KL006	-1.43767675	B	-0.76	0.4496	1.89320338
	KN003	0.85238827	B	0.44	0.6620	1.94352184
	KP440	3.42394637	B	1.84	0.0675	1.86352250
	KR004	3.83537645	B	2.08	0.0408	1.84573325
	KR006	-0.00535166	B	-0.00	0.9978	1.91800107
	KT001	3.06397549	B	1.65	0.1025	1.85720479
	KT436	2.87060089	B	1.57	0.1207	1.83224962
	KV002	1.05002959	B	0.57	0.5710	1.84769215
	KV007	2.50283139	B	1.33	0.1856	1.87416499
	KX007	3.29651668	B	1.74	0.0856	1.89630323
	KX438	2.13050439	B	1.15	0.2514	1.84565255
	KZ002	2.96943326	B	1.60	0.1123	1.85154169
	KZ012	3.98444607	B	2.18	0.0319	1.82823811
	KZ014	3.42562701	B	1.72	0.0881	1.98642462
	LB005	3.09294332	B	1.63	0.1069	1.89873548
	LD012	1.97498096	B	1.00	0.3193	1.97221548
	LD439	1.75193307	B	0.88	0.3828	1.99791790
	LE005	0.67142970	B	0.36	0.7176	1.85044086
	LH004	0.72317915	B	0.37	0.7158	1.98019755
	LH014	-0.59385954	B	-0.31	0.7596	1.93485860
	LH440	2.93776286	B	1.46	0.1485	2.01559658
	LJ011	0.00000000	B	.	.	.

Table 7. Regression analysis of the effects of a.o. bottom type on the biomass of size group one. The input data for the analysis has been the photographic observations, not average figures for each station as in the other analyses.

SHRIMP PHOTO 1981-85
SINGLE SHOT ANALYSIS
NOTE: TEMPERATURE HAS BEEN RECODED

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB11

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	8	5681.49469681	710.18683710	446.92	0.0001	0.168091	178.1887
ERROR	17695	28118.63800822	1.58907251		ROOT MSE		LNB11 MEAN
CORRECTED TOTAL	17703	33800.13270502			1.26058419		0.70744354

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
BTYP	3	1850.23086322	388.12	0.0001	3	1441.29459155	302.33	0.0001
DE	1	1328.03488907	835.73	0.0001	1	702.20378078	441.90	0.0001
TE	1	273.47371190	172.10	0.0001	1	0.04953546	0.03	0.8599
KL	1	36.59025955	23.03	0.0001	1	3.91301405	2.46	0.1214
LA	1	1553.06037564	977.34	0.0001	1	1871.16940062	1177.52	0.0001
LO	1	640.10459742	402.82	0.0001	1	640.10459742	402.82	0.0001

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-15.15479827 B	-17.15	0.0001	0.88383814
BTYP	A	0.67422686 B	5.39	0.0001	0.12504424
	B	0.08892085 B	0.71	0.4785	0.12545726
	C	-0.08125478 B	-0.63	0.5276	0.12861873
	D	0.00000000 B	.	.	.
DE		-0.00317896	-21.02	0.0001	0.00015123
TE		-0.00255645	-0.18	0.8599	0.01447942
KL		0.00344904	1.55	0.1214	0.00222657
LA		0.39090091	34.32	0.0001	0.01139153
LO		-0.18010092	-20.07	0.0001	0.00897351

NOTE: THE X'X MATRIX HAS BEEN DEEMED SINGULAR AND A GENERALIZED INVERSE HAS BEEN EMPLOYED TO SOLVE THE NORMAL EQUATIONS. THE ABOVE ESTIMATES REPRESENT ONLY ONE OF MANY POSSIBLE SOLUTIONS TO THE NORMAL EQUATIONS. ESTIMATES FOLLOWED BY THE LETTER B ARE BIASED AND DO NOT ESTIMATE THE PARAMETER BUT ARE BLUE FOR SOME LINEAR COMBINATION OF PARAMETERS (OR ARE ZERO). THE EXPECTED VALUE OF THE BIASED ESTIMATORS MAY BE OBTAINED FROM THE GENERAL FORM OF ESTIMABLE FUNCTIONS. FOR THE BIASED ESTIMATORS, THE STD ERR IS THAT OF THE BIASED ESTIMATOR AND THE T VALUE TESTS HO: E(BIASED ESTIMATOR) = 0. ESTIMATES NOT FOLLOWED BY THE LETTER B ARE BLUE FOR THE PARAMETER.

Table 8. Regression analysis of the effects of a.o. bottom type on the biomass of size group two. The input data for the analysis has been the photographic observations, not average figures for each station as in the other analyses.

SHRIMP PHOTO 1981-85
SINGLE SHOT ANALYSIS
NOTE: TEMPERATURE HAS BEEN RECODED

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB12

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	8	10522.86168841	1315.35771105	678.28	0.0001	0.234685	134.7724
ERROR	17695	34315.36291375	1.93926888		ROOT MSE		LNB12 MEAN
CORRECTED TOTAL	17703	44838.22460216			1.39257635		1.03328013

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
BTYP	3	2215.01168384	380.73	0.0001	3	2029.22489557	348.80	0.0001
DE	1	4081.23380703	2104.52	0.0001	1	1861.69543137	960.00	0.0001
TE	1	701.80707365	361.89	0.0001	1	45.61379573	23.52	0.0001
KL	1	181.45324043	93.57	0.0001	1	87.41466878	45.08	0.0001
LA	1	2712.94678133	1398.95	0.0001	1	3102.59423973	1599.88	0.0001
LO	1	630.40910213	325.08	0.0001	1	630.40910213	325.08	0.0001

PARAMETER		ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-21.49943643 B	-22.02	0.0001	0.97638230
BTYP	A	0.94727720 B	6.86	0.0001	0.13813782
	B	0.29073087 B	2.10	0.0359	0.13859353
	C	-0.05225456 B	-0.37	0.7131	0.14208603
	D	0.00000000 B	.	.	.
DE		-0.00517615	-30.98	0.0001	0.00016706
TE		-0.07757600	-4.85	0.0001	0.01599552
KL		0.01651413	6.71	0.0001	0.00245970
LA		0.50335295	40.00	0.0001	0.01258430
LO		-0.17873175	-18.03	0.0001	0.00991310

NOTE: THE X'X MATRIX HAS BEEN DEEMED SINGULAR AND A GENERALIZED INVERSE HAS BEEN EMPLOYED TO SOLVE THE NORMAL EQUATIONS. THE ABOVE ESTIMATES REPRESENT ONLY ONE OF MANY POSSIBLE SOLUTIONS TO THE NORMAL EQUATIONS. ESTIMATES FOLLOWED BY THE LETTER B ARE BIASED AND DO NOT ESTIMATE THE PARAMETER BUT ARE BLUE FOR SOME LINEAR COMBINATION OF PARAMETERS (OR ARE ZERO). THE EXPECTED VALUE OF THE BIASED ESTIMATORS MAY BE OBTAINED FROM THE GENERAL FORM OF ESTIMABLE FUNCTIONS. FOR THE BIASED ESTIMATORS, THE STD ERR IS THAT OF THE BIASED ESTIMATOR AND THE T VALUE TESTS HO: E(BIASED ESTIMATOR) = 0. ESTIMATES NOT FOLLOWED BY THE LETTER B ARE BLUE FOR THE PARAMETER.

Table 9. Regression analysis of the effects of a.o. bottom type on the biomass of size group three. The input data for the analysis has been the photographic observations, not average figures for each station as in the other analyses.

SHRIMP PHOTO 1981-85
SINGLE SHOT ANALYSIS
NOTE: TEMPERATURE HAS BEEN RECODED

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB13

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	8	4470.77303362	558.84662920	190.60	0.0001	0.079365	121.2474
ERROR	17695	51882.36122146	2.93203511		ROOT MSE		LNB13 MEAN
CORRECTED TOTAL	17703	56353.13425508			1.71231863		1.41225174

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
BTYP	3	475.14951922	54.02	0.0001	3	260.94802241	29.67	0.0001
DE	1	537.40041646	183.29	0.0001	1	271.63215724	92.64	0.0001
TE	1	352.69636594	120.29	0.0001	1	5.11555561	1.74	0.1866
KL	1	0.39381651	0.13	0.7140	1	4.44898511	1.52	0.2180
LA	1	2789.96648296	951.55	0.0001	1	3038.75274155	1036.40	0.0001
LO	1	315.16643254	107.49	0.0001	1	315.16643254	107.49	0.0001

PARAMETER		ESTIMATE		T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-23.88972295	B	-19.90	0.0001	1.20056441
BTYP	A	-0.34507557	B	-2.03	0.0422	0.16985493
	B	-0.60254015	B	-3.54	0.0004	0.17041528
	C	-0.56726701	B	-3.25	0.0012	0.17470967
	D	0.00000000	B	.	.	.
DE		-0.00197717		-9.63	0.0001	0.00020542
TE		-0.02597920		-1.32	0.1866	0.01966817
KL		-0.00372668		-1.23	0.2180	0.00302446
LA		0.49814734		32.19	0.0001	0.01547372
LO		-0.12637479		-10.37	0.0001	0.01218920

NOTE: THE X'X MATRIX HAS BEEN DEEMED SINGULAR AND A GENERALIZED INVERSE HAS BEEN EMPLOYED TO SOLVE THE NORMAL EQUATIONS. THE ABOVE ESTIMATES REPRESENT ONLY ONE OF MANY POSSIBLE SOLUTIONS TO THE NORMAL EQUATIONS. ESTIMATES FOLLOWED BY THE LETTER B ARE BIASED AND DO NOT ESTIMATE THE PARAMETER BUT ARE BLUE FOR SOME LINEAR COMBINATION OF PARAMETERS (OR ARE ZERO). THE EXPECTED VALUE OF THE BIASED ESTIMATORS MAY BE OBTAINED FROM THE GENERAL FORM OF ESTIMABLE FUNCTIONS. FOR THE BIASED ESTIMATORS, THE STD ERR IS THAT OF THE BIASED ESTIMATOR AND THE T VALUE TESTS HO: E(BIASED ESTIMATOR) = 0. ESTIMATES NOT FOLLOWED BY THE LETTER B ARE BLUE FOR THE PARAMETER.

Table 10. Regression analysis of the effects of a.o. bottom type on the biomass of size group four. The input data for the analysis has been the photographic observations, not average figures for each station as in the other analyses.

SHRIMP PHOTO 1981-85
SINGLE SHOT ANALYSIS
NOTE: TEMPERATURE HAS BEEN RECODED

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB14

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	8	1425.26469979	178.15808747	89.55	0.0001	0.038910	208.1806
ERROR	17695	35204.18111134	1.98949879		ROOT MSE		LNB14 MEAN
CORRECTED TOTAL	17703	36629.44581113			1.41049594		0.67779513

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
BTYP	3	366.43700658	61.40	0.0001	3	549.32980456	92.04	0.0001
DE	1	351.18467383	176.52	0.0001	1	255.06874413	128.21	0.0001
TE	1	92.18731607	46.34	0.0001	1	17.01303194	8.55	0.0035
KL	1	47.54447443	23.90	0.0001	1	50.68495715	25.48	0.0001
LA	1	561.94330179	282.45	0.0001	1	564.74083740	283.86	0.0001
LO	1	5.96917708	3.00	0.0833	1	5.96917708	3.00	0.0833

PARAMETER		ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-11.94152790 B	-12.08	0.0001	0.98894633
BTYP	A	-0.86109863 B	-6.15	0.0001	0.13991537
	B	-0.88574080 B	-6.31	0.0001	0.14037695
	C	-0.17478715 B	-1.21	0.2246	0.14391439
	D	0.00000000 B	.	.	.
DE		0.00191594	11.32	0.0001	0.00016921
TE		-0.04737728	-2.92	0.0035	0.01620135
KL		-0.01257486	-5.05	0.0001	0.00249135
LA		0.21475077	16.85	0.0001	0.01274624
LO		-0.01739193	-1.73	0.0833	0.01004066

NOTE: THE X'X MATRIX HAS BEEN DEEMED SINGULAR AND A GENERALIZED INVERSE HAS BEEN EMPLOYED TO SOLVE THE NORMAL EQUATIONS. THE ABOVE ESTIMATES REPRESENT ONLY ONE OF MANY POSSIBLE SOLUTIONS TO THE NORMAL EQUATIONS. ESTIMATES FOLLOWED BY THE LETTER B ARE BIASED AND DO NOT ESTIMATE THE PARAMETER BUT ARE BLUE FOR SOME LINEAR COMBINATION OF PARAMETERS (OR ARE ZERO). THE EXPECTED VALUE OF THE BIASED ESTIMATIONS MAY BE OBTAINED FROM THE GENERAL FORM OF ESTIMABLE FUNCTIONS. FOR THE BIASED ESTIMATORS, THE STD ERR IS THAT OF THE BIASED ESTIMATOR AND THE T VALUE TESTS H0: E(BIASED ESTIMATOR) = 0. ESTIMATES NOT FOLLOWED BY THE LETTER B ARE BLUE FOR THE PARAMETER.

Table 11. Regression analysis of the effects of a.o. bottom type on the biomass of size group five. The input data for the analysis has been the photographic observations, not average figures for each station as in the other analyses.

SHRIMP PHOTO 1981-83
SINGLE SHOT ANALYSIS
NOTE: TEMPERATURE HAS BEEN RECODED

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB15

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	8	63.61126900	7.95140863	20.40	0.0001	0.009139	582.4069
ERROR	17695	6897.13017013	0.38977848		ROOT MSE		LNB15 MEAN
CORRECTED TOTAL	17703	6960.74143913			0.62432242		0.10719694

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
BTYP	3	10.74957272	9.19	0.0001	3	17.59182889	15.04	0.0001
DE	1	8.42124169	21.61	0.0001	1	25.39089875	65.14	0.0001
TE	1	24.29920116	62.34	0.0001	1	20.10840997	51.59	0.0001
KL	1	13.37155568	34.31	0.0001	1	12.32722708	31.63	0.0001
LA	1	6.48719383	16.64	0.0001	1	5.82374560	14.94	0.0001
LO	1	0.28180393	0.72	0.3952	1	0.28180393	0.72	0.3952

PARAMETER		ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT		-0.91194137 B	-2.08	0.0372	0.43773352
BTYP	A	-0.17684618 B	-2.85	0.0043	0.06193020
	B	-0.14351515 B	-2.31	0.0209	0.06213451
	C	-0.05506252 B	-0.86	0.3874	0.06370027
	D	0.00000000 B	.	.	.
DE		0.00060449	8.07	0.0001	0.00007490
TE		-0.05150723	-7.18	0.0001	0.00717114
KL		-0.00620149	-5.62	0.0001	0.00110274
LA		0.02180777	3.87	0.0001	0.00564182
LO		0.00377889	0.85	0.3952	0.00444426

NOTE: THE X'X MATRIX HAS BEEN DEEMED SINGULAR AND A GENERALIZED INVERSE HAS BEEN EMPLOYED TO SOLVE THE NORMAL EQUATIONS. THE ABOVE ESTIMATES REPRESENT ONLY ONE OF MANY POSSIBLE SOLUTIONS TO THE NORMAL EQUATIONS. ESTIMATES FOLLOWED BY THE LETTER B ARE BIASED AND DO NOT ESTIMATE THE PARAMETER BUT ARE BLUE FOR SOME LINEAR COMBINATION OF PARAMETERS (OR ARE ZERO). THE EXPECTED VALUE OF THE BIASED ESTIMATORS MAY BE OBTAINED FROM THE GENERAL FORM OF ESTIMABLE FUNCTIONS. FOR THE BIASED ESTIMATORS, THE STD ERR IS THAT OF THE BIASED ESTIMATOR AND THE T VALUE TESTS HO: E(BIASED ESTIMATOR) = 0. ESTIMATES NOT FOLLOWED BY THE LETTER B ARE BLUE FOR THE PARAMETER.

Table 12. Primary run of the biomass model including all parameters except crossproducts involving correlated parameters.

SHRIMP PHOTO BIOMASS MODEL, 1981-1985
CROSSPRODUCTS INVOLVING CORRELATED PARAMETERS REMOVED

BACKWARD ELIMINATION PROCEDURE FOR DEPENDENT VARIABLE LNBIALL

STEP 0 ALL VARIABLES ENTERED R SQUARE = 0.58699523 C(P) = 67.00000000

	DF	WEIGHTED SS	MEAN SQUARE	F	PROB>F
REGRESSION	66	117081.33883896	3252.25941219	3.24	0.0001
ERROR	82	82377.41662309	1004.60264174		
TOTAL	118	199458.75546205			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	-2342.12540872				
U	228.97207373	429.99532197	286.18985720	0.28	0.5950
DEP	0.56895896	0.33380660	2918.54474673	2.91	0.0921
LA	69.98187533	29.98415550	5472.45029362	5.45	0.0220
LO	-4.05684033	29.93957076	18.44501472	0.02	0.8925
KL	2.68577160	3.11698009	745.92004789	0.74	0.3914
TE0	-22.74555164	25.83550435	778.66987991	0.78	0.3812
TE1	9.70916442	26.23464709	137.59655940	0.14	0.7123
TE2	-38.37344605	23.68467964	2637.06533688	2.62	0.1090
T_4	15.51481344	17.35422061	802.92910992	0.80	0.3739
DEDE	-0.00008178	0.00003009	7418.73163923	7.38	0.0080
LALA	-0.47807298	0.30604536	2438.61701355	2.43	0.1231
LOLO	0.07470612	0.10579219	500.95588197	0.50	0.4821
KLKL	-0.00682749	0.01191378	329.92705340	0.33	0.5682
TOTO	0.10100756	0.24748108	167.34703416	0.17	0.6842
T1T1	0.12256283	0.24635213	248.65617598	0.25	0.6202
T2T2	-0.07791085	0.20950059	138.93758617	0.14	0.7109
T4T4	-0.59510987	0.29855570	3991.51600431	3.97	0.0496
DELA	-0.00583187	0.00413885	1994.58095208	1.99	0.1626
DELO	-0.00215005	0.00241344	797.28887387	0.79	0.3756
DEKL	-0.00102513	0.00079375	1675.64749186	1.67	0.2002
DET4	0.00541850	0.00523819	3074.95463225	1.07	0.3040
LALO	-0.06014765	0.34311755	30.87065322	0.03	0.8613
LAKL	-0.00631956	0.04459721	20.17219722	0.02	0.8877
LAT0	0.32436778	0.38278333	721.37934544	0.72	0.3992
LAT1	-0.08313004	0.39175520	45.35133101	0.05	0.8323
LAT2	0.53692521	0.35194526	2338.27902114	2.33	0.1309
LAT4	-0.30008945	0.26371090	1300.88707101	1.29	0.2585
LOKL	-0.03205686	0.03753091	732.92258784	0.73	0.3955
LOT4	0.38933373	0.21772950	636.54014253	0.63	0.4283
KLT0	0.09820710	0.06254652	2478.70183147	2.47	0.1202
KLT1	-0.09905273	0.08482316	1369.92992541	1.36	0.2463
KLT2	0.11617948	0.06927887	2825.21594329	2.81	0.0974
KLT4	-0.06265625	0.05155523	1483.80778733	1.48	0.2277
T0T4	-0.26570216	0.35719983	553.85559083	0.55	0.4591
T1T4	-1.37980478	0.76678103	3253.02109703	3.24	0.0756
T2T4	0.18409394	0.42547111	108.07590439	0.19	0.6664

Table 13. Final regression model for the biomass of all size groups combined. The Table gives information from the analysis itself together with estimates for the model parameters.

SHRIMP PHOTO, BIOMASS 1981 - 1985
66*00N - 69*30N
ALL SIZES

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB(ALL SUM
WEIGHT:

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	9	98427.58025842	10936.39780649	11.80	0.0001	0.493473	3813.7777
ERROR	109	101031.17520363	926.89151563		ROOT MSE		LNB(ALL MEAN
CORRECTED TOTAL	118	199458.75546205			30.44489310		0.79828703

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
LA	1	63665.60249665	68.69	0.0001	1	7535.54290079	8.13	0.0052
LO	1	793.84772869	0.86	0.3568	1	6514.34868887	7.03	0.0092
T2	1	3495.25979314	3.77	0.0547	1	5531.70511497	5.97	0.0162
DE*DE	1	1577.29595121	1.70	0.1955	1	17209.77006119	18.57	0.0001
LA*LA	1	9334.63416666	10.07	0.0020	1	7590.13745545	8.19	0.0051
T1*T1	1	3.21769653	0.00	0.9531	1	2780.46388787	3.00	0.0861
LA*DE	1	12157.95973371	14.12	0.0004	1	15877.63058711	17.13	0.0001
LA*T1	1	2019.08064056	2.18	0.1428	1	3424.07743791	3.69	0.0572
LA*T2	1	5415.68205128	5.84	0.0173	1	5415.68205128	5.84	0.0173

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-2195.63017768	-2.83	0.0055	775.17505926
LA	65.27007163	2.85	0.0052	22.89164660
LO	-0.37118409	-2.65	0.0092	0.14001298
T2	-27.89379541	-2.44	0.0162	11.41806614
DE*DE	-9.8765349E-05	-4.31	0.0001	0.00002292
LA*LA	-0.48189028	-2.86	0.0051	0.16859834
T1*T1	0.29960034	1.73	0.0861	0.17298089
LA*DE	0.00095222	4.14	0.0001	0.00023007
LA*T1	-0.02212244	-1.92	0.0572	0.01151001
LA*T2	0.40705570	2.42	0.0173	0.16839986

Table 14. Final regression model for the biomass of size group one. The Table gives information from the analysis itself together with estimates for the model parameters.

SHRIMP PHOTO, BIOMASS 1981 - 1985
66*DUN - 69*JAN
SIZE GROUP 1

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB11
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	6	210944.76311661	35157.46051944	13.05	0.0001	0.411523	1915.4129
ERROR	112	301650.97892434	2693.31231182		ROOT MSE		LNB11 MEAN
CORRECTED TOTAL	118	512595.74204096			51.89713202		-2.70944876

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
LA	1	77707.03109888	28.85	0.0001	1	22961.05502734	8.49	0.0043
LO	1	37765.59160669	14.02	0.0003	1	28085.74989834	10.43	0.0016
TO	1	9916.47352212	3.68	0.0576	1	11612.45231234	4.31	0.0401
LA*LA	1	27992.30168172	10.39	0.0017	1	9296.34431232	3.45	0.0658
LO*LO	1	53173.08504050	19.74	0.0001	1	57505.67644499	21.35	0.0001
LA*LO	1	4390.28016671	1.63	0.2043	1	4390.28016671	1.63	0.2043

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-6686.13089988	-4.50	0.0001	1486.43697776
LA	108.62694834	2.93	0.0043	37.08488456
LO	104.37948751	3.23	0.0016	32.32320610
TO	-0.50564709	-2.08	0.0401	0.24351678
LA*LA	-0.59959808	-1.86	0.0658	0.32273606
LO*LO	-0.65172130	-4.62	0.0001	0.14104247
LA*LO	-0.45502858	-1.28	0.2043	0.35639854

Table 15. Final regression model for the biomass of size group two. The Table gives information from the analysis itself together with estimates for the model parameters.

SHRIMP PHOTO, BIOMASS 1981 - 1985
66°00N - 69°30N
SIZE GROUP 2

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB12
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	9	161768.53390295	17974.28154477	9.71	0.0001	0.444950	3235.6663
ERROR	109	201796.98473079	1851.34848377		ROOT MSE		LNB12 MEAN
CORRECTED TOTAL	118	363565.51863374			43.02729929		-1.32978174

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
LA	1	99992.85001645	54.01	0.0001	1	13343.68612095	7.21	0.0084
T1	1	26457.25936667	14.29	0.0003	1	8317.35005456	4.49	0.0363
DE*DE	1	620.53760580	0.34	0.5638	1	6903.34173856	3.73	0.0561
LA*LA	1	3915.28689709	2.11	0.1488	1	16302.05969149	8.81	0.0037
LO*LO	1	10147.42660593	5.48	0.0210	1	7044.27861694	3.80	0.0537
TU*TU	1	679.03080832	0.37	0.5460	1	4823.99027898	2.17	0.1433
LA*DE	1	6688.61491547	3.61	0.0600	1	5425.43182265	2.93	0.0898
DE*LO	1	7377.53005447	3.98	0.0484	1	8223.65730241	4.44	0.0374
LA*LO	1	5889.49763275	3.18	0.0773	1	5889.49763275	3.18	0.0773

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-3056.61367394	-2.72	0.0077	1125.75955378
LA	89.33087411	2.68	0.0084	33.27421069
T1	-0.67881552	-2.12	0.0363	0.32026049
DE*DE	-5.8582903E-05	-1.93	0.0561	0.00003034
LA*LA	-0.75150519	-2.92	0.0037	0.25325314
LO*LO	-0.17465840	-1.95	0.0537	0.08953963
TU*TU	-0.11098418	-1.47	0.1433	0.07527949
LA*DE	-0.00306903	-1.71	0.0898	0.00179278
DE*LO	0.00437941	2.11	0.0374	0.00207791
LA*LO	0.26290630	1.78	0.0773	0.14740299

Table 16. Final regression model for the biomass of size group three. The Table gives information from the analysis itself together with estimates for the model parameters.

SHRIMP PHOTO, BIOMASS 1981 - 1985
66°00N - 69°30N
SIZE GROUP 3

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB13
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	8	151131.49210113	18891.43651264	15.97	0.0001	0.537397	11444.3317
ERROR	110	130097.15021513	1182.70136559		ROOT MSE		LNB13 MEAN
CORRECTED TOTAL	118	281228.64231626			34.39042549		-0.30050182

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
DE	1	5722.78567191	4.84	0.0299	1	10779.41398134	9.11	0.0032
LA	1	86154.58147427	72.85	0.0001	1	3984.37999952	3.37	0.0691
TO	1	748.21649306	0.63	0.4281	1	1548.34558364	1.31	0.2550
T2	1	1257.39062911	1.06	0.3048	1	5170.31622062	4.37	0.0388
DE*DE	1	27271.89182535	23.06	0.0001	1	32309.52426390	27.32	0.0001
LA*LA	1	6134.66900169	5.19	0.0247	1	4274.32945731	3.61	0.0599
DE*LA	1	20111.16676737	17.00	0.0001	1	19754.69622997	16.70	0.0001
DE*LO	1	3730.79023837	3.15	0.0785	1	3730.79023837	3.15	0.0785

PARAMETER	ESTIMATE	T FOR HO: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-1582.38580609	-1.78	0.0774	887.56127675
DE	-0.44410273	-3.02	0.0032	0.14710364
LA	47.79791837	1.84	0.0691	26.04150963
TO	-0.26196278	-1.14	0.2550	0.22895134
T2	-0.48851715	-2.09	0.0388	0.23364623
DE*DE	-0.00013160	-5.23	0.0001	0.00002518
LA*LA	-0.36325223	-1.90	0.0599	0.19107851
DE*LA	0.00858461	4.09	0.0001	0.00210055
DE*LO	-0.00093135	-1.78	0.0785	0.00052438

Table 17. Final regression model for the biomass of size group four. The Table gives information from the analysis itself together with estimates for the model parameters.

SHRIMP PHOTO, BIOMASS 1981 - 1985
66°00N - 69°30N
SIZE GROUP 4

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNBI4
WEIGHT: SQM

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	13	186268.82814712	14328.37139593	10.85	0.0001	0.573187	2938.8621
ERROR	105	138701.76958012	1320.96923410		ROOT MSE		LNBI4 MEAN
CORRECTED TOTAL	118	324970.59772724			36.34514045		-1.23670792

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
LA	1	72218.07298715	54.67	0.0001	1	8449.93579505	6.40	0.0129
T1	1	687.39802360	0.52	0.4723	1	11533.98099315	8.73	0.0039
T4	1	1680.79143763	1.27	0.2619	1	22671.63066431	17.16	0.0001
DE*DE	1	100.99948823	0.08	0.7827	1	31790.21650534	24.07	0.0001
LA*LA	1	16238.61154526	12.29	0.0007	1	8812.03067921	6.67	0.0112
T2*T2	1	1703.07635342	1.29	0.2588	1	10543.46374211	7.98	0.0057
T4*T4	1	2775.99638410	2.10	0.1501	1	8036.82147312	6.08	0.0153
LA*DE	1	34502.10546553	26.12	0.0001	1	18739.24667756	14.19	0.0003
DE*LO	1	8682.45416360	6.57	0.0118	1	4981.16883719	3.77	0.0548
LA*T1	1	19444.96255280	14.72	0.0002	1	12837.15022975	9.72	0.0024
T2*KL	1	111.06833340	0.08	0.7724	1	15895.22065245	12.03	0.0008
T4*KE	1	14020.17718721	10.61	0.0015	1	18159.04277110	13.75	0.0003
T1*T4	1	14103.11422519	10.68	0.0015	1	14103.11422519	10.68	0.0015

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-2318.45375801	-2.50	0.0139	926.90995277
LA	68.95033189	2.53	0.0129	27.26189294
T1	-46.53644537	-2.95	0.0039	15.74888975
T4	6.86789119	4.14	0.0001	1.65779663
DE*DE	-0.00012857	-4.91	0.0001	0.00002621
LA*LA	-0.51785912	-2.58	0.0112	0.20050259
T2*T2	-0.28167160	-2.83	0.0057	0.09970060
T4*T4	-0.67865001	-2.47	0.0153	0.27513767
LA*DE	0.00217903	3.77	0.0003	0.00057854
DE*LO	-0.00107417	-1.94	0.0548	0.00055316
LA*T1	0.72040134	3.12	0.0024	0.23109287
T2*KL	0.10188715	3.47	0.0008	0.02937193
T4*KL	-0.09480674	-3.71	0.0003	0.02557049
T1*T4	-1.13547835	-3.27	0.0015	0.34751031

Table 18. Final regression model for the biomass of size group five. The Table gives information from the analysis itself together with estimates for the model parameters.

SHRIMP PHOTO, BIOMASS 1981 - 1985
66*OON - 69*JUN
SIZE GROUP 5

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: LNB15
WEIGHT: SQR

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	7	99186.01305297	14169.43043614	5.87	0.0001	0.270225	1291.1417
ERROR	111	267863.61114623	2413.18560600		ROOT MSE		LNB15 MEAN
CORRECTED TOTAL	118	367049.62419920			49.12418636		-3.80470920

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE III SS	F VALUE	PR > F
LA	1	20037.39396582	8.30	0.0048	1	13944.03375455	5.78	0.0179
LO	1	6026.37566615	2.50	0.1169	1	3567.24804953	1.48	0.2266
T2	1	22778.05459307	9.44	0.0027	1	12431.85137943	5.15	0.0252
LA*LA	1	24179.88440286	10.02	0.0020	1	14123.10217542	5.85	0.0172
KL*KL	1	6304.58074455	2.61	0.1089	1	9723.08398860	4.03	0.0472
LA*T2	1	13907.45359804	5.76	0.0180	1	12090.60303291	5.01	0.0271
T2*KL	1	5952.27008248	2.47	0.1191	1	5952.27008248	2.47	0.1191

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	-2908.10480012	-2.39	0.0187	1218.85396059
LA	86.53800168	2.40	0.0179	36.00045750
LO	-0.24924844	-1.22	0.2266	0.20500353
T2	-40.41215706	-2.27	0.0252	17.80489832
LA*LA	-0.64134811	-2.42	0.0172	0.26510080
KL*KL	-0.00792032	-2.01	0.0472	0.00394581
LA*T2	0.59056396	2.24	0.0271	0.26375135
T2*KL	0.07708879	1.57	0.1191	0.04908460

Table 19. Combinations of parameters, their squares and crossproducts after determination of the best possible models for the different size groups. The figures in the table give the rank of significance for the elements in the model as seen in Tables 14-19.

PARAMETER	SIZE GROUPS					
	all	1	2	3	4	5
DE				3		
LA	4	3	2	6	11	2
LO	5	2				7
T0		4		8		
T1			3		8	
T2	6			4		3
T4					2	
DExDE	1		6	1	1	
LAxLA	3	5	1	5	10	1
LOxLO		1	5			
T0xT0			9			
T1xT1	9					
T2xT2					9	
T4xT4					12	
DExLA	2		8	2	3	
DExLO			4	7	13	
LAxLO		6	7			
LAxT1	8				7	
LAxT2	7					4
KLxT2					5	6
KLxT4					4	
T1xT4					6	

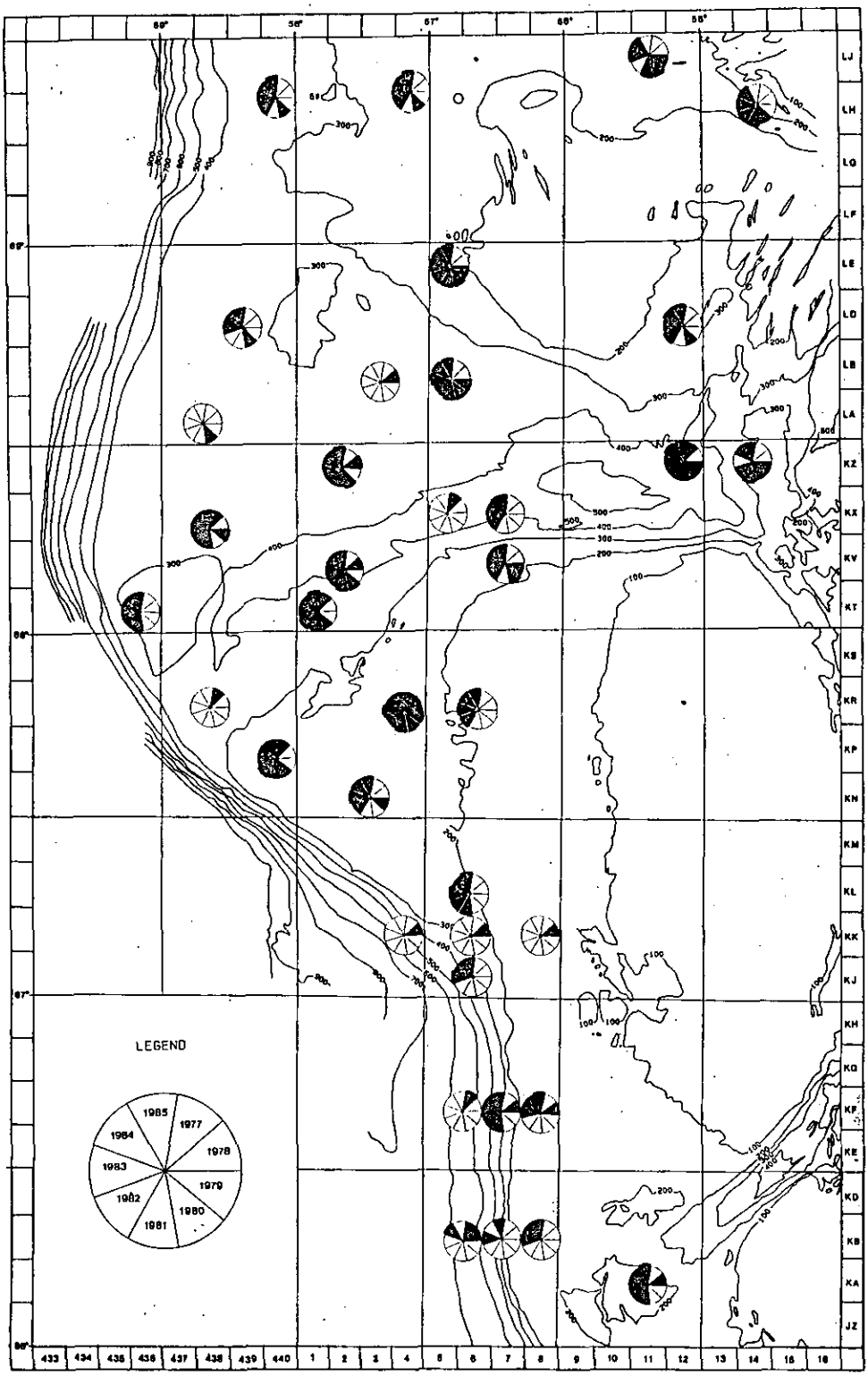

Fig. 1. Map of sampling stations in 1977-85. The shaded areas in the circles denote years in which sampling has been carried out, and the "exploded" parts of the circles show years in which small shrimp (groups one and two) have been dominating.

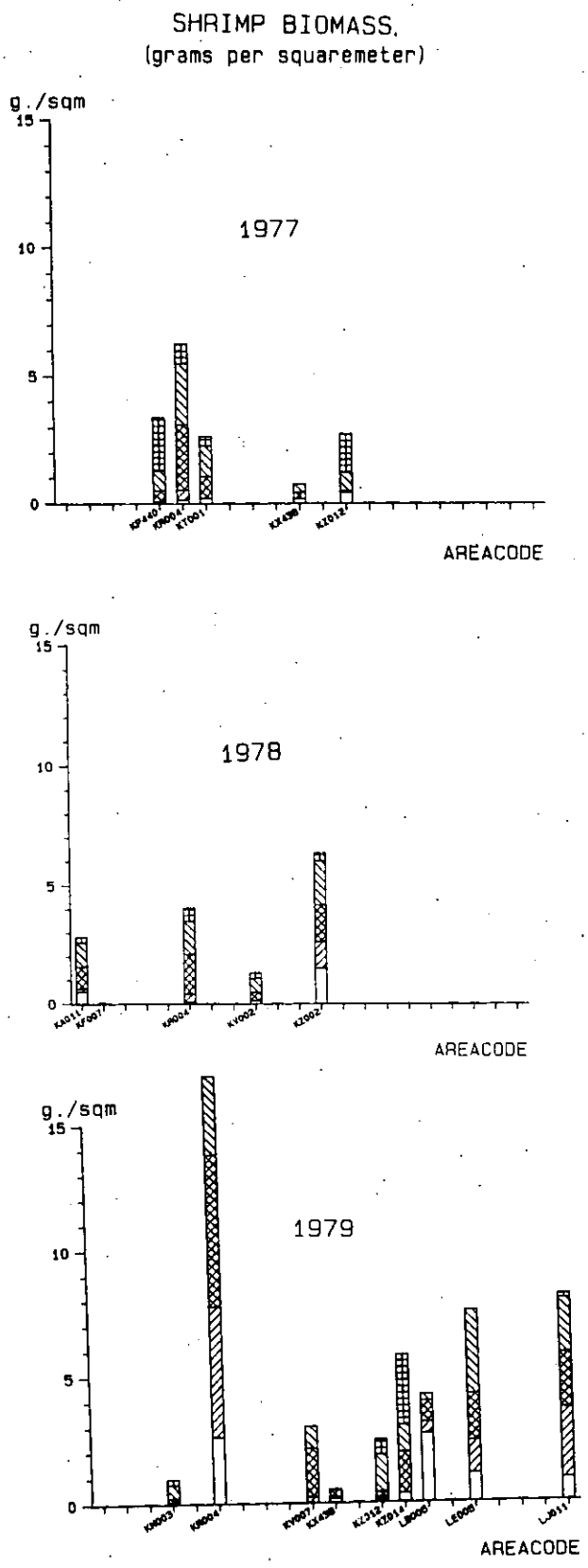

Fig. 2a. Density of shrimp biomass and size distribution on selected samling sites 1977-79. For area codes see Fig. 1.

SHRIMP BIOMASS,
(grams per squaremeter)

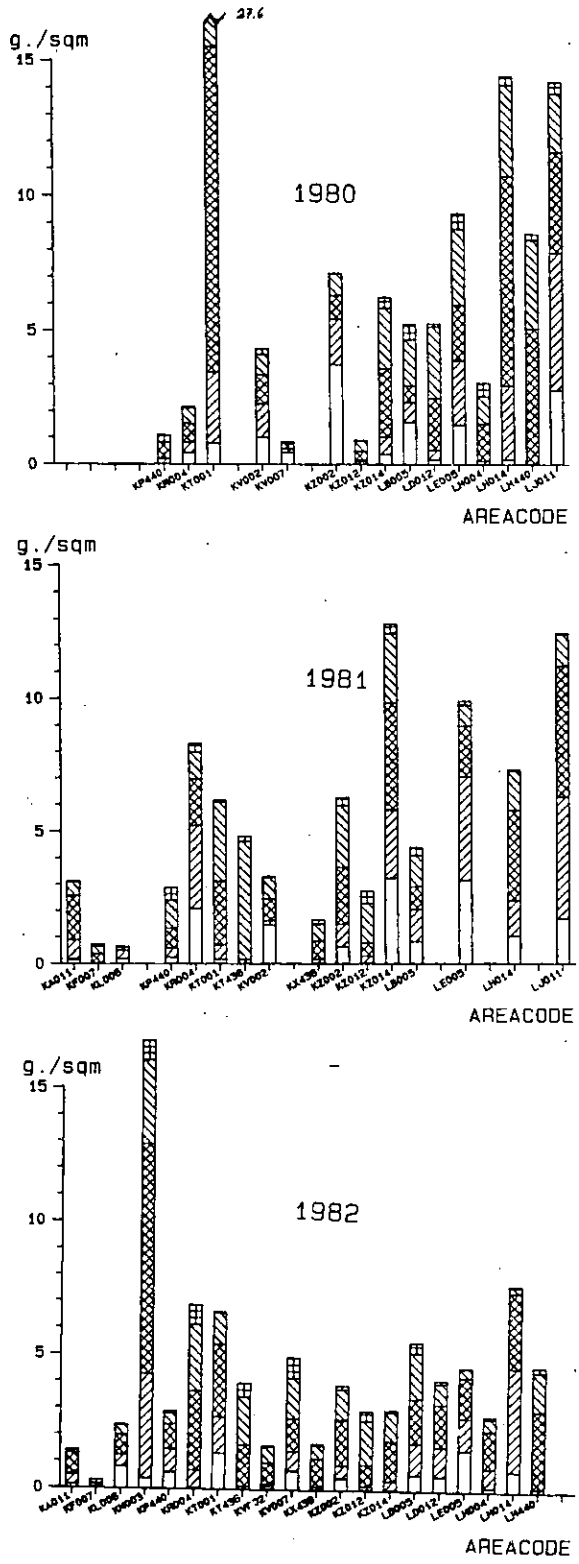

Fig. 2b. Density of shrimp biomass and size distribution on selected samling sites 1980-82. For area codes see Fig. 1.

SHRIMP BIOMASS.
(grams per squaremeter)

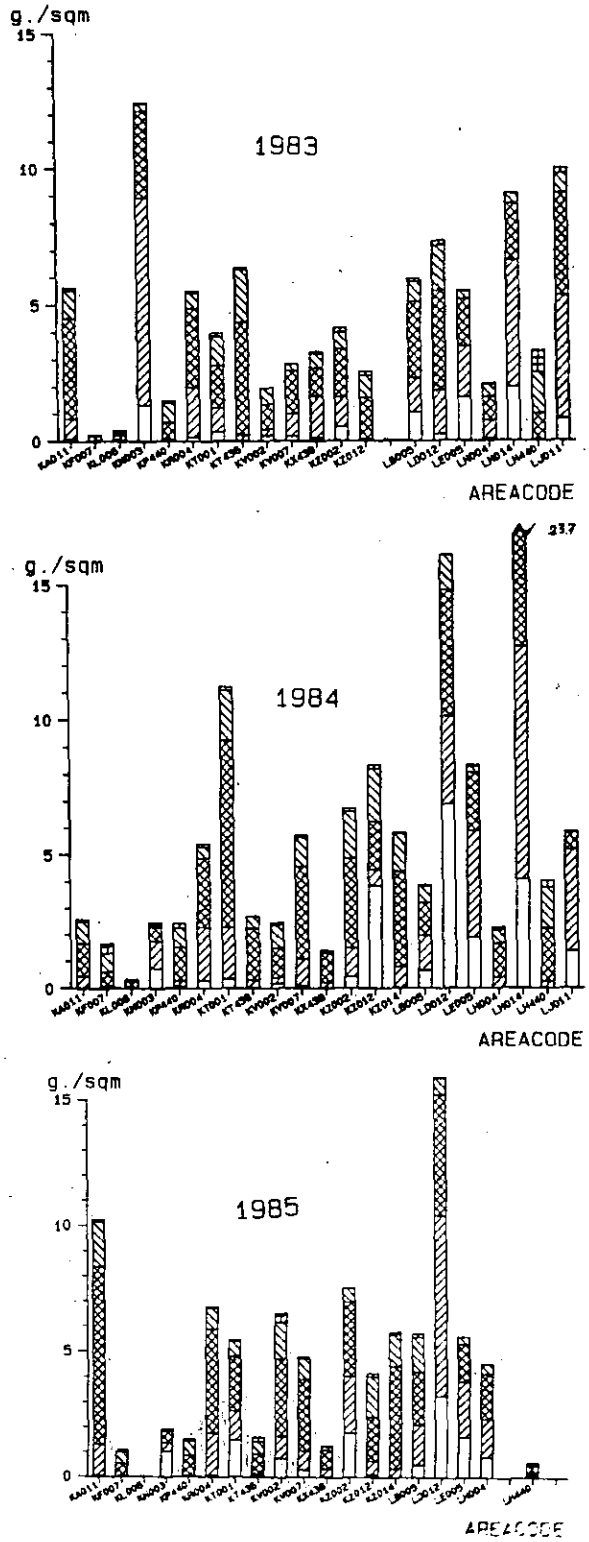

Fig. 2c. Density of shrimp biomass and size distribution on selected samling sites 1983-85. For area codes see Fig. 1.

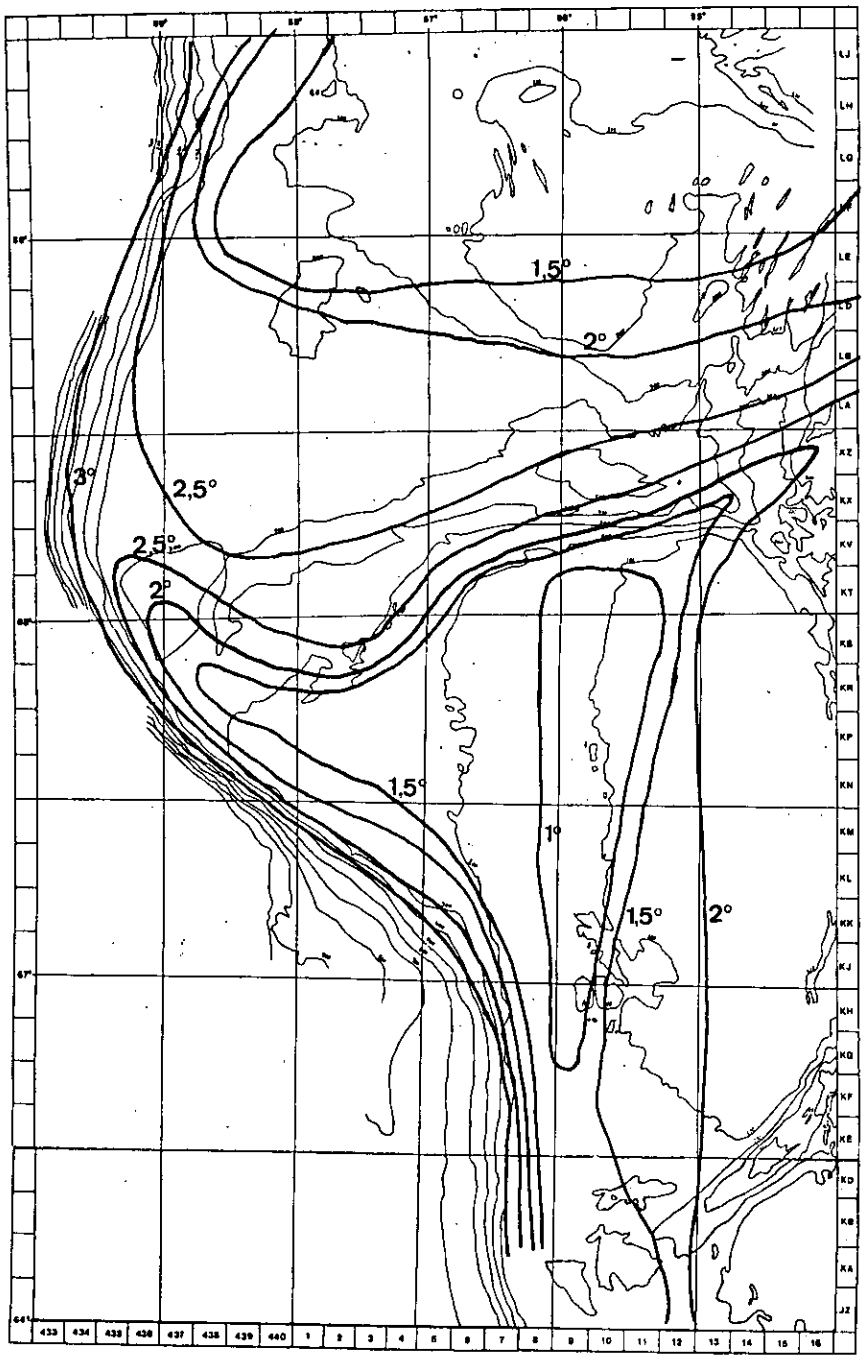

Fig. 3. Bottom temperatures (isotherms) for July-August 1985.

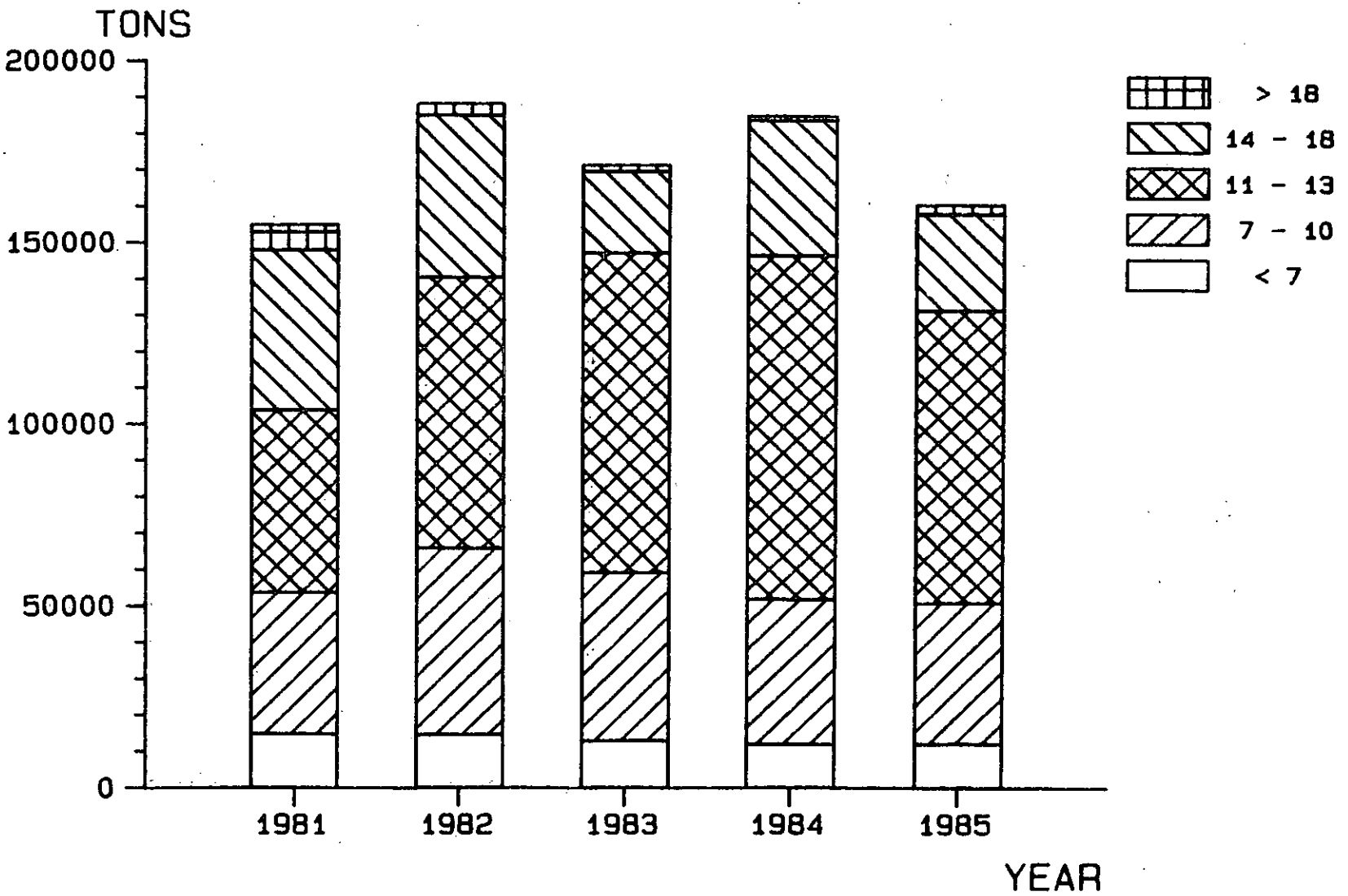

Fig. 4. Total estimated biomass in size groups. The unit applied to the size grouping is millimeters on the reading screen.

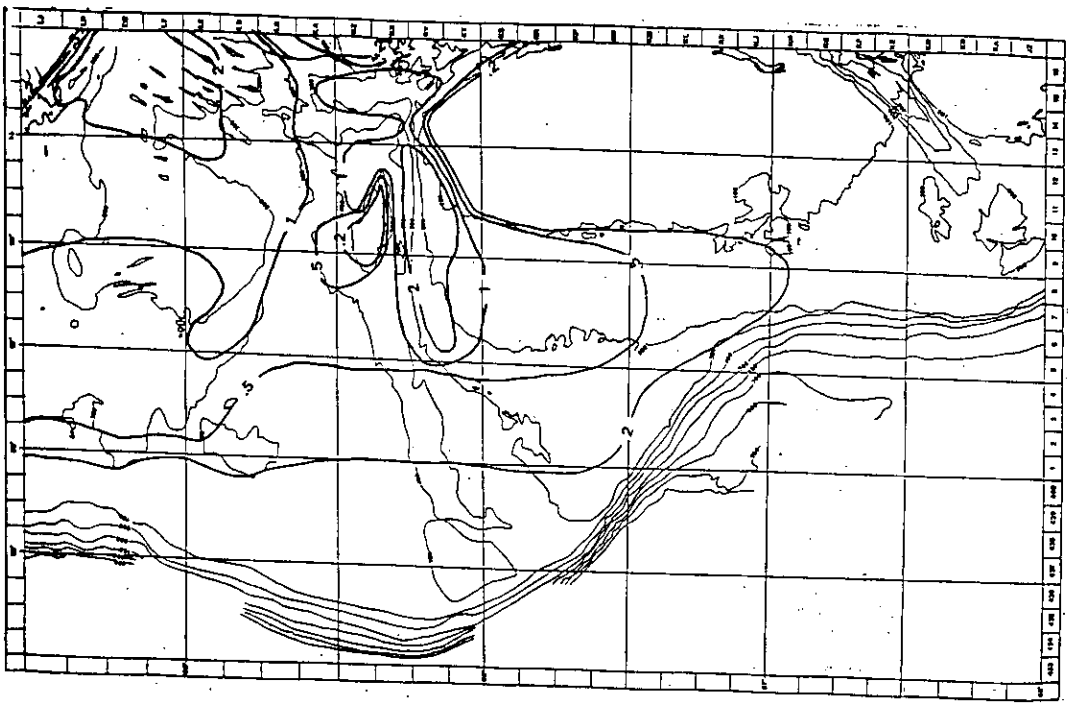

Fig. 5b. Isolines for different levels of estimated biomass of shrimp of size group two in 1981.

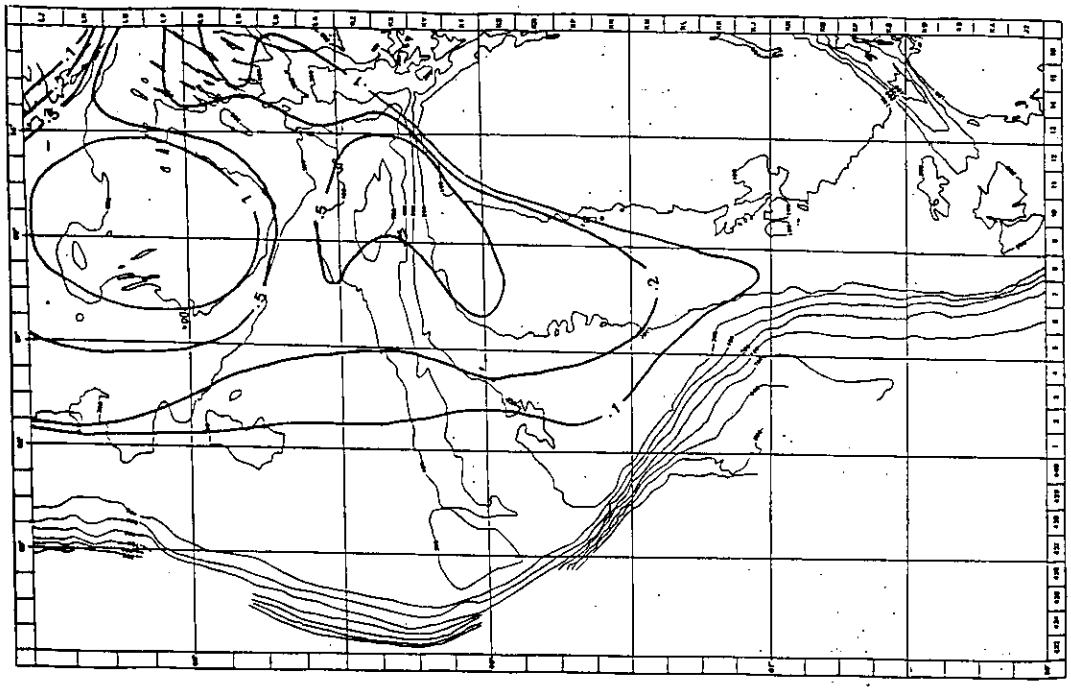

Fig. 5a. Isolines for different levels of estimated biomass of shrimp of size group one in 1981.

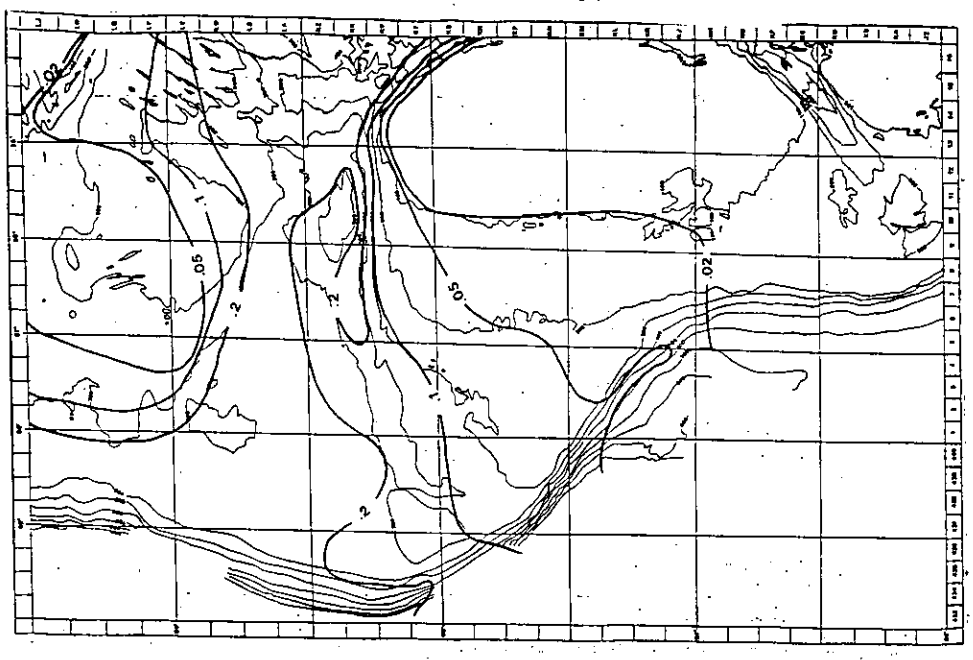

Fig. 5e. Isolines for different levels of estimated biomass of shrimp of size group five in 1981.

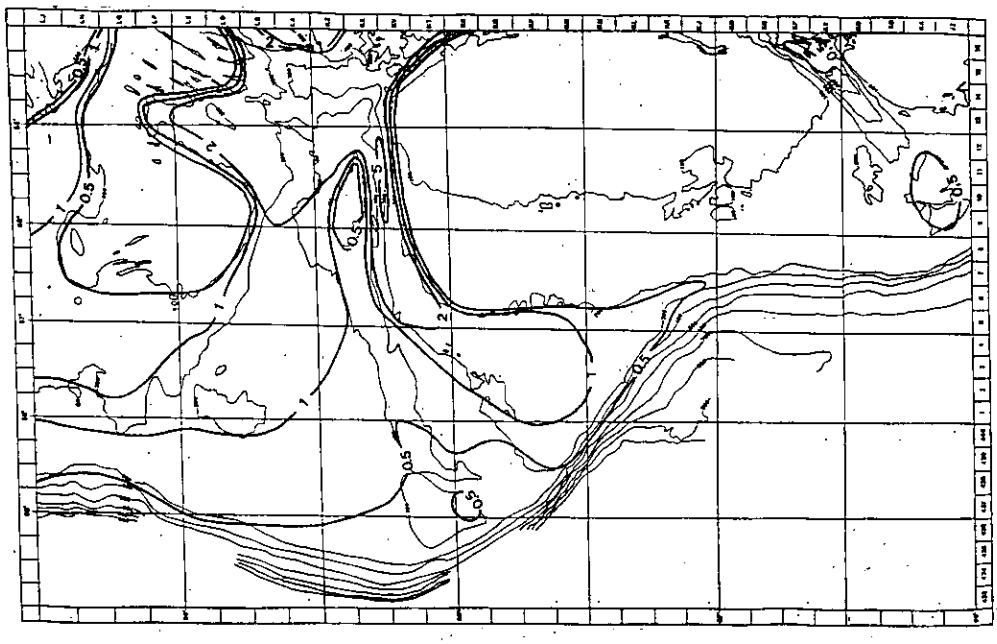

Fig. 5d. Isolines for different levels of estimated biomass of shrimp of size group four in 1981.

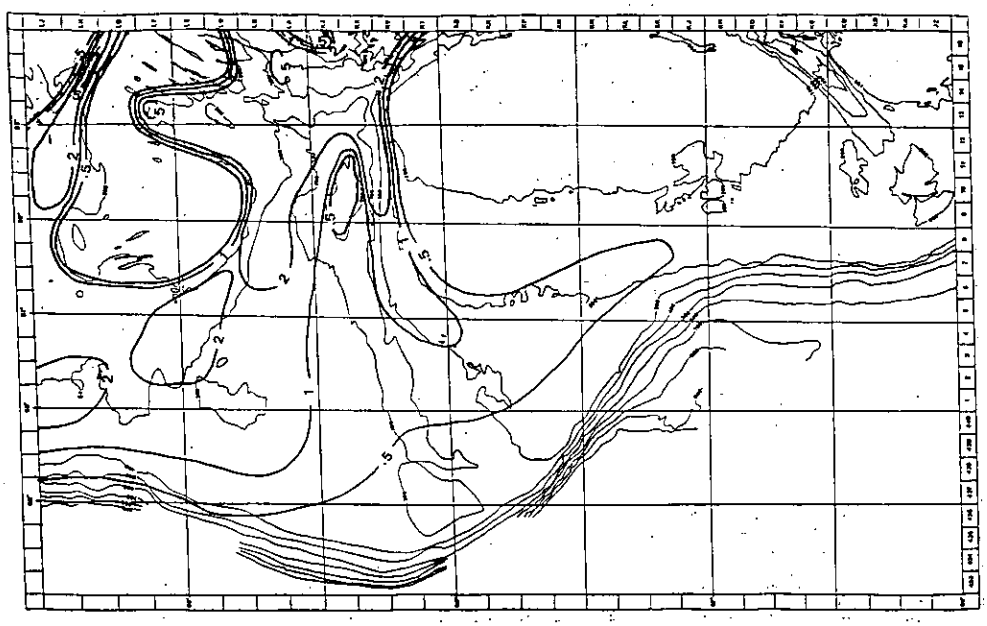

Fig. 5c. Isolines for different levels of estimated biomass of shrimp of size group three in 1981.

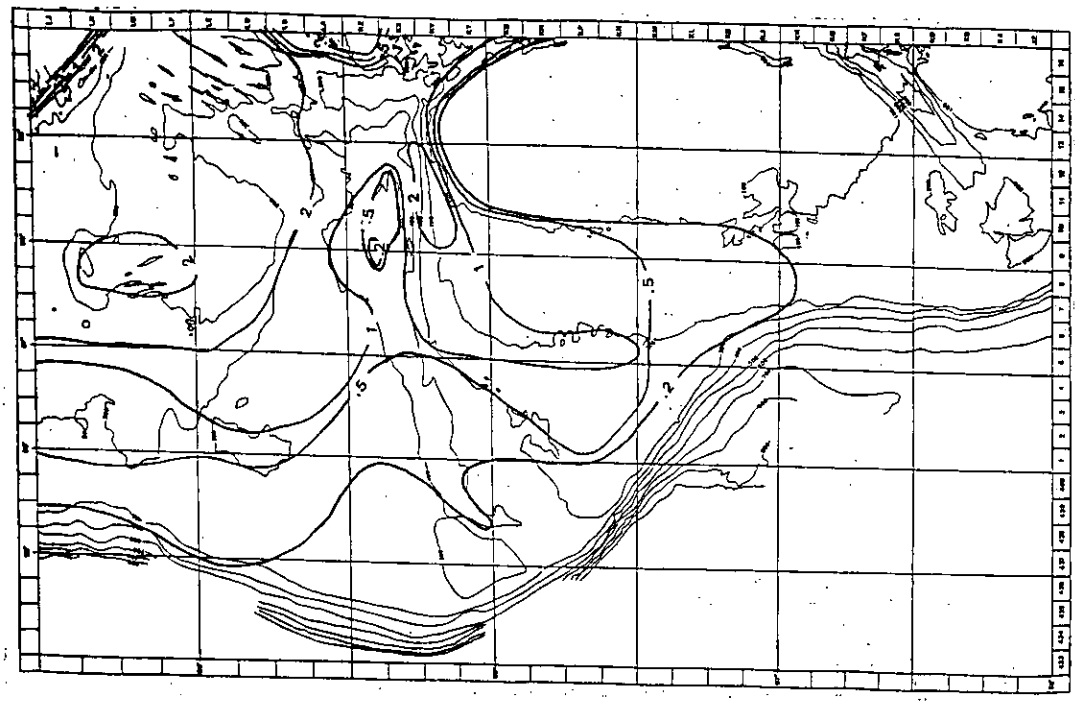

Fig. 6b. Isolines for different levels of estimated biomass of shrimp of size group two in 1982.

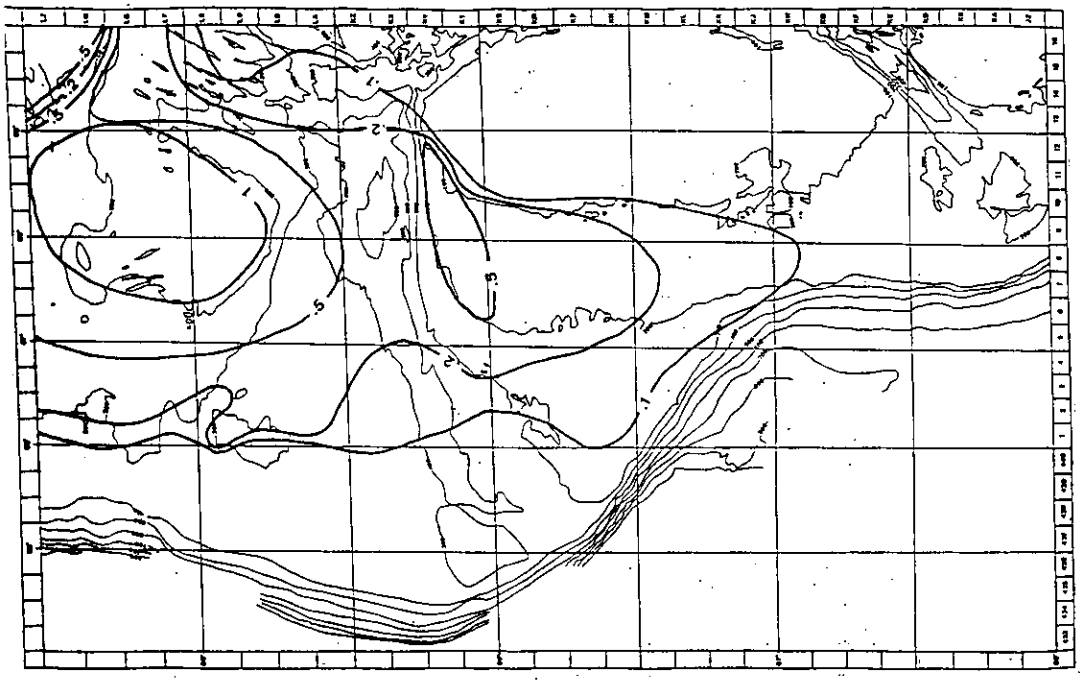

Fig. 6a. Isolines for different levels of estimated biomass of shrimp of size group one in 1982.

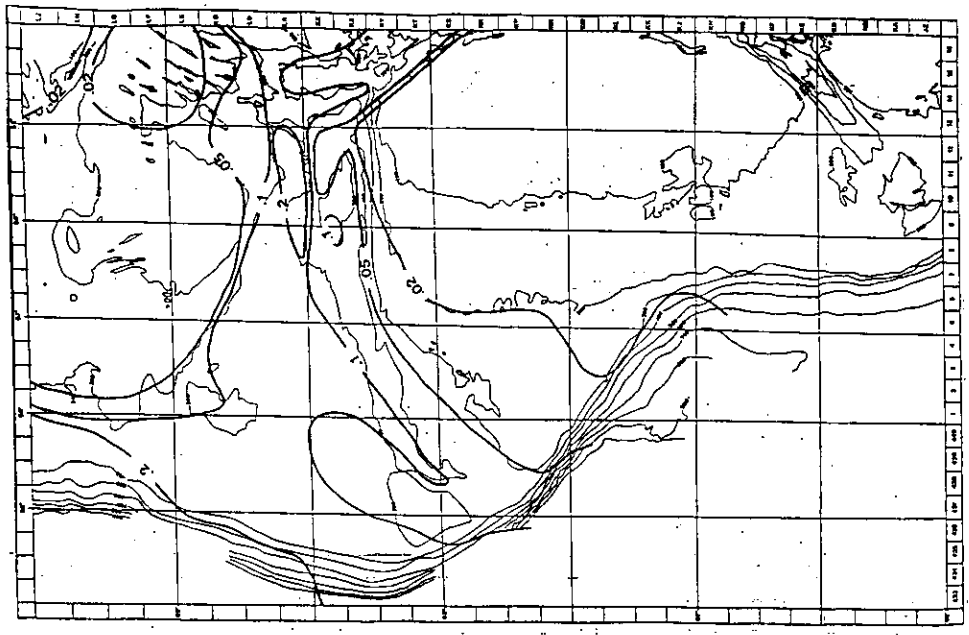

Fig. 6e. Isolines for different levels of estimated biomass of shrimp of size group five in 1982.

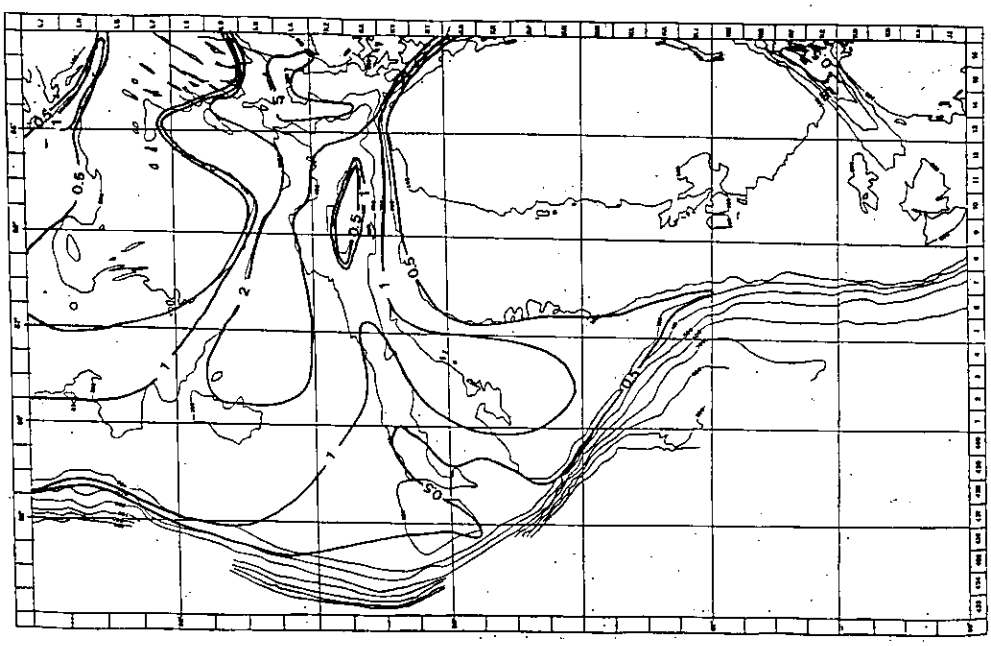

Fig. 6d. Isolines for different levels of estimated biomass of shrimp of size group four in 1982.

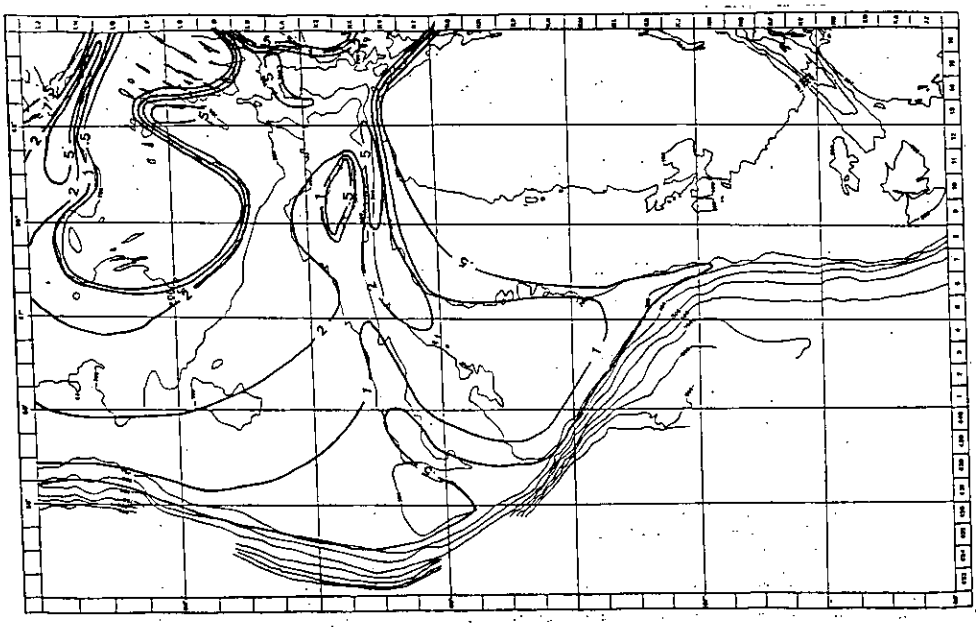

Fig. 6c. Isolines for different levels of estimated biomass of shrimp of size group three in 1982.

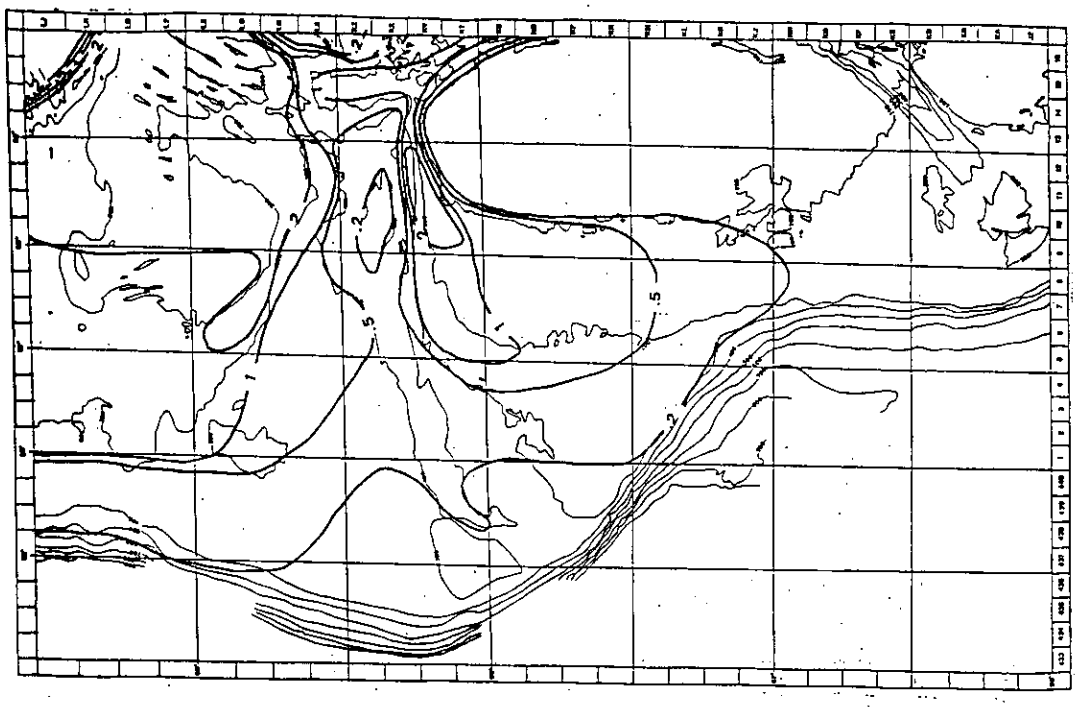

Fig. 7b. Isolines for different levels of estimated biomass of shrimp of size group two in 1983.

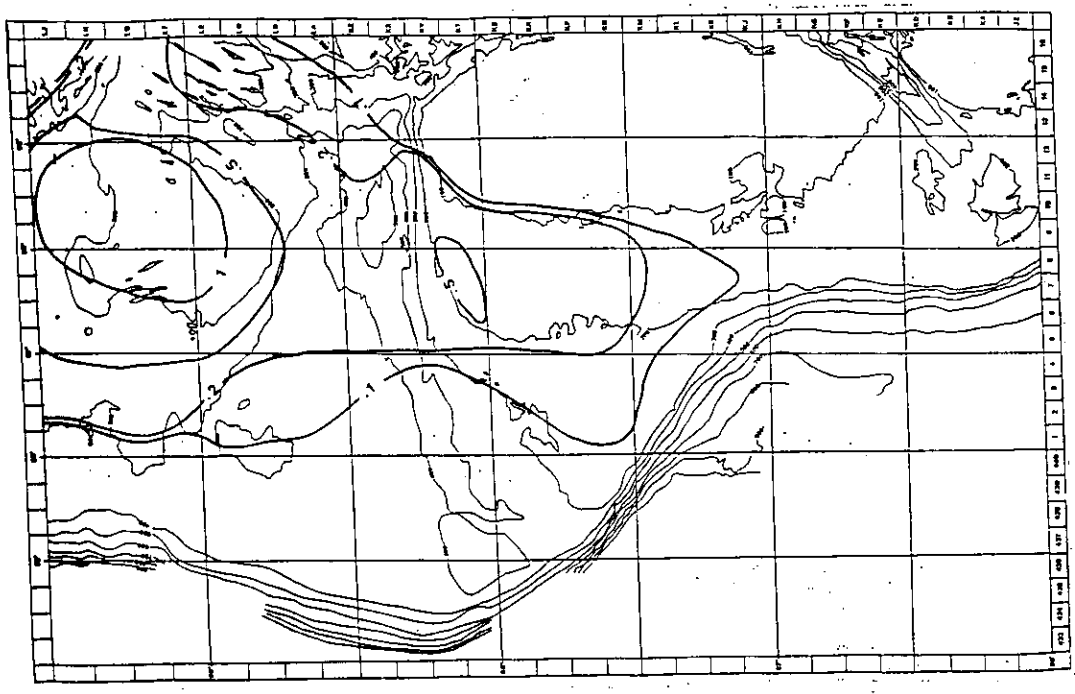

Fig. 7a. Isolines for different levels of estimated biomass of shrimp of size group one in 1983.

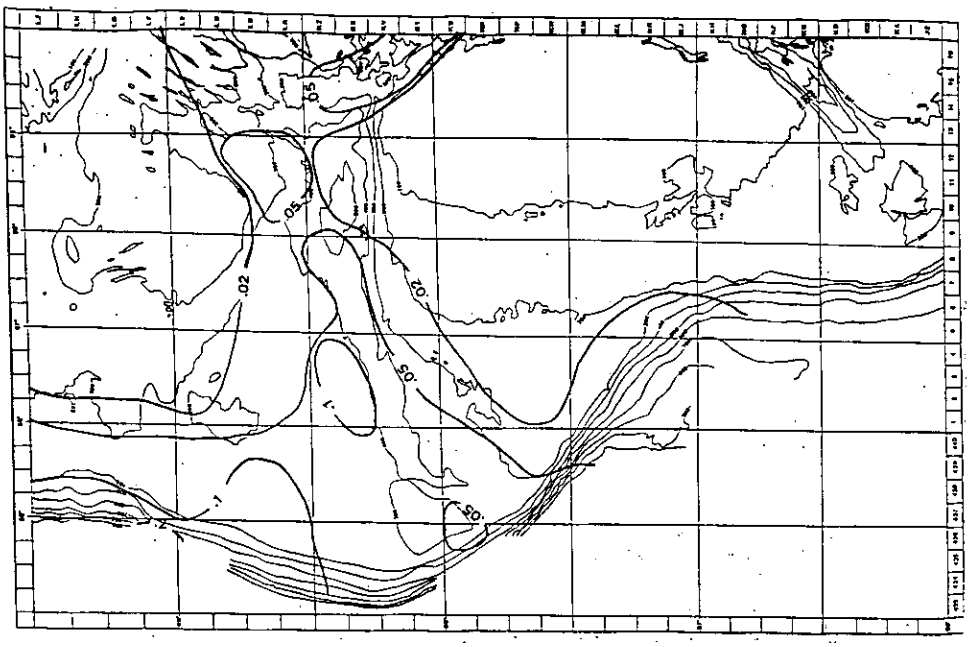

Fig. 7e. Isolines for different levels of estimated biomass of shrimp of size group five in 1983.

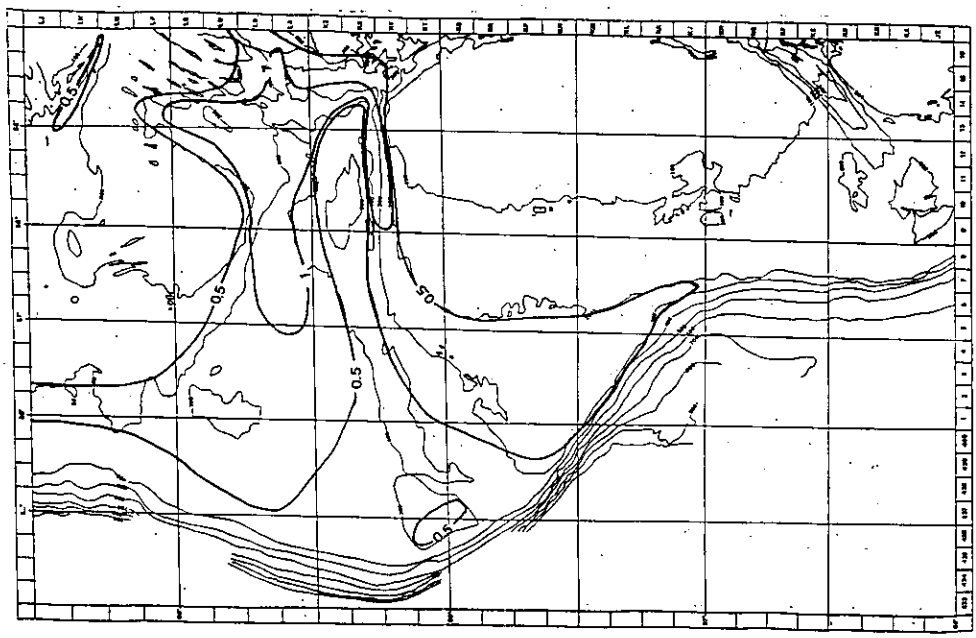

Fig. 7d. Isolines for different levels of estimated biomass of shrimp of size group four in 1983.

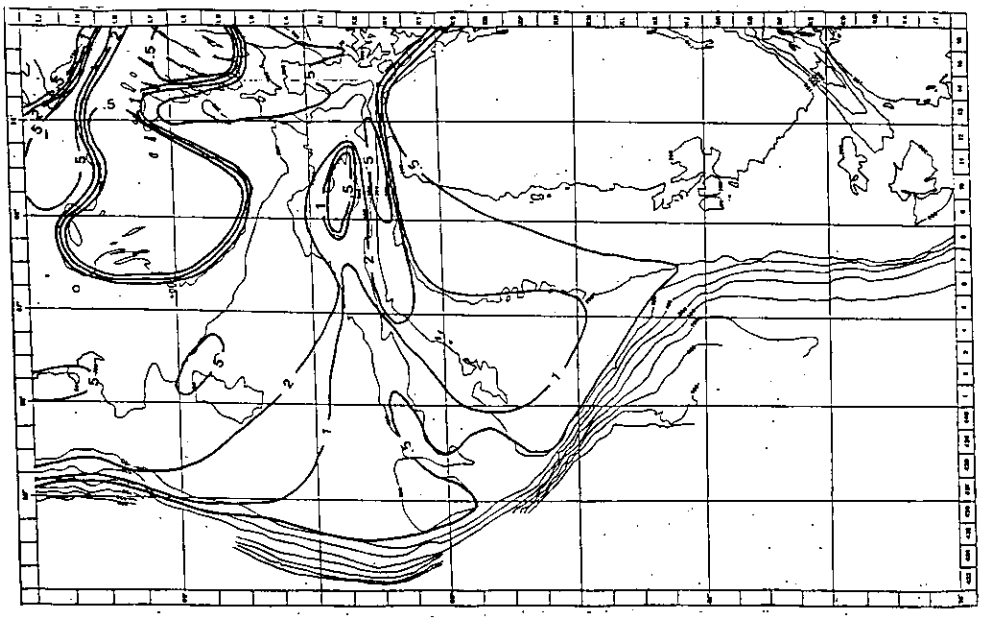

Fig. 7c. Isolines for different levels of estimated biomass of shrimp of size group three in 1983.

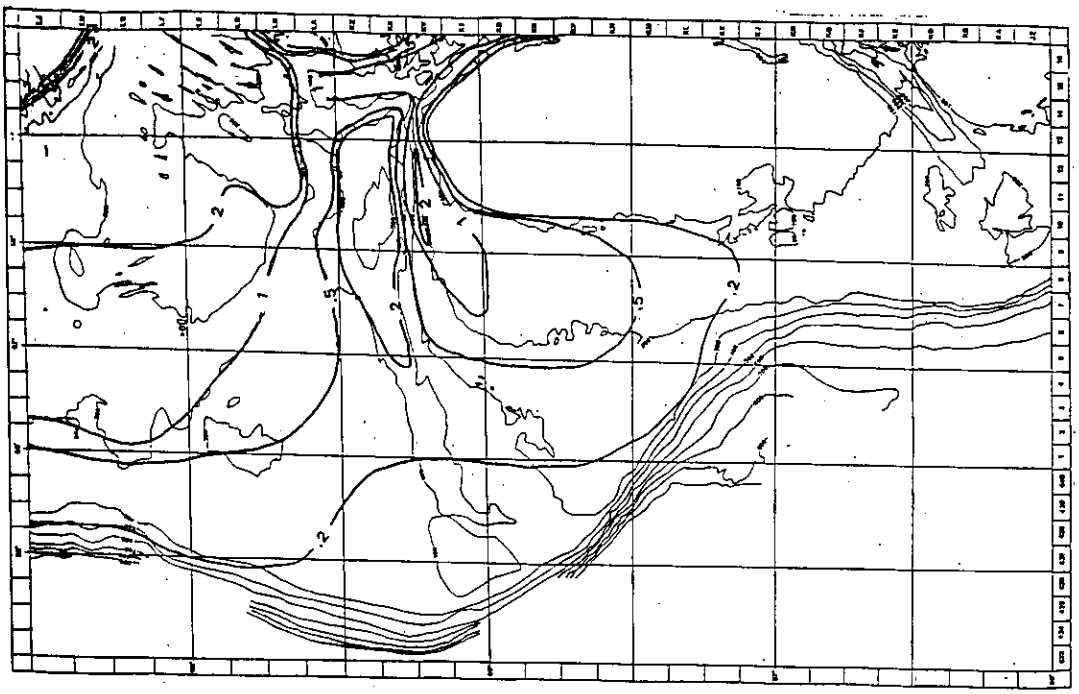

Fig. 8b. Isolines for different levels of estimated biomass of shrimp of size group two in 1984.

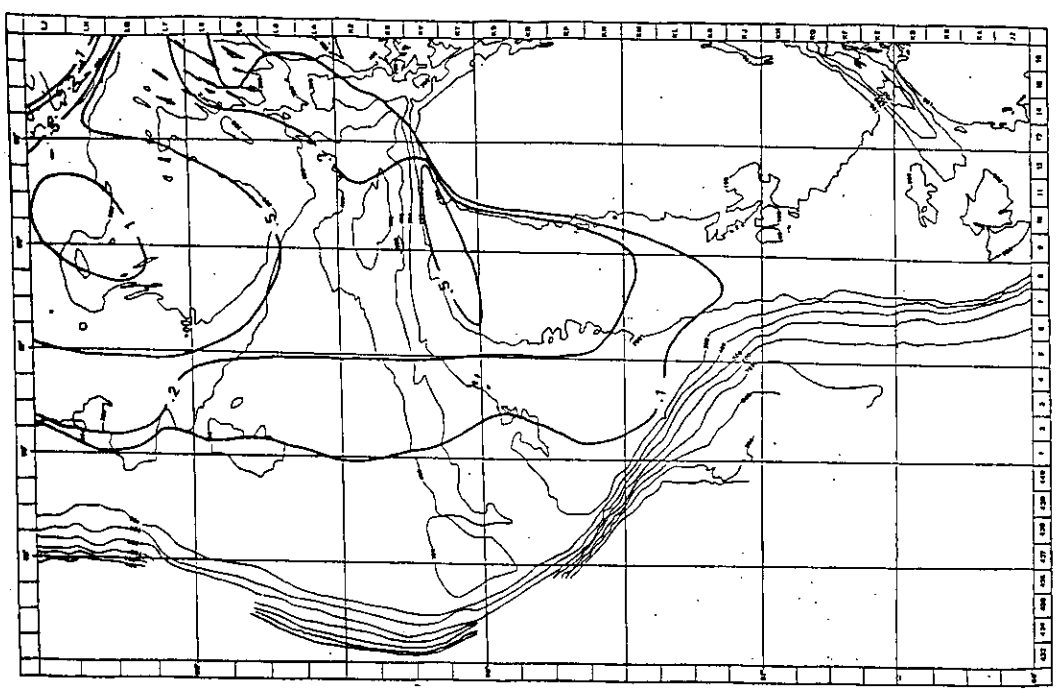

Fig. 8a. Isolines for different levels of estimated biomass of shrimp of size group one in 1984.

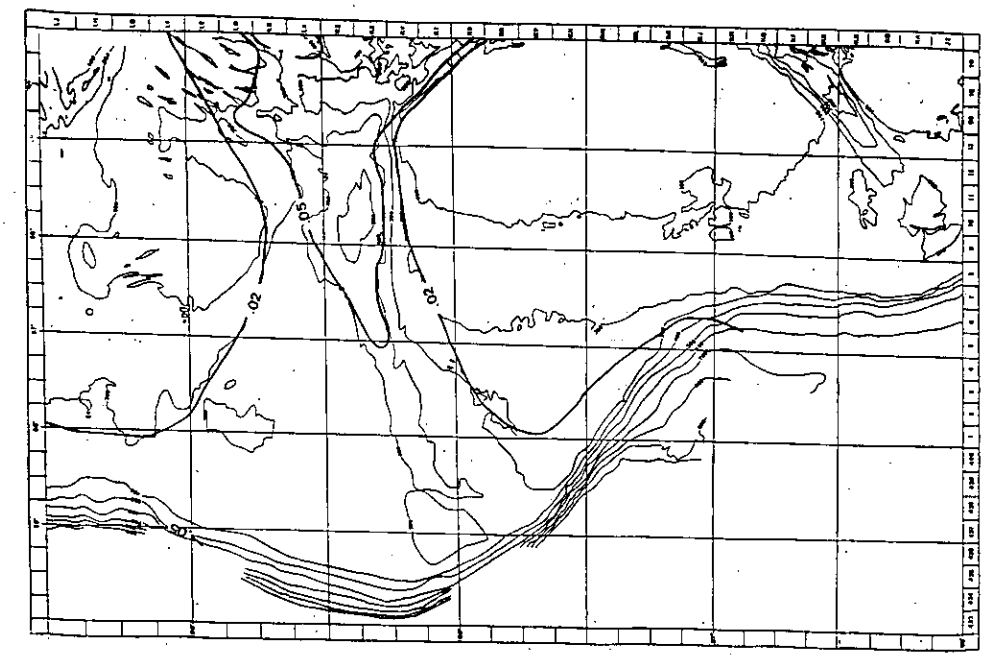

Fig. 8e. Isolines for different levels of estimated biomass of shrimp of size group five in 1984.

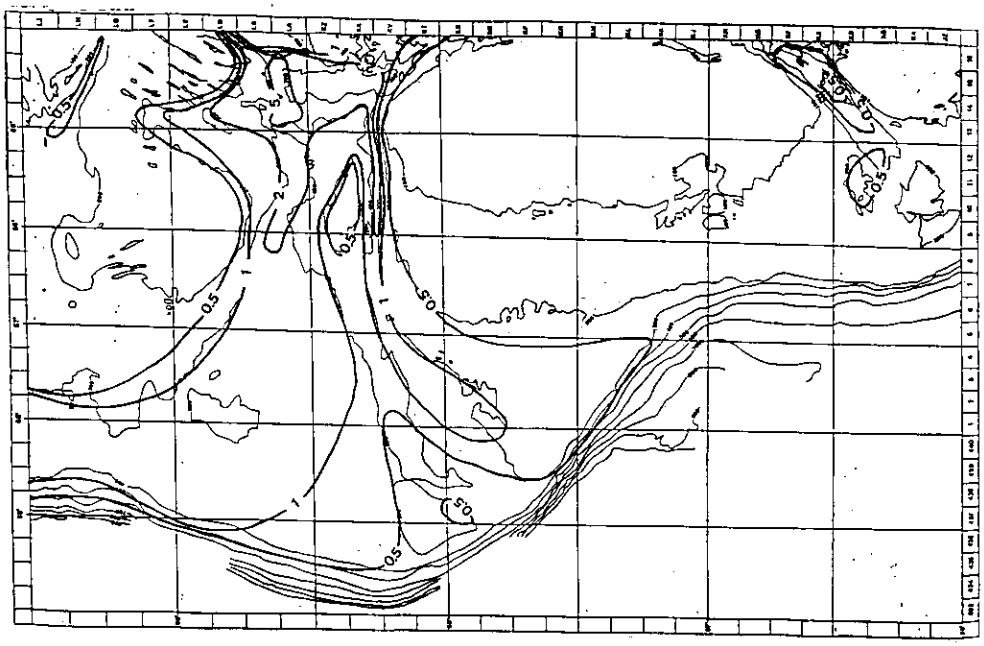

Fig. 8d. Isolines for different levels of estimated biomass of shrimp of size group four in 1984.

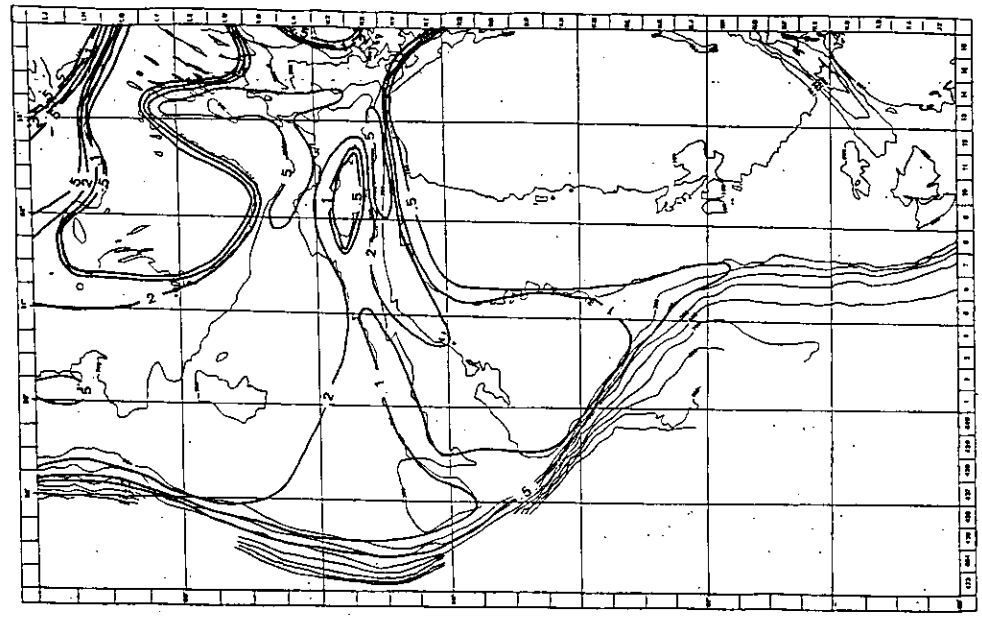

Fig. 8c. Isolines for different levels of estimated biomass of shrimp of size group three in 1984.

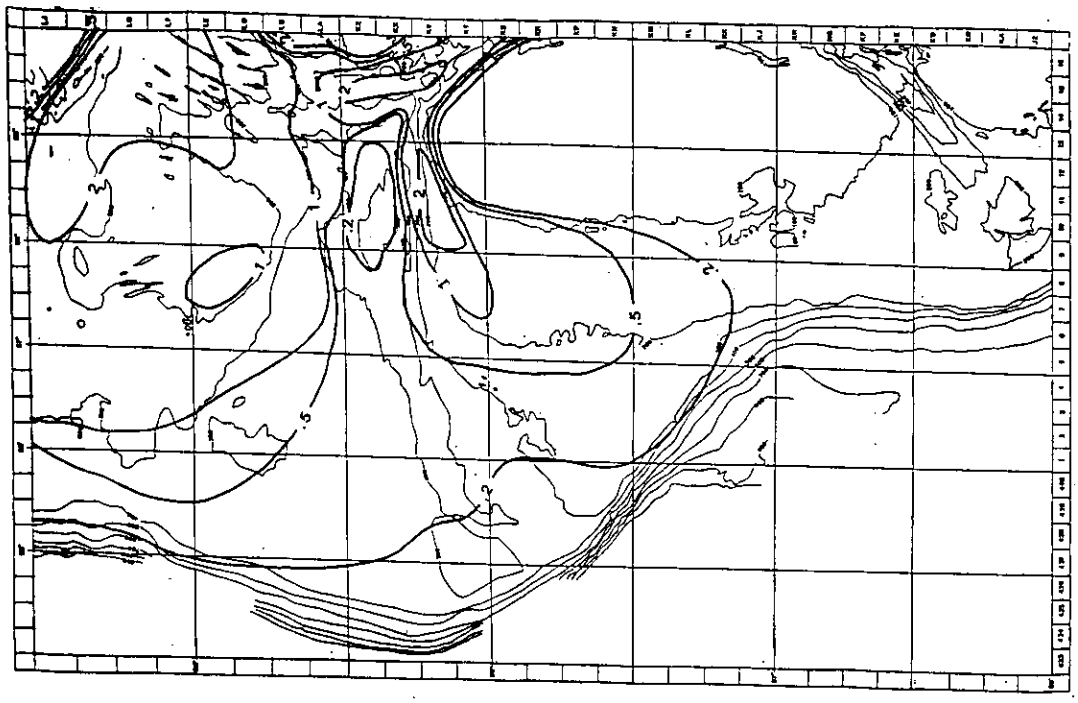

Fig. 9b. Isolines for different levels of estimated biomass of shrimp of size group two in 1985.

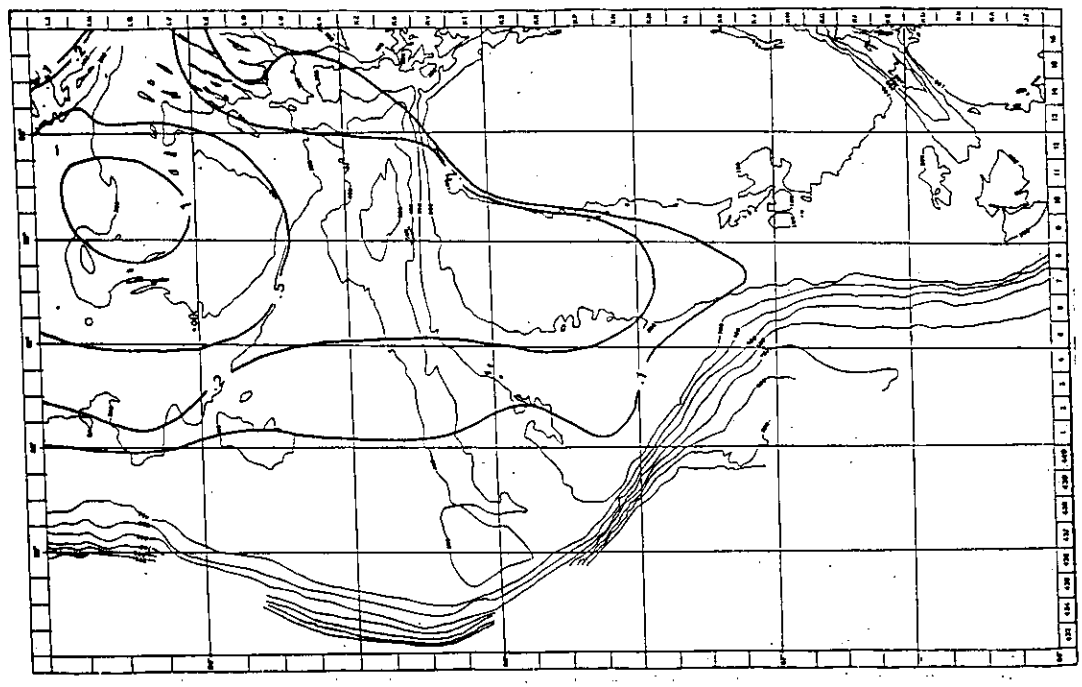

Fig. 9a. Isolines for different levels of estimated biomass of shrimp of size group one in 1985.

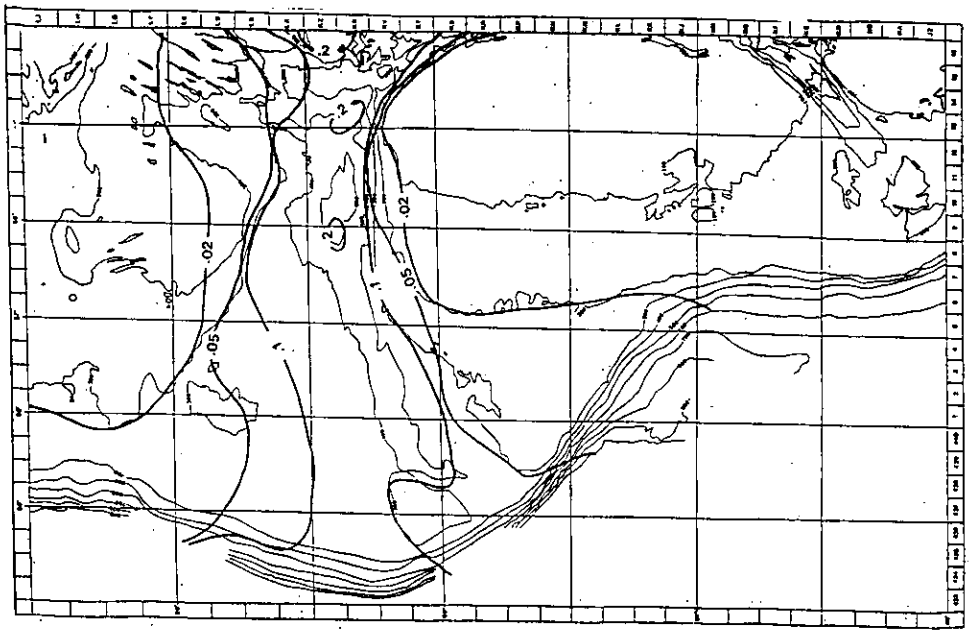

Fig. 9e. Isolines for different levels of estimated biomass of shrimp of size group five in 1985.

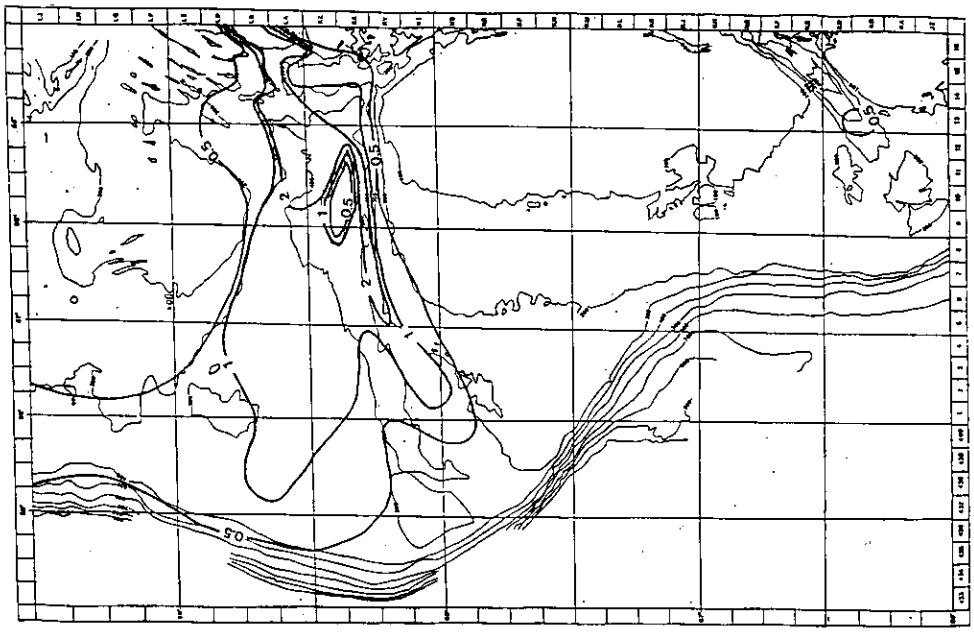

Fig. 9d. Isolines for different levels of estimated biomass of shrimp of size group four in 1985.

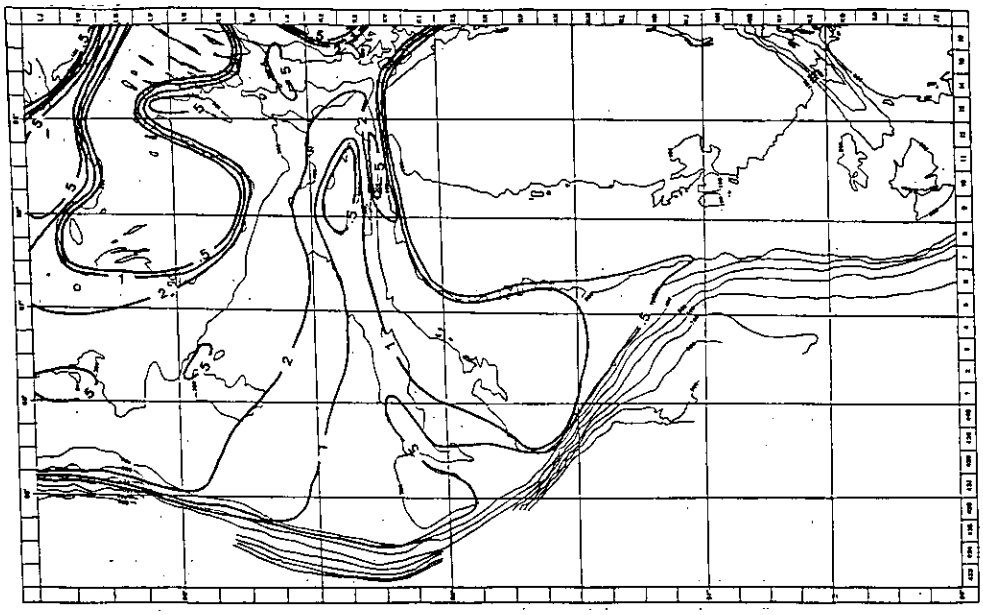

Fig. 9c. Isolines for different levels of estimated biomass of shrimp of size group three in 1985.