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Biomass estimate, length distribution and growth of the shrimp stock on the Nose of the Bank (Div. 3L) in May-Jun 1997.

by

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Introduction

The shrimp stock on the Nose of the Bank is generally considered to be part of the Div. 3L shrimp stock. An exploratory fishery was carried out on the part of this stock that lies out side the Canadian EEZ by two Faroese commercial shrimp trawlers in February-June 1994 (Nicolajsen, 1994). In the fall of 1996 the Faroese Government decided to implement a fisheries research program on the shrimp stock component on the Nose of the Bank in the NAFO regulatory area out side the Canadian EEZ. The aim of the program was to assess the stock size and record by-catch levels of important demersal fish species. The current paper deals with the assessment and by-catch records are reported elsewhere.

Materials and methods.

The fisheries research survey program consisted of four surveys carried out by the Faroese commercial shrimp trawler Høgifossur in November-December 1996, February, May-June, and August 1997. For each trip the trawl stations were chosen in two different way; 1. the stations were selected as in a stratified random trawl survey design (Fig. 1) and 2. by the skipper in a realistic fishery as to be able to record realistic by-catch levels. A single and double Angmassalik 3000 shrimp trawl was used. Meshsize in the codend is 40mm and the bar spacing in the sorting grade is 22mm.

Standardisation of data. For each station the density was calculated. The data were standardised dividing the catches by tow length and width of the trawl. The tow length was calculated by multiplying towing time with the average towing speed. The width of the trawl (single and double) was calculated as the average distance between the doors as measured by Scanmar distance measuring devices. The midpoint position of the tow was assigned to the density value (Fig. 2).

Biomass estimates were done in two different ways: 1. Area swept method usings data from stations selected by a stratified random trawl survey design and 2. Spatial analysis using data from all stations.

With regards to the stratified random trawl survey in November 1996 the coverage was very poor and no calculations were made for this trip. Number of stations by trip were 36, 27, and 25 for February, May-June and August 1997 and coverage was 30%, 21%, 27% for each trip respectively. In the area swept biomass estimate the average density for each station was calculated by strata, expanded to the strata area and total biomass calculated by summing over all strata by trip.

In the spatial analysis assessment of the biomass data from all stations were pooled together and a spatial analysis was done using the Surfer software package.

From the shrimp catch at each station a sample of about 200 specimens was taken and the oblique carapace length (OCL) was measured with vernier callipers to the nearest 0.5mm. The length frequencies for all stations were pooled together without standardisation or weighting.

From the modes of the length distribution mean length at age was estimated.

Results

The calculations of the area swept biomass calculations are shown in Tab. 1 and the results of the area swept and spatial analysis stock biomass estimates by trip are shown in Tab. 2.

The area swept method biomass values range from 2607t to 3849t with a mean value of 3266t. The values deviate from the mean by -18%, 5%, and 20% for February, May-June and August 1997 respectively.

The spatial analysis biomass values range from 2200t and 3900t with a mean value of 3200t. In 1994 the stock biomass was calculated by the area swept method to

2756t (Nicolajsen, 1994). The values deviate from the mean value by -31%, 22%, 9%, and 0% for November 1996, February, May-June and August 1997 respectively.

With the spatial analysis program a contour plot for each trip was produced (Fig 3). Generally speaking the main concentration of shrimp was in the northern part of the area between 47°30'N and 48°00'N latitude though a small component was found further south between 46°30'N and 47°00'N latitude in November-December 1996 and in May-June 1997. This concurs with the findings of the Faroese exploratory fishery in 1994 (Nicolajsen, 1994). The highest densities were found shallower than 400 m apart from in May-June 1997 when they were below the 400 m contour line.

Length frequencies for each trip are shown in Fig. 4. By looking at the modes of the length frequencies the mean OCL for age group 1 yr in November-December 1996 was estimated to about 12mm. In the same way the mean OCL for age group 2 yr was estimated to about 13mm, 14.5mm, 16mm, and 17.5mm for November-December 1996, February, May-June, August 1997. The mean OCL for age group 3 yr was estimated to about 18mm, 19mm, 19.5mm, and 21mm for each period respectively. Similarly the mean OCL for age group 4 yr is estimated to about 21mm, obscure, 23.5mm, and 23.5mm. The mean OCL for age group 5 yr in May- June 1997 is estimated to about 24mm. A tentative growth curve can be constructed from this (Fig. 5).

The proportion of age group 1 relative to the other age groups is very small in November-December 1996 but gradually increases as age group 2 through out the period. The relative proportion of age group 3 generally increases through the period as well. The relative proportion of age group 4 seemed generally to decreases through the period. The relative proportion of age group 5 is not easy to distinguish except for May-June 1997 were it is dominant.

Discussion

When spawning in August one would expect most of the stock to be concentrated in one area as opposed to a more dispersed allocation of the stock in the rest of the year and the area swept method biomass value for August, 3849t, is the highest in that series and the spatial analysis estimate for the same period is equal to the mean biomass value of 3200t.

In November-December 1996 the stock seemed to be more dispersed as the density was relatively low. In February 1997 the northern stock component biomass had increased as the density increased and had moved somewhat southwards. In May-June 1997 the northern component of the stock had spread over a larger area and part of it gone deeper with high concentrations below 400 m. In August the situation was much like in February with high concentrations.

The biomass calculation is probably an underestimation. Biomass estimates for the Flemish Cap shrimp stock tend to be equal or lower than annual catches (Nicolajsen, 1993, 1994, 1997, Parsons *et al.* 1997). No information is available on the ratio between stock assessment and real stock size but as long as the fleet takes about three times the estimated stock size, as was the case in 1996, an educated guess could be that the actual stock might be 3-5 times the estimate.

By measuring the distance between the doors instead of that between the wings, the width of the trawl might overestimated.

Reference

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PARSONS, D.G., D.W. KULKA, and P.J.VEITCH. 1997. Distribution, biomass, abundance and demography of shrimp (*Pandalus borealis*) on Flemish Cap (NAFO Division 3M) basedon data obtained during a Canadian research trawl survey, September-October, 1996. NAFO SCR, 97/81, 14p.

Table 1. Area swept assessment of the shrimp stock on Grand Bank (Div. 3L) outside the Canadian EEZ.

Period	Strata no.	Average density t*km-2	Strata area km2	Biomass t	Number of stations	Number of squares in strata	Coverage %
February 1997	3	0.307	772	237	3	9	33
	4	0.773	2915	2253	18	34	53
	5	0.027	1372	37	3	16	19
	6	0.003	772	3	2	9	22
	7	0.038	1286	48	3	15	20
	8	0.034	857	29	5	10	50
	10	0.000	2229	0	2	26	8
	Total		10204	2607	36	119	
	Unweighted Average	0.169					30
	Weighted Average	0.256					30
May-June 1997	2	0.002	3173	6	2	37	5
	3	1.272	772	982	3	9	33
	4	0.071	2915	207	9	34	26
	5	0.205	1372	281	5	16	31
	6	0.231	772	178	2	9	22
	7	0.784	1286	1008	4	15	27
	8	0.792	857	679	2	10	20
	Total		11147	3341	27	130	
	Unweighted Average	0.479					21
	Weighted Average	0.300					21
August 1997	3	2.051	772	1583	4	9	44
	4	0.591	2915	1723	9	34	26
	5	0.096	1372	131	5	16	31
	6	0.059	772	45	3	9	33
	7	0.159	1286	204	3	15	20
	8	0.189	857	162	1	10	10
	Total		7975	3849	25	93	
	Unweighted Average	0.524					27
	Weighted Average	0.483					27

Table 2 Biomass calculations for the Div. 3L shrimp stock by two methods and for four periods.

Period	Kriging Biomass t	Area Swept Biomass t	Ratio between methods
November-December 1996	2189	N/A	
February 1997	3908	2607	1.50
May-June 1997	3468	3341	1.04
August 1997	3214	3849	0.84
Average	3195	3266	0.98

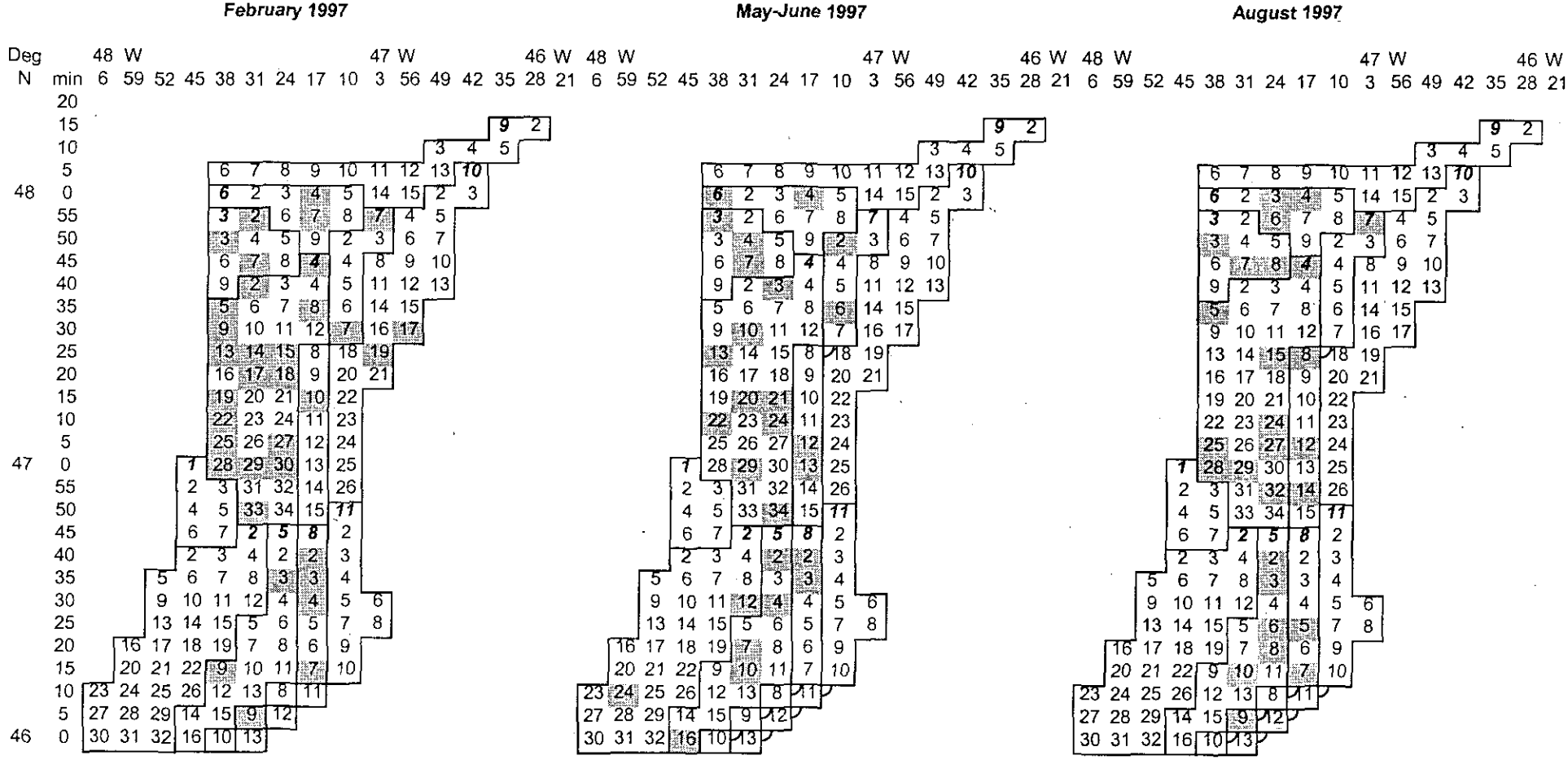

Figure 1. The Nose of the Bank divided into strata and squares. First number in a strata is the strata no. and other numbers are square numbers. The grey squares are selected stations.

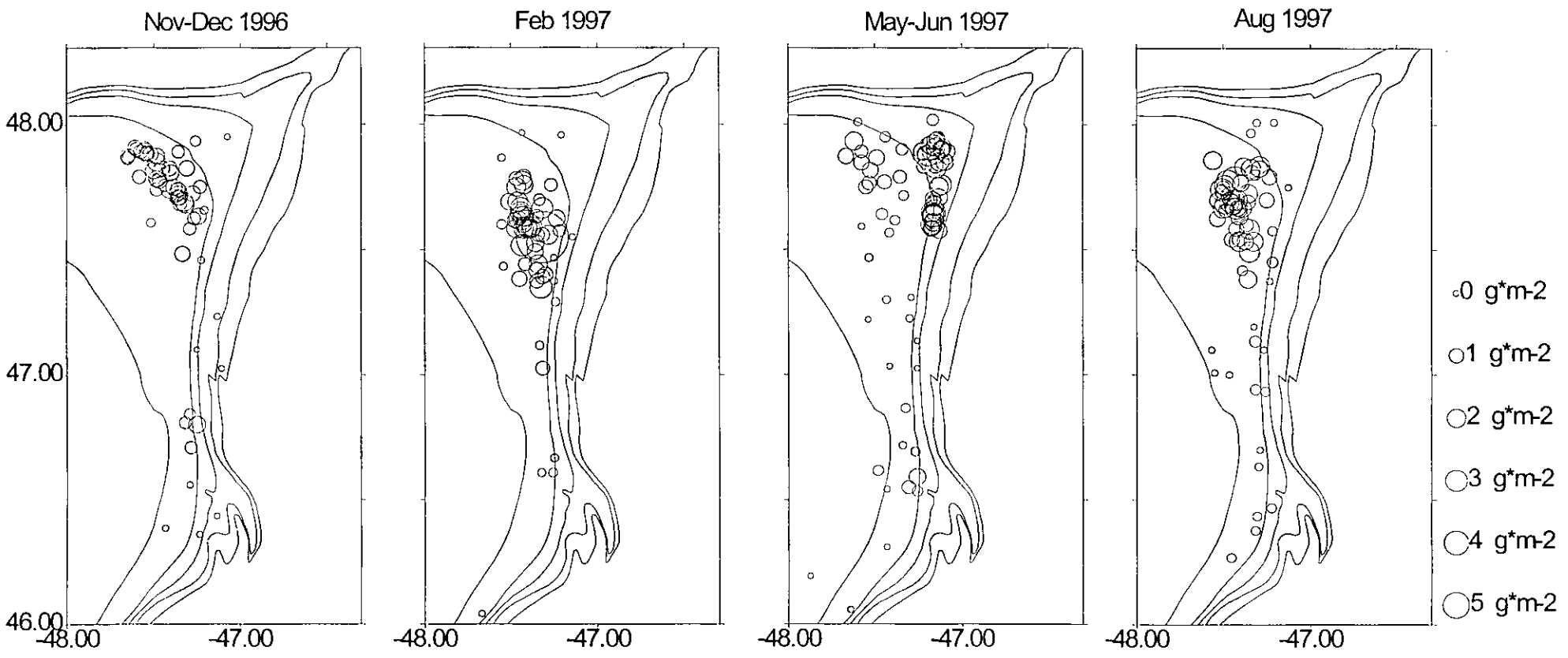

Figure 2 Average density (g*m-2) of northern shrimp at haul midpoint in Div 3L for four periods.

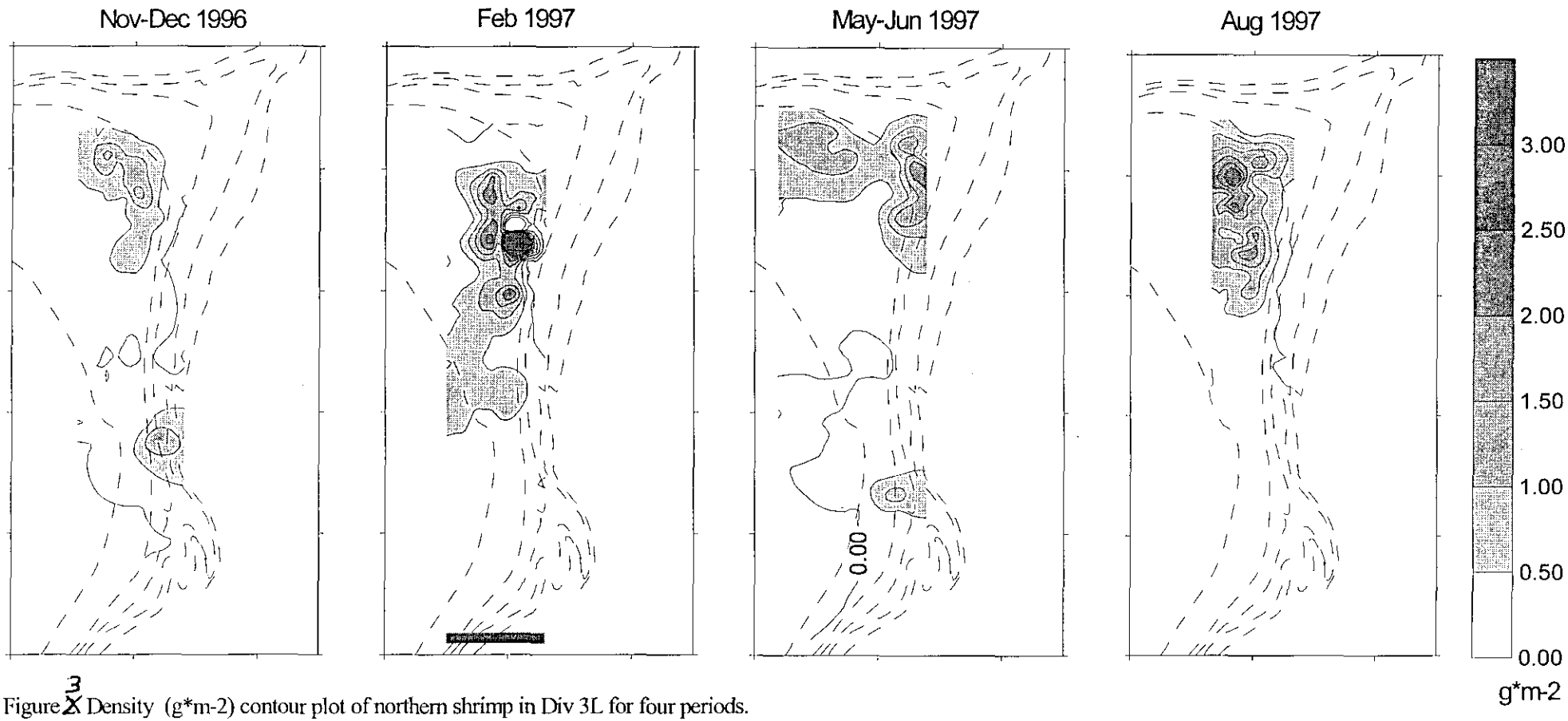

Figure 3 Density (g*m-2) contour plot of northern shrimp in Div 3L for four periods.

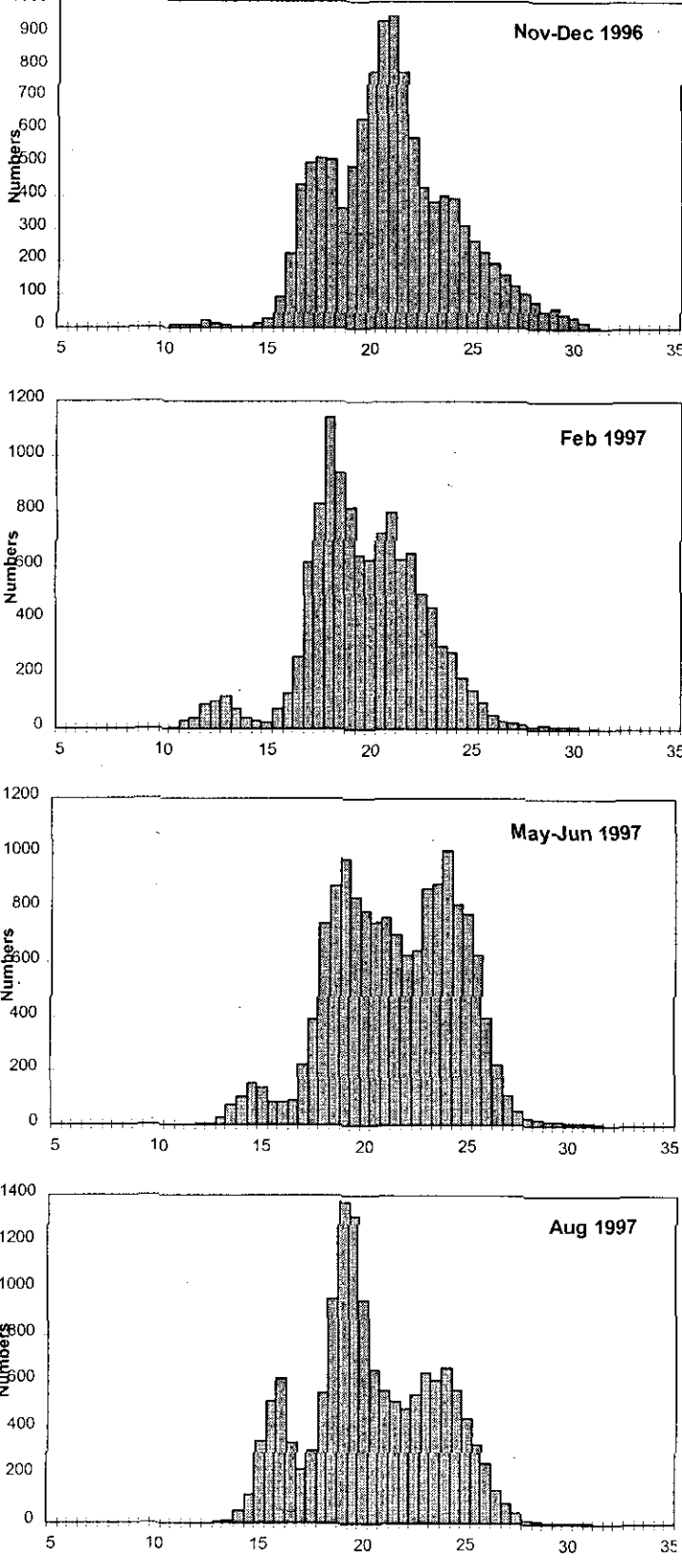

Fig 4. Length frequencies of shrimp in Div 3L in four periods.

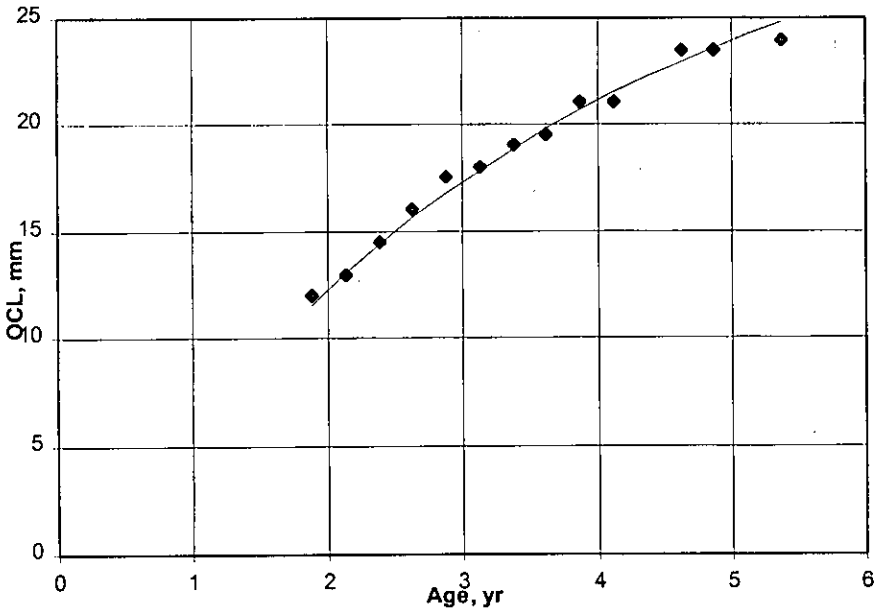

Fig 5. Growth of shrimp in Div 3L.