International Commission for the Northwest Atlantic Fisheries

Serial No. 3602
(D.c. 3)

ICNAF Res.Doc. 75/109

ANNUAL MEETING - JUNE 1975

Report on Larval Herring Distribution in the Gulf of Maine and on Georges Bank, 27 September - 18 October 1974

by

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INTRODUCTION

R/V **Wieczno** conducted surveys of larval herring /Clupea harengus/ distribution in the Gulf of Maine, the Southern Scotian Shelf and on Georges Bank.

The survey was the scheduled ICNAF Larval Herring Survey, on annual, cooperative ICNAF study since 1971.

The cruise tracks /Fig. 1/ show the ICNAF stations occupied.

The number of herring larvae within Georges Bank and Nantucket Shoal was significantly lower in 1974 than in 1973 although both fisheries data and length frequencies of herring larvae indicate the delay of spawning period.

This situation could have happened as a result of hydrological anomalies occuring in this area in this period.

METHODS

Larval herring were sampled with a single pair of 61 cm Bongo nets with mesh-size 505 mm and 333 mm. Tows were single oblique and to a maximum depth of 100 m or from near bottom when the station depth was shallower at a towing speed of 3,5 knots.

Rate of net deployment was 50 m/min while houlback rate was 10 m/min, continuous to the surface. All plankton samples were preserved in 5% formalin and sorted in Plankton Sorting and Taxonomic Center in Szczecin - Poland at every station temperatures, salinity, oxygen and phosphorous content were measured at standard depth levels using standard methods /reversing termometers, salinometer, Winkler method and Murphy-Riley method/.

Additional samples with 20 cm Bongo nets were taken at selected stations /Fig. 1/ for studies of larvae feeding. Ten - minute Neuston tows using a net with a 1 x 2 m mouth and .505 mm were also made at stations shown on the map. Results from these additional samples will not be discussed in this report.

HYDROLOGICAL CONDITIONS

Distribution of hydrological elements and the anomaly of surface and bottom water temperature are shown on figures 2 - 9.

The area to the south of Georges Bank was covered by warm Gulf Stream waters with maximum surface temperature 22,7°C and salinity of 35,7‰ . From the North they are bordered with the frontal zone characterized by great horizontal gradients.

Over eastern and southern part of Georges Bank the tongue of colder water with temperatures 13 - 14°C and salinity 32,7‰ flowing from Gulf of Maine was observed.

Central part of Georges Bank was covered by waters with temperature 14 - 16°C and very uniform salinity 32,6 - 32,7‰ . In the Gulf of Maine the water temperature raised from 10,9 - 12,0°C in the coastal zone to 16,3°C in the south western part. The salinity increased from 32,0‰ in the western part to 33,8‰ in the eastern part.

The highest surface phosphorous contens were found in the coastal zone of north-eastern part of the Gulf of Maine /0,9 ug at/l/ and in the central part of Georges Bank /0,7 ug at/l/.

The phosphorous contens decrease to the trace amount to the southwestern part of Bank.

The tongue of cooler water with temperature 11 - 13°C and salinity 33 - 34‰ was extended over the southern Georges Bank Slope between 40 and 100m isobaths.

In the southern part of Gulf of Maine the lowest temperature 6 - 7°C was found between 70 and 150 isobaths. The penetration of the 9°C and 35‰ water from the open Ocean to the Gulf of Maine through the channel between Georges Bank and Browns Bank

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in the layer 80 - 150 mm was observed.

Farther entering the Gulf of Maine this water masses reached the bottom and extended over eastern part of the Gulf. Westward temperature of the bottom water decreased to 6°C and salinity to 33‰ .

The bottom layer of the central Georges Bank was occupied by 13 - 16,9°C water with pretty uniform salinity /32,5 - 32,8‰ /. Along the southern Slope of the Georges Bank an inflow of 10,7 - 12°C and 33 - 34‰ water from the northeastern periphery was observed in the bottom layer.

The highest phosphorus content in the near-bottom waters /1,5 ug at/l/ was found in the southern portion of the Gulf of Maine while the lowest /0,3 ug at/l/ on the Nantucket Shoals.

Phosphorus content near the bottom of central Georges Bank varied between 0,6 - 0,8 ug at/l.

Comparing the results of the surface and bottom water temperature with the long period records one can see that the surface of the most of the surveyed area was covered by waters with positive anomalies and the highest differences /up to 5,6°C/ were at the border with the Gulf Stream waters.

Other big area with the higher temperature and anomalies reaching + 2,8°C was the southwestern portion of the Gulf of Maine and northeastern part of Georges Bank.

Waters with negative anomalies were covering the area of nothern /- 1,0°C/ and western part /- 1,9°/ of the Gulf of Maine.

It should be noted that northern winds prevailed at this time what could have been one of the reason of these anomalies.

It was also clearly evident that the near bottom waters positively deviated from the mean data. Maximum value of positive anomaly /+ 6,5°C/ occured on Browns Bank.

The area with higher near bottom temperature /up to + 4,1°C/ extended as a narrow strip along the northern edge of Georges Bank.

Negative anomalies occured on small patches on the northern part of the Gulf of Maine /- 0,4°C/ and south of Nantucket Shoals /- 0,8°C/ only.

LARVAL HERRING DISTRIBUTION

The distribution of herring larvae taken by r/v Wieczno during the Fall 1974 survey, in numbers per 10 m^2 are given in Figure 10 showing larvae divided into three size groups and their total number.

All larvae are from the .505 mm net. A total number of 18 565 larval herring were captured during the survey. Nearly the same number of larvae / 18 607/ were taken in 1973 but their distribution differs markedly between both years.

There was about five times less larvae taken on Nantucket Shoals and two times less on the Georges Bank in 1974 as in 1973.

According to the comparison shown in Table 1 the production of herring larvae off Nova Scotia appears to increase in following years since 1972 and in 1974 exceeded six times the number of larvae produced in 1973.

The number of herring larvae from coastal Gulf of Maine shows also a slight increase in 1974.

Comparing the estimate abundance of larvae separately for areas and size groups /Table 1, Fig. 12/ and the length frequency distribution /Fig. 11/ one could come to the condusion that on Nantucket Shoals and Georges Bank there was a delay of spawning as a result of of the above mentioned hydrological anomalies.

It should be also noted that 1974 survey started about 5 - 7 days earlier on particular areas as in previous years.

Both, number and mean length of larvae in ~~the~~ Nantucket Shoals and Georges Bank are lower than in previous years. There is nearly a lack of larvae over 10 mm length,

while the newly hatched larvae are concentrated over a small area with very low evidence of dispersion.

Comparison of abundance of herring larvae
during the r/v Wieczno surveys, 1972 - 1974.

A r e a	Investigation period	Number of larvae x 10^{-9}				
		$\leq$ 10mm	10-15 mm	15-20mm	$>$20mm	total
Nantucket Shoals /St. 1-30/	2.X.-7.X.1972	244	183	23	-	450
	30.IX.-7.X.1973	440	9,7	0,43	0	450
	27.IX.-1.X.1974	110,4	4,3	0	0	114,7
Georges Bank /St. 50-64 70-85 88-99/	11.X.-22.X.1972	158	245	85	-	489
	7.X.-17.X.1973	2300	530	95	5	2930
	3.X.-10.X.1974	1379,4	1,9	0,9	0	1382,4
Nova Scotia /St. 102-109 112-124/	23.X.-25.X.1972	9,2	54	75	-	138
	17.X.-20.X.1973	6,8	120	110	14	250
	11.X.-15.X.1974	195,6	1178,2	159,5	16,2	1549,6

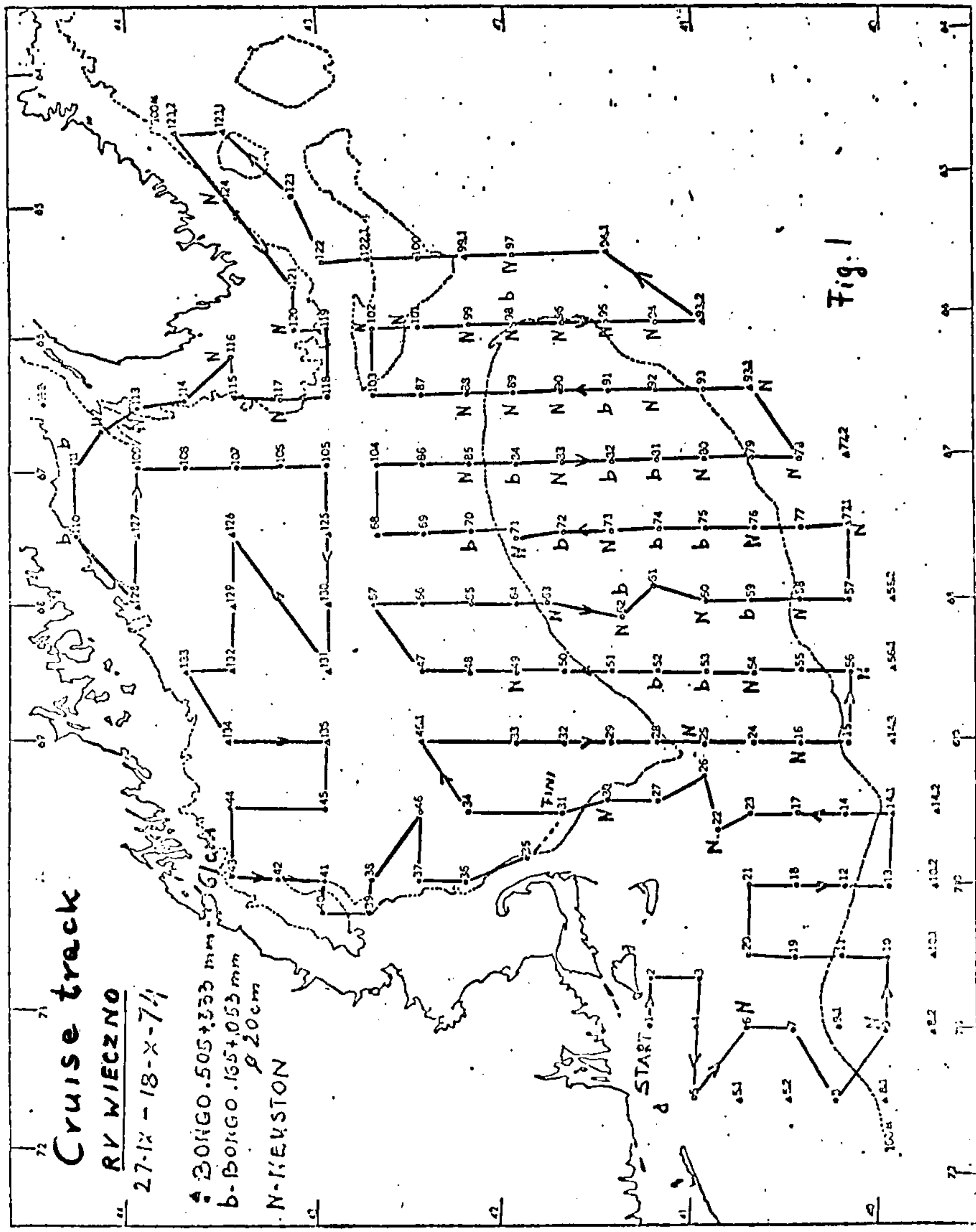
Cruise track
RV WIECZNO
27-IX - 18-X-74
BONGO .505+.333 mm
b - BONGO .165+.053 mm
ø 20 cm
N - NEUSTON
START
FINI

Fig. 1

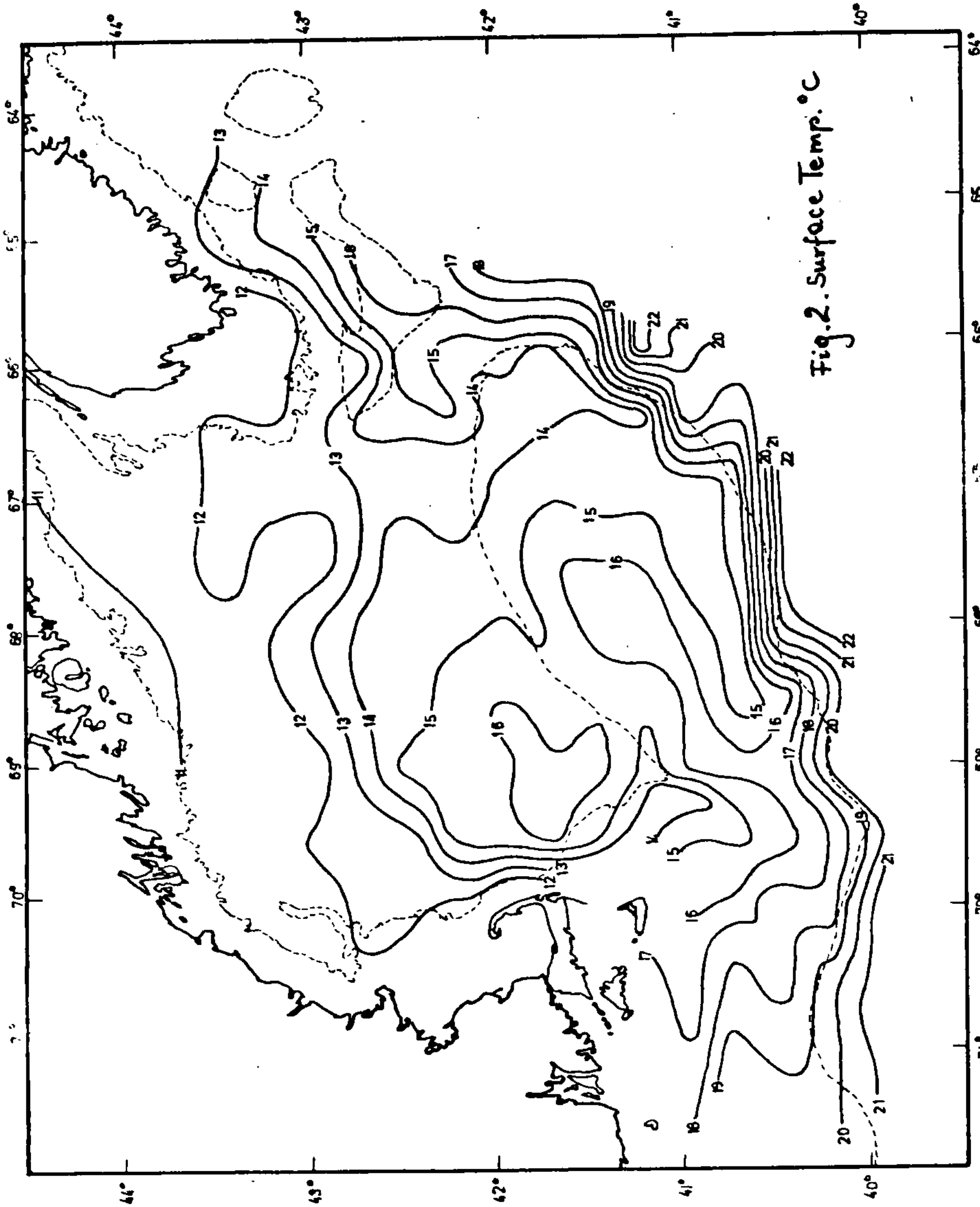

Fig. 2. Surface Temp. °C

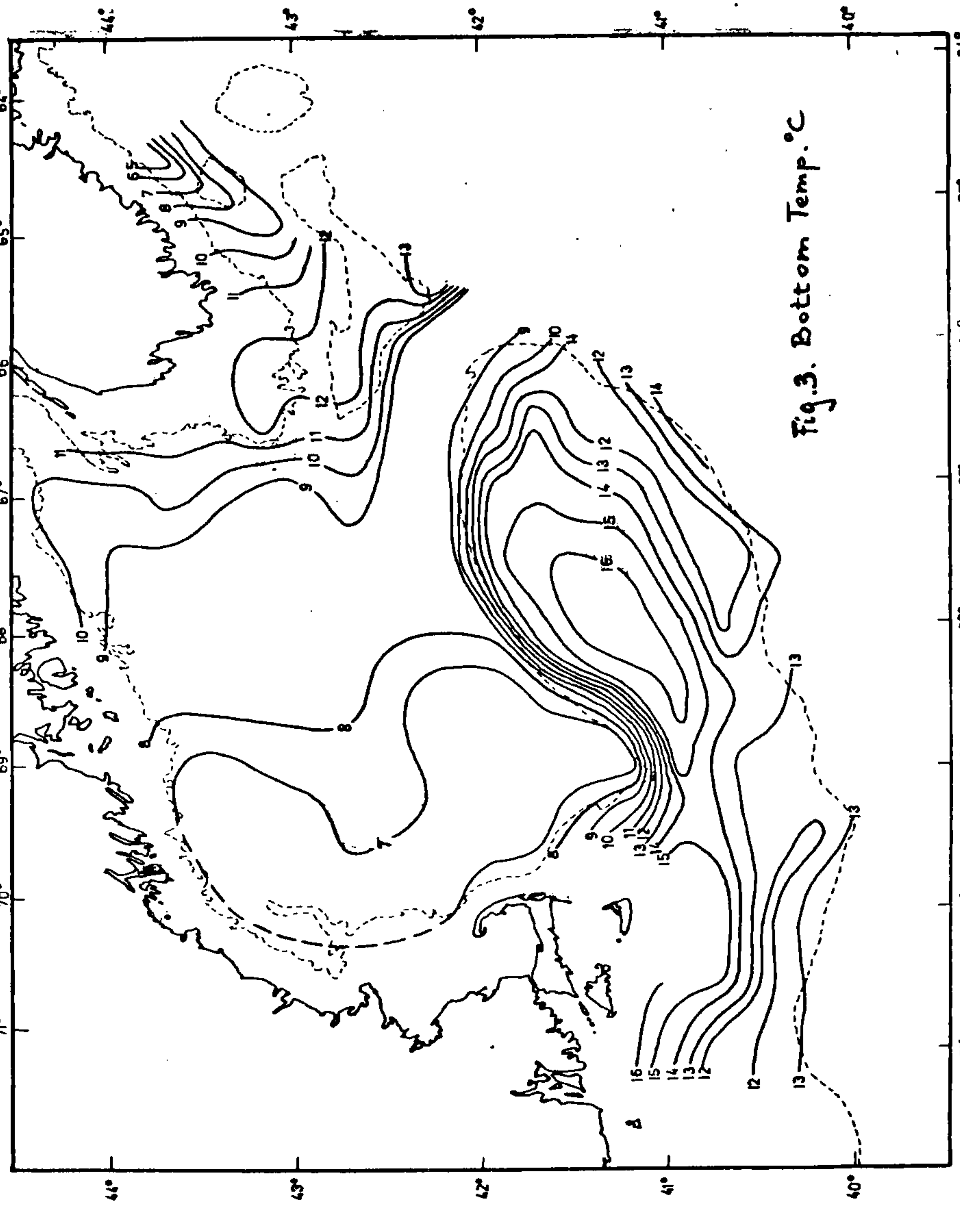

Fig. 3. Bottom Temp. °C

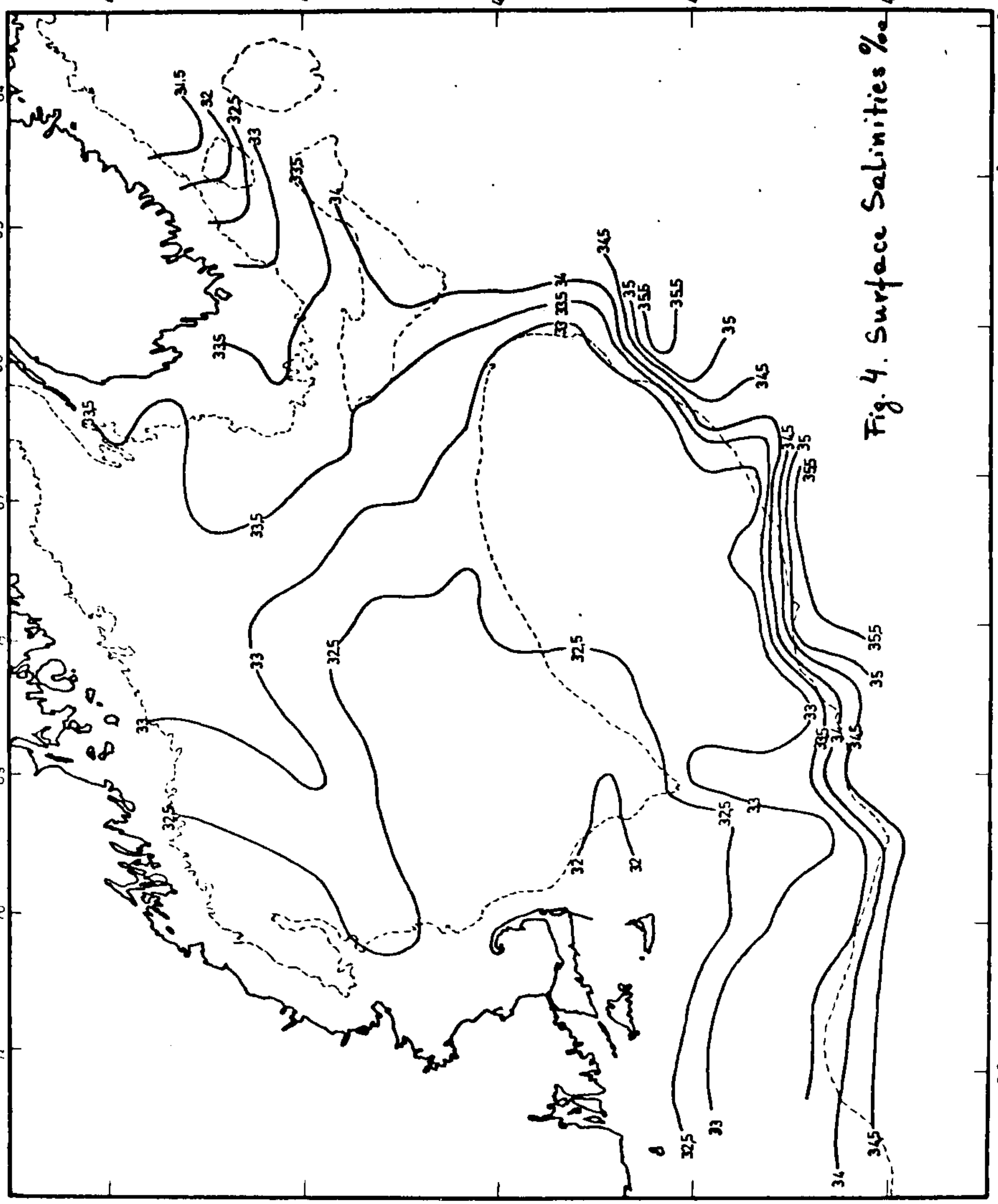

Fig. 4. Surface Salinities ‰

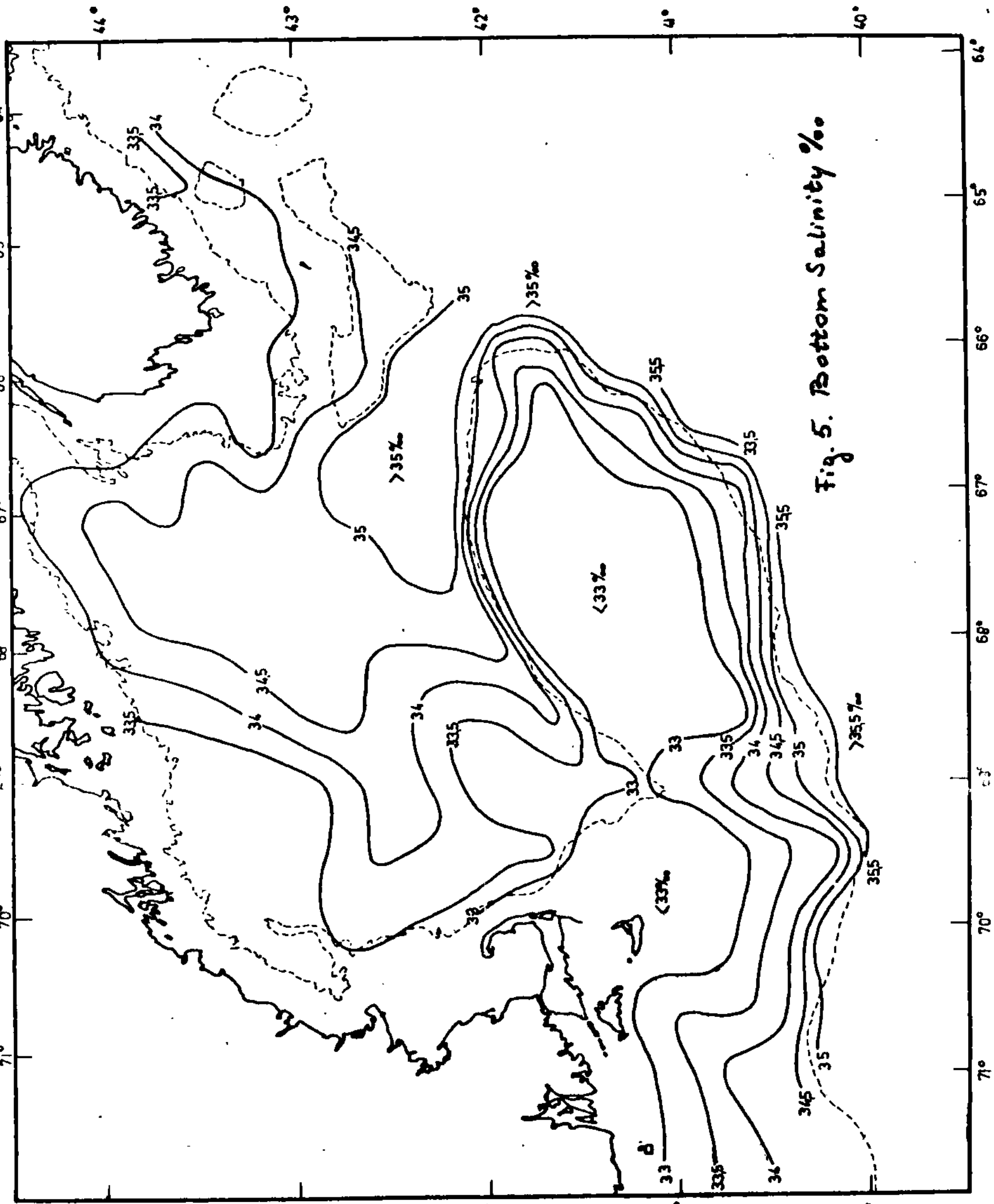

Fig. 5. Bottom Salinity ‰

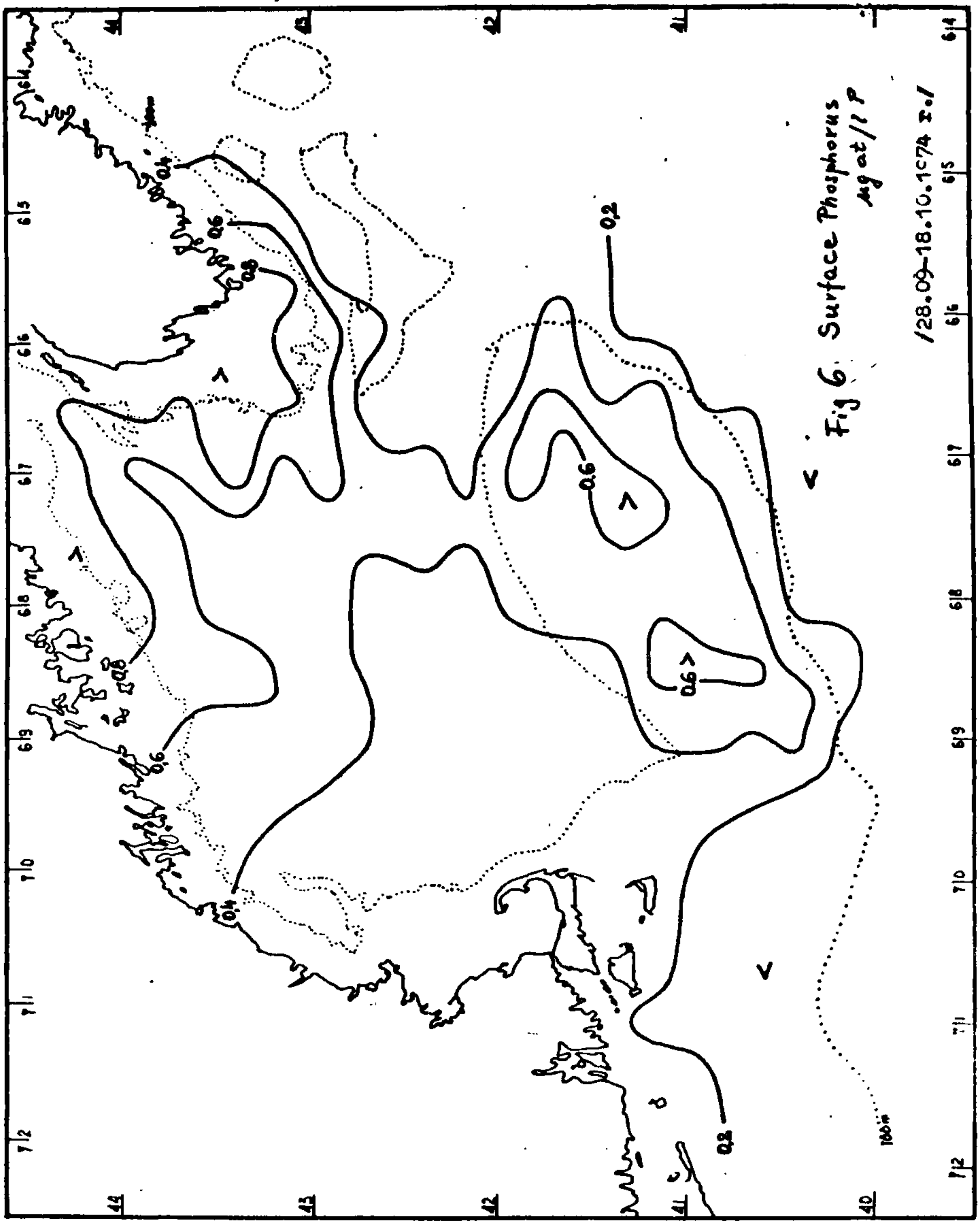
Fig 6 Surface Phosphorus
µg at/l P
28.09-18.10.1974

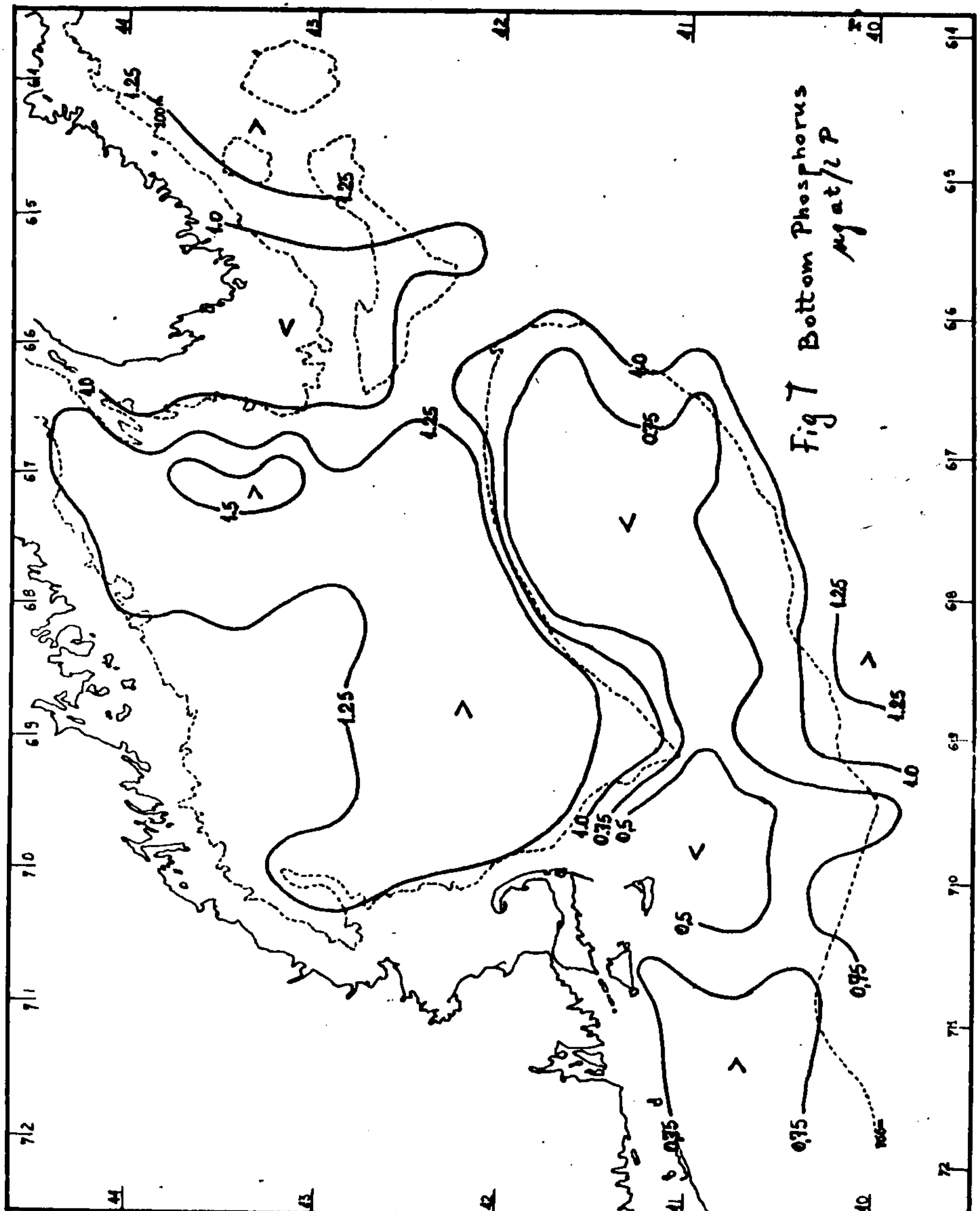

Fig 7 Bottom Phosphorus
μg at/l P

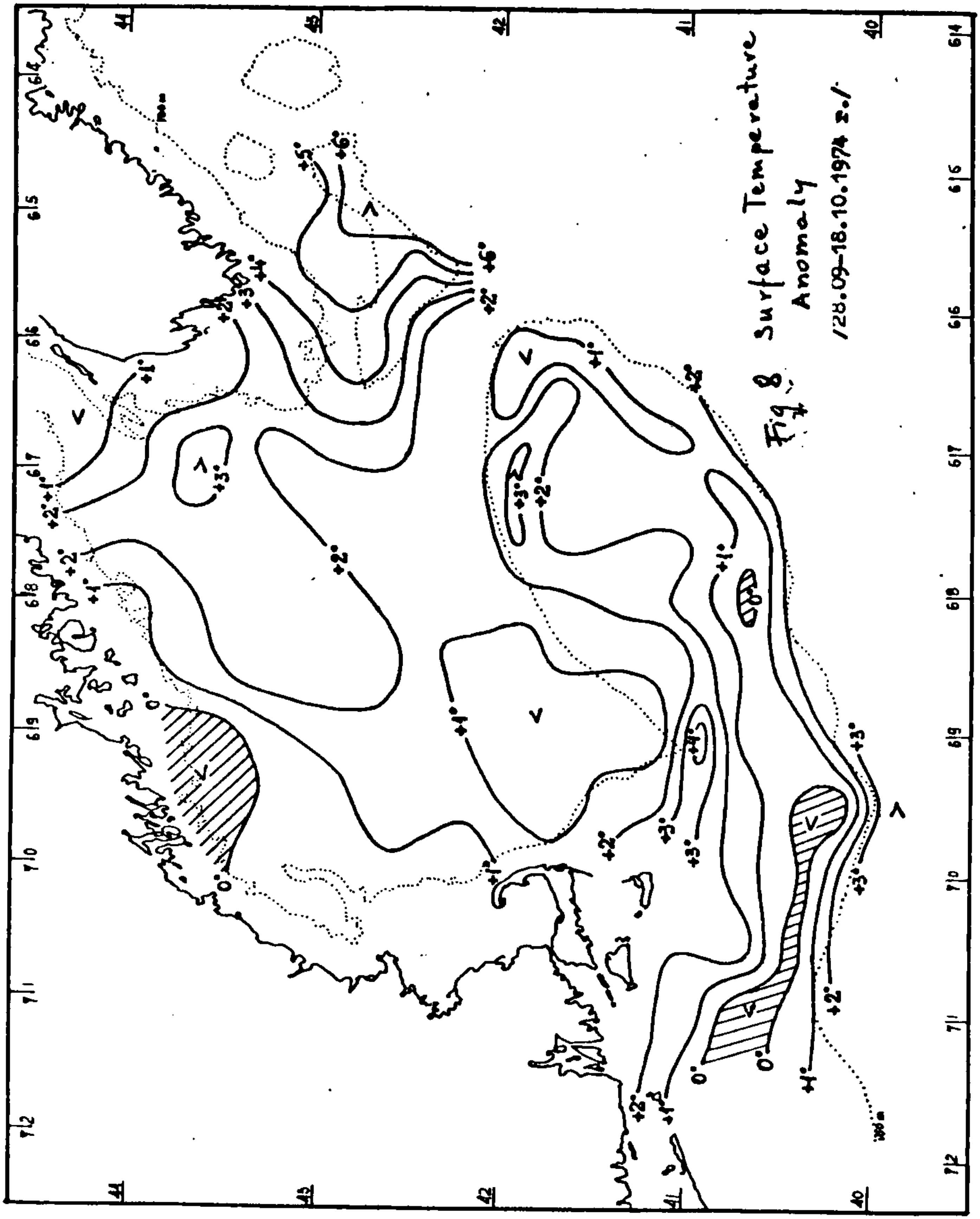

Fig 8 Surface Temperature Anomaly
/28.09-18.10.1974 z./

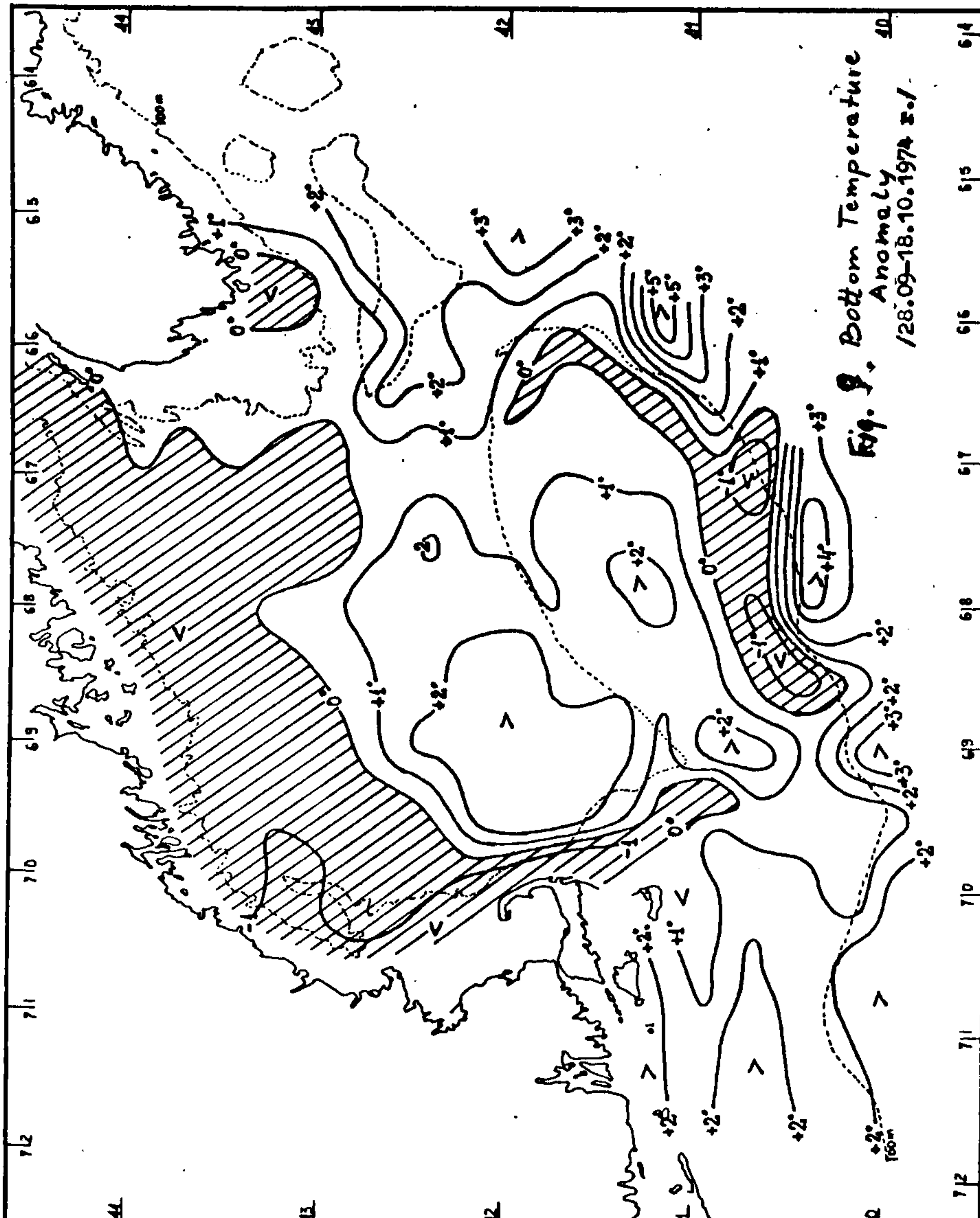

Fig. 9. Bottom Temperature Anomaly /28.09–18.10.1974 s./

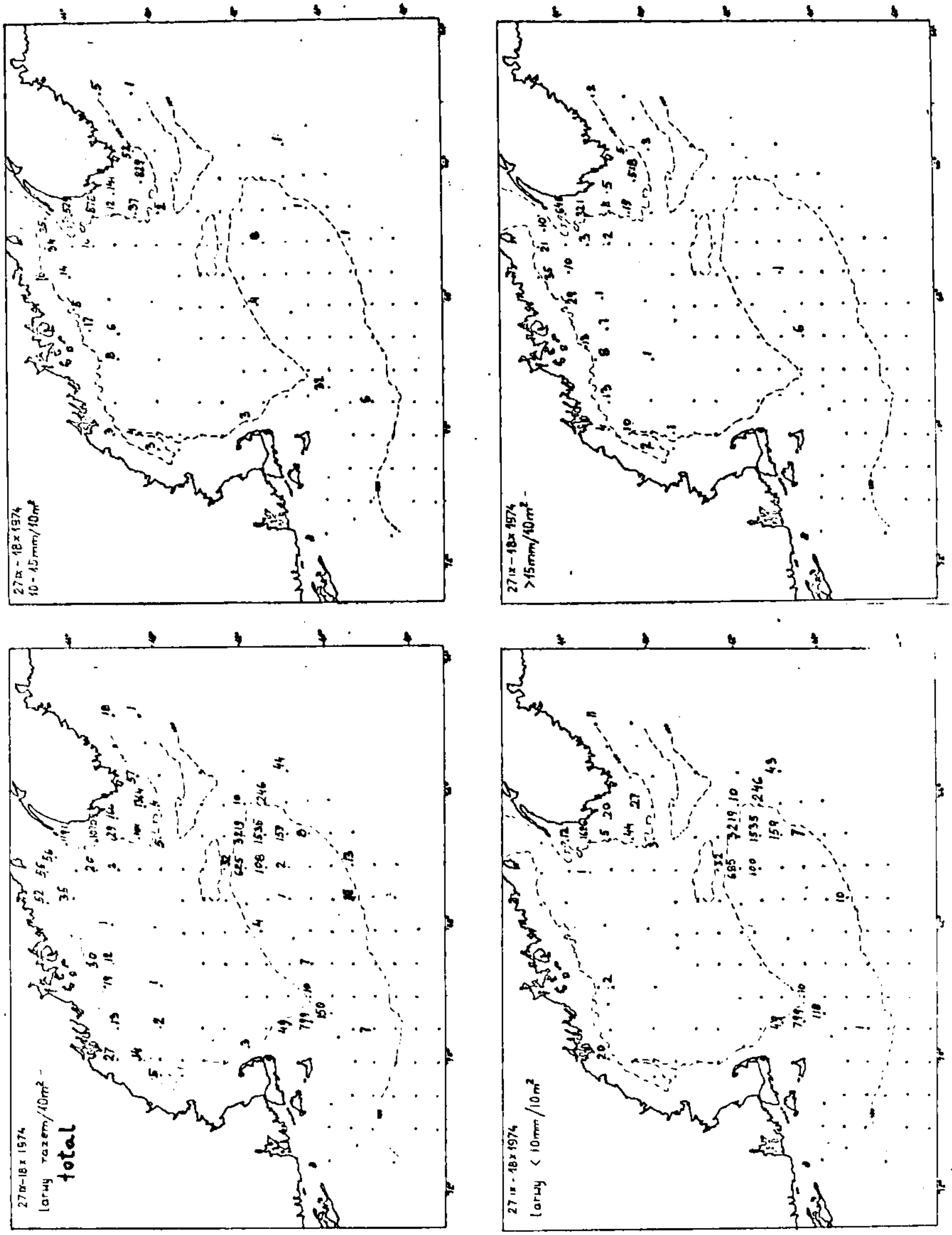

Fig. 10 Distribution of herring larvae during survey in 1974

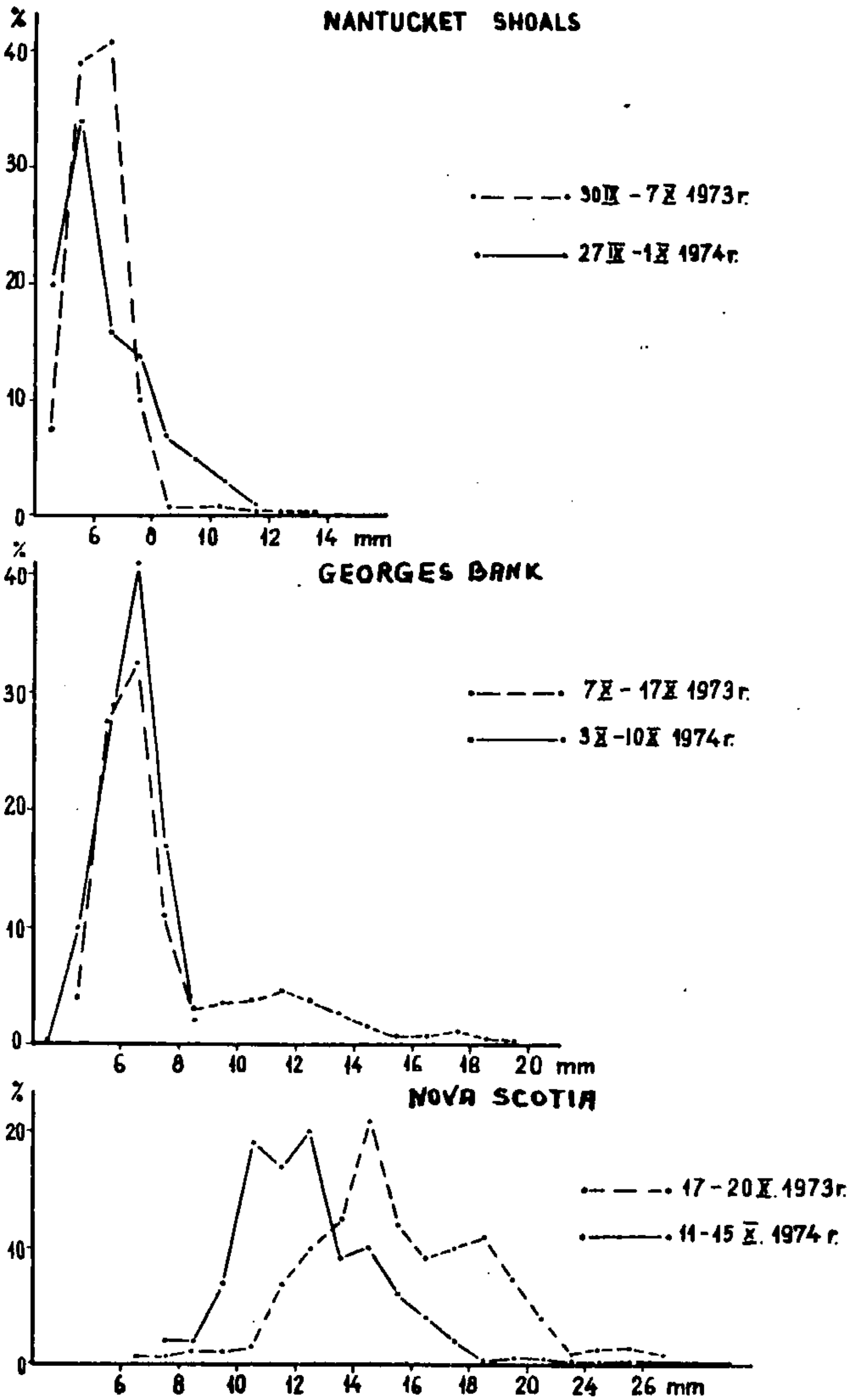

Fig. 11 Length frequency distribution 1973-1974

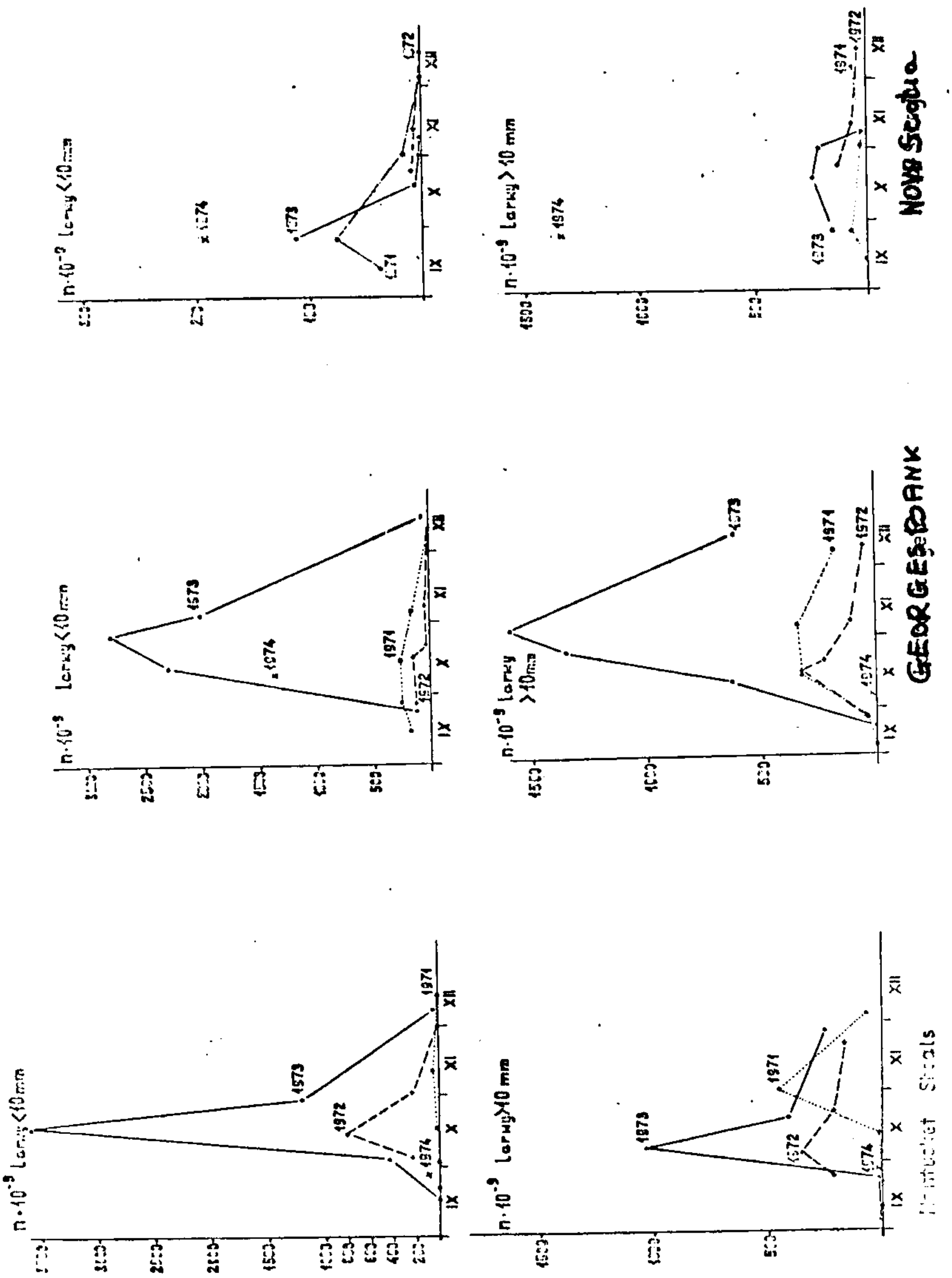

Fig. 12 Comparison of herring larvae abundance 1971-74