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Preliminary results of herring larvae survey on Georges Bank, 15 October-1 November 1973[1]

by

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ABSTRACT

In this paper are given the preliminary results of herring larvae survey in the Georges Bank area carried out by RTM *Belogorsk* (AtlantNIRO, Kaliningrad) from 15 October to 1 November 1973, according to ICNAF program accepted in 1971. The preliminary results indicate the higher spawning intensity in herring as compared with 1972 and better feeding conditions for larvae which developed under great influence of hydrometeorological factors.

INTRODUCTION

The survey carried out by RTM *Belogorsk* from 15 October to 1 November 1973 continued the series of investigations begun in 1971 according to ICNAF program on determination of herring spawning stock in the Georges Bank area based on larvae abundance and environmental factors.

The area from 40°N to 44°N and from 71°30'W to 65°W was covered (Fig. 1). A total of 119 stations were fulfilled. The stations 110, 111, 112, 116 were excluded as situated in the Canadian buffer zone. Station 120 was omitted because of bad weather conditions.

MATERIAL AND METHODS

Ichthyoplankton was sampled by oblique towing method using doubled Bongo plankton sampler with the mouth of 61 cm in diameter, at the ship velocity of 3.5 knots. The mesh-size of the nets used was 0.505 and 0.333 mm. The sampling was started as a rule, at the depth of 100 m or at any depth the station permitted, provided that the plankton sampler was towed 10 m above the bottom. The plankton sampler was shot at the velocity of 50 m/sec and lifted at the velocity of 8-10 m/sec.

The depth of plankton sampler towing was registered by Time-Depth-Recorder. The volume of filtered water was determined by means of a current meter.

Ichthyoplankton samples were selected and treated under the binocular microscope MBI-1. Total length of herring larvae was measured to within 1 mm. From the samples containing a large number of larvae, 100 randomly taken specimens were measured. To accelerate the sorting out procedure the Folsome divider was used.

Simultaneously, at the stations the samples of seston were collected, which was mainly represented by zooplankton. Seston was sampled by means of a smaller model of plankton sampler fixed on the wire 1 m above the larger model. The mesh-size of the net was 0.168 mm. Thus, a total of 119 seston samples were collected. Seston biomass is determined by volumetrical method using the Jashnov's device and followed by calculation under 1 m^2. According to calculated data a chart of seston biomass distribution was drawn.

Parallel to ichthyoplankton and seston sampling, water temperature and salinity measurements were obtained at every station by standard depth levels by Nansen bottles.

RESULTS OF THE SURVEY

Temperature and salinity. In Figs. 2-5 a distribution of temperature and salinity in the surface and pre-bottom layers during the survey is shown. The distribution of water temperature on the surface (Fig. 2) indicates the availability of a gradient zone along the southeastern and southern Georges Bank slopes which

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most probably resulted from advection of the Gulf Stream water. This undulating zone is most pronounced in 66°30'W-67°30'W area where the intensive inflow of the Gulf Stream water can be observed (Figs. 2 and 3). On the surface along the northern slopes of the Bank, another gradient zone is seen, however, in contrast to the southern one it is considerably weakened. Water temperature over the central part of the Bank is 14.2-15.0°C and the salinity lies within the range of 32.0-32.4‰ from the surface to the bottom (Figs. 2-5). The larger part of the Gulf of Maine is characterized by homogeneous temperature on the surface. To the southwest and to the south of Nova Scotia, a well pronounced zone occurs which is stipulated by merging of relatively cold (10.6-11.0°C) and salt (32.8-33.0‰) water of Labrador origin and warmer (11.1-11.7°C) but less salty (29.8-32.0‰) inshore water (Figs. 2 and 3). In general, the distribution of water temperature and salinity on the surface during the survey resulted from joint interaction of the Gulf Stream water advection and wind-driven mixing. It should be noted that in October the northern, eastern and southeastern winds prevailed with the mean velocity of 6.9 m/sec. It is likely that the joint effect of wind and advection had considerably influenced the distribution of plankton and larvae.

Plankton. On the chart of seston distribution (Fig. 6), three principal areas of high biomass (over 25 g/m^2) can be distinguished. The first area of maximum biomass reaching 85.2 g/cm^2 (owing mainly to salpas and phytoplankton) is situated southern of Cape Cod. The second one occupies the northern Gulf of Maine and the region southern of Nova Scotia which coincides with the gradient zone. Maximum biomass in the northern Gulf of Maine reached 50 g/m^2 and was mainly represented by Copepoda, while southern of Nova Scotia maximum biomass reached 1,266 g/m^2 owing to a great number of Ctenophora. The largest and most abundant in plankton is the Bank area proper, confined to a 100-m isobath. Copepoda represented a dominating group there. The southern border of the area in general repeats the undulating shape of the gradient zone noted above. Where the Gulf Stream water overflows the Bank, the plankton biomass is lower as compared with the areas of higher biomass due to weakened advection. The comparison of seston distribution (Fig. 6) predominated by zooplankton, with that of herring larvae (Fig. 7) indicates that the area of larvae spreading on Georges Bank and the area of high seston biomass coincide. In the points of the Gulf Stream inflow with relatively low seston biomass herring larvae are absent. From the above-mentioned it can be suggested that in 1973 herring larvae in Georges Bank appeared to be in rather favourable feeding conditions which had been formed under certain influence of hydrometeorological factors.

Herring larvae. In the present report, data on herring larvae caught by a 0.505-mm mesh-size net are given. A total of 60,087 larvae were caught during the survey as compared with 10,383 in 1972. A general pattern of larvae distribution is similar to that in October 1972, however, differs from it in abundance. At the stations southern of Cape Cod maximum larvae number in October 1973 reached 23,120 per hauling, while in 1972 it was 3,448 (Figs. 7 and 8). Length frequency ranged here from 5.3 to 12.8 mm at M = 7.44. Therefore, this region was spawning area of herring in 1973. In the northern Georges Bank the number of larvae caught was higher than at the same time in the previous year. Around the southern extremity of Nova Scotia at Station 113, 1,265 larvae were caught at M = 17.25 mm. Spawning in 1973 is characterized by higher intensity compared with 1972.

DISCUSSION

Judging from the survey results the spawning of herring on Georges Bank in 1973 proceeded more intensively than in 1972, which is confirmed by quantitative ratio in haulings for both years. The bulk of the larvae occurred within the Bank area confined to a 200-m isobath. Besides, this area appeared to be the most abundant in food plankton as compared with other observed areas. The southern border of plankton and larvae spreading coincides with configuration of the gradient zone stipulated by the Gulf Stream water advection. The northern border of spreading area was possibly affected by winds predominating during that time.

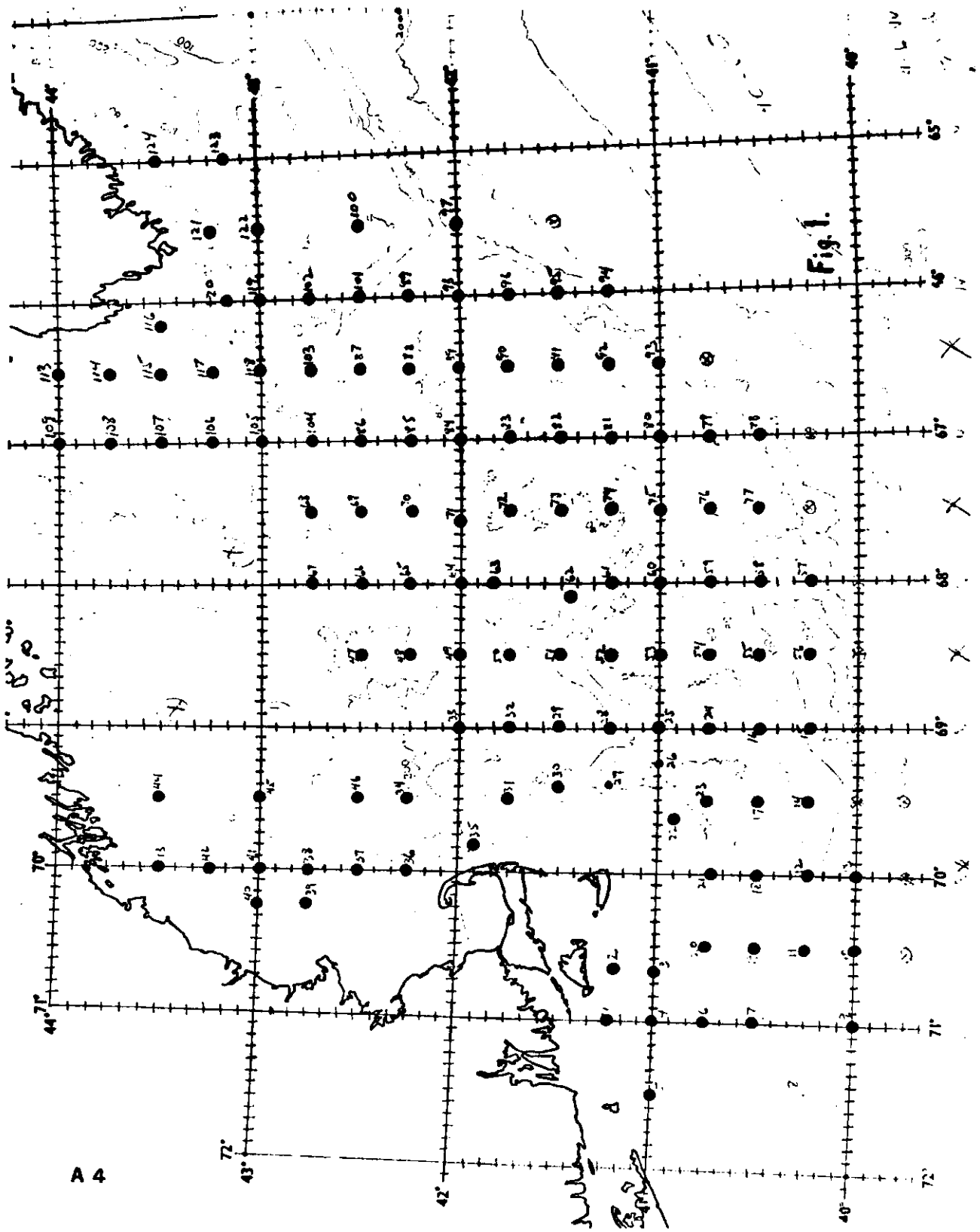

Fig. 1. The position of stations in October 1973.

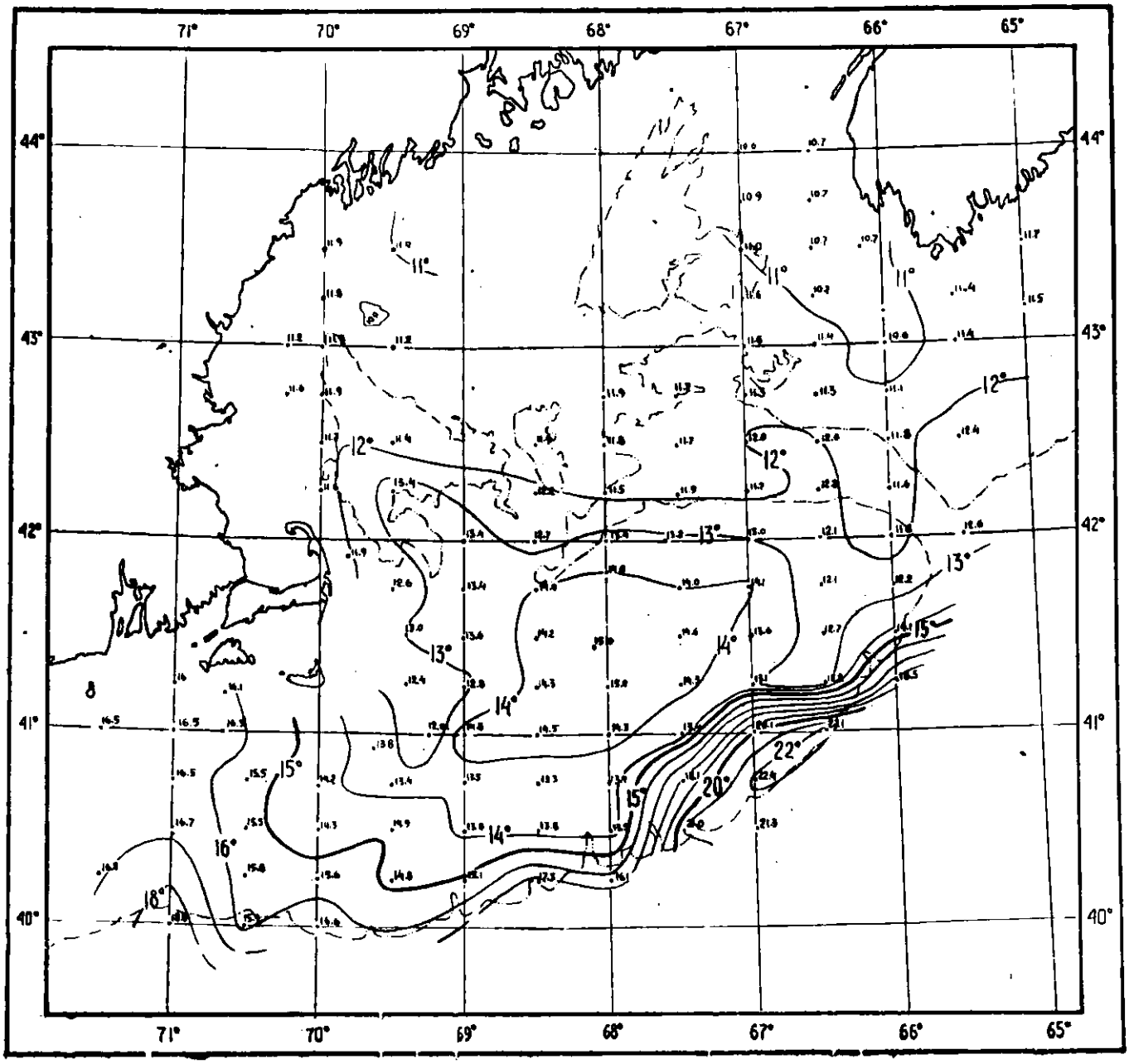

Fig. 2. Distribution of water temperature on the surface, 15 October - 1 November 1973.

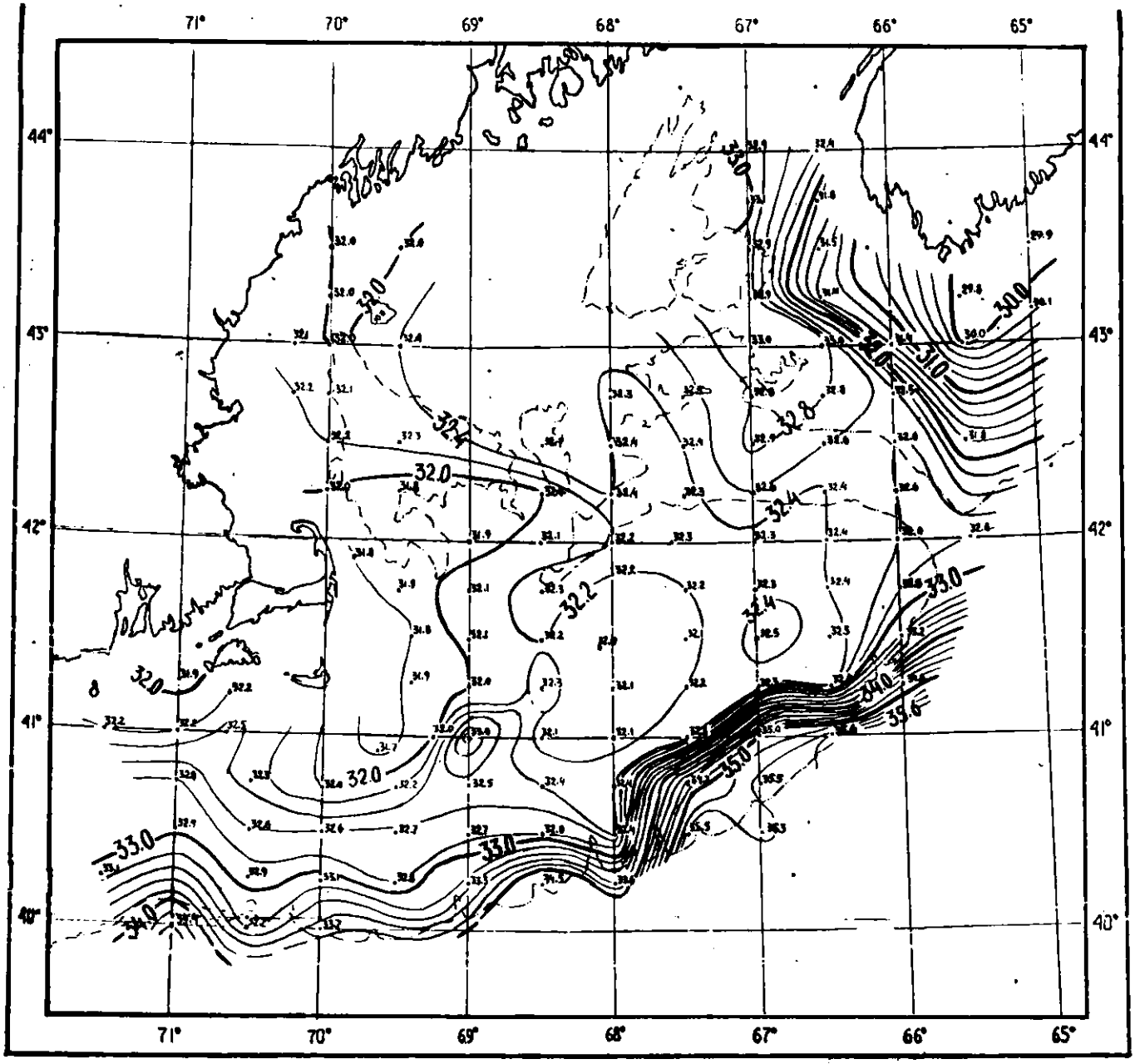

Fig. 3. Salinity distribution on the surface, 15 October - 1 november 1973.

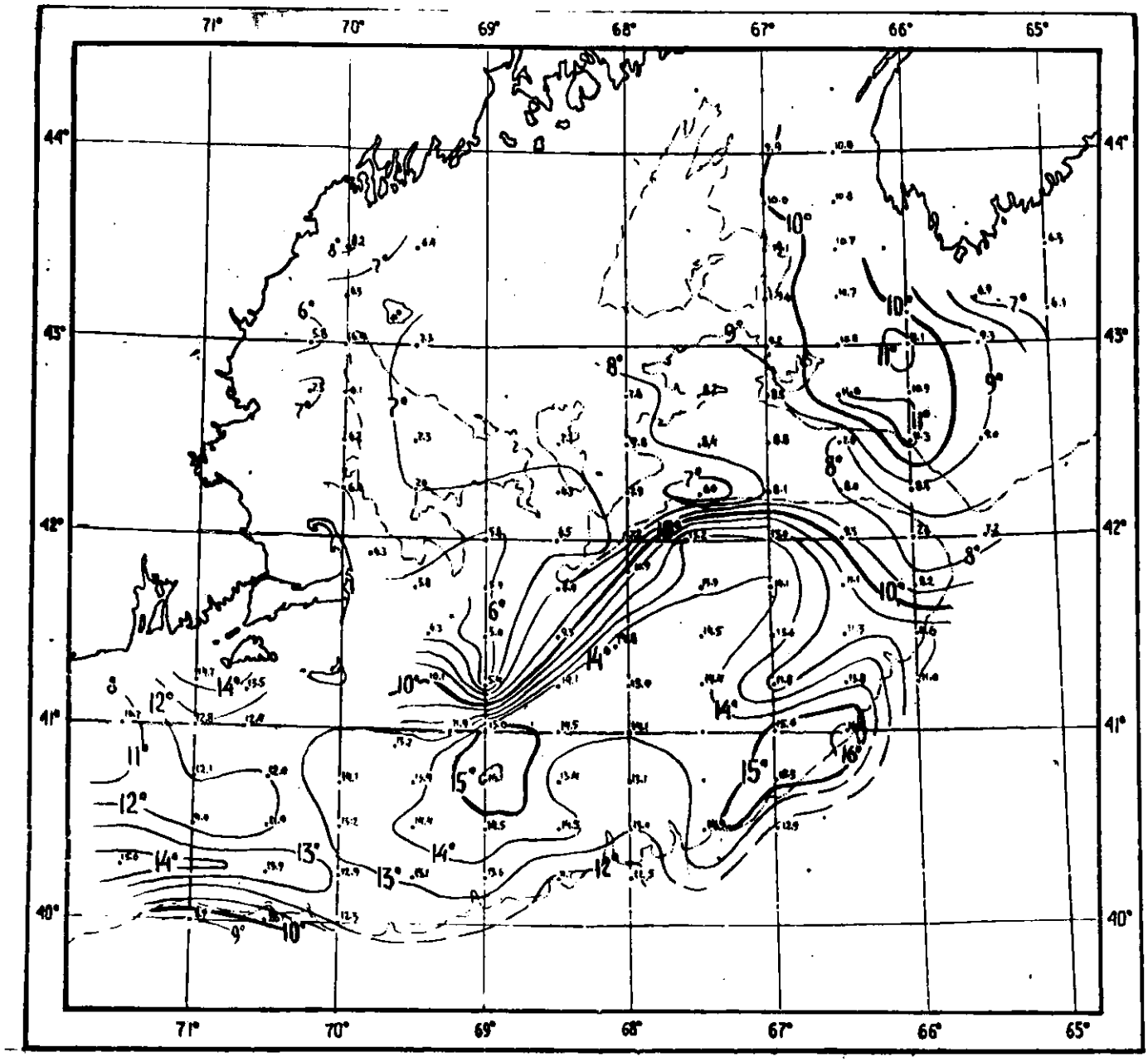

Fig. 4. Distribution of pre-bottom temperature, 15 October - 1 November 1973

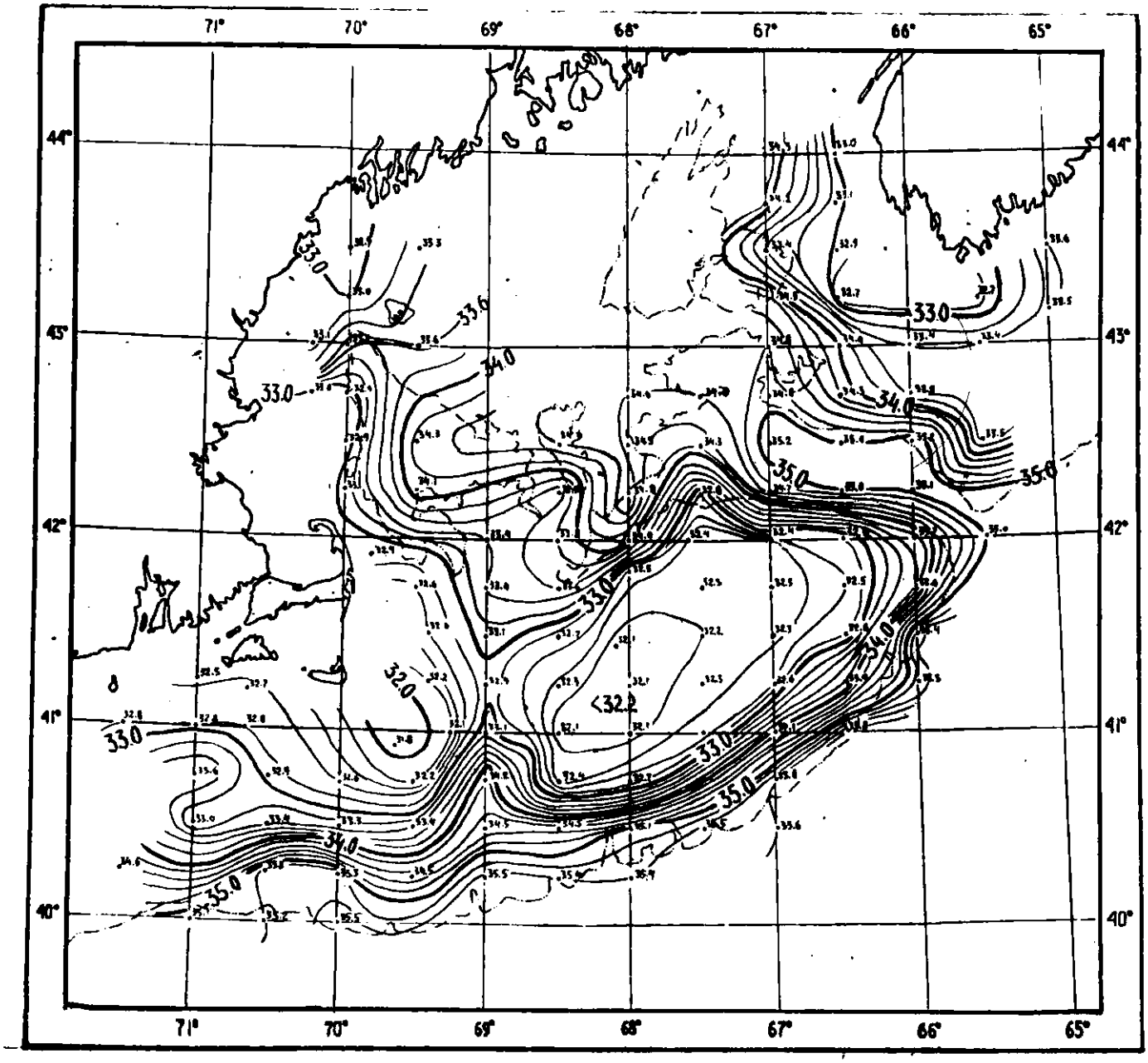

Fig. 5. Distribution of pre-bottom salinity, 15 October - 1 November 1973.

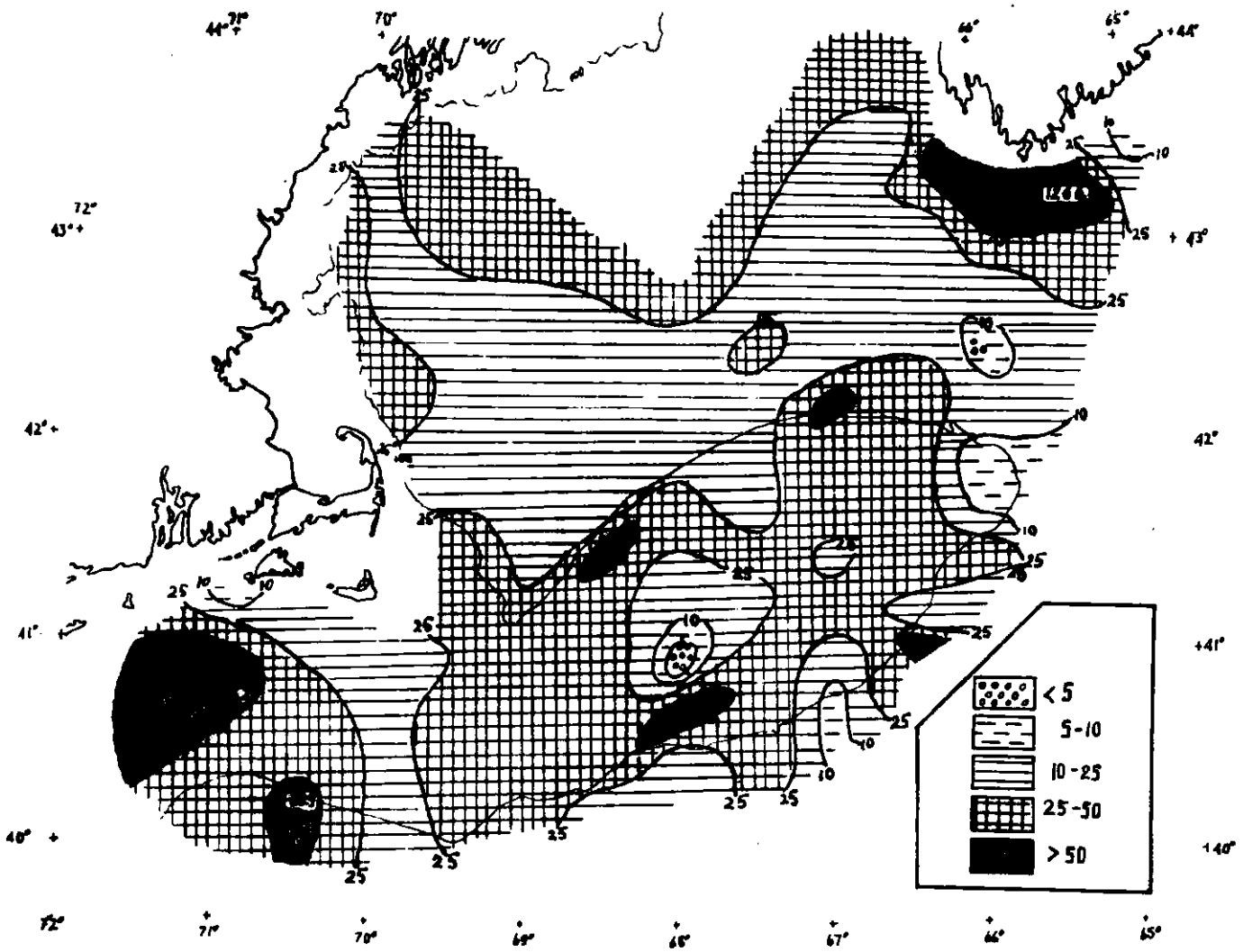

Fig. 6. Seston distribution, 15 October - 1 November 1973.

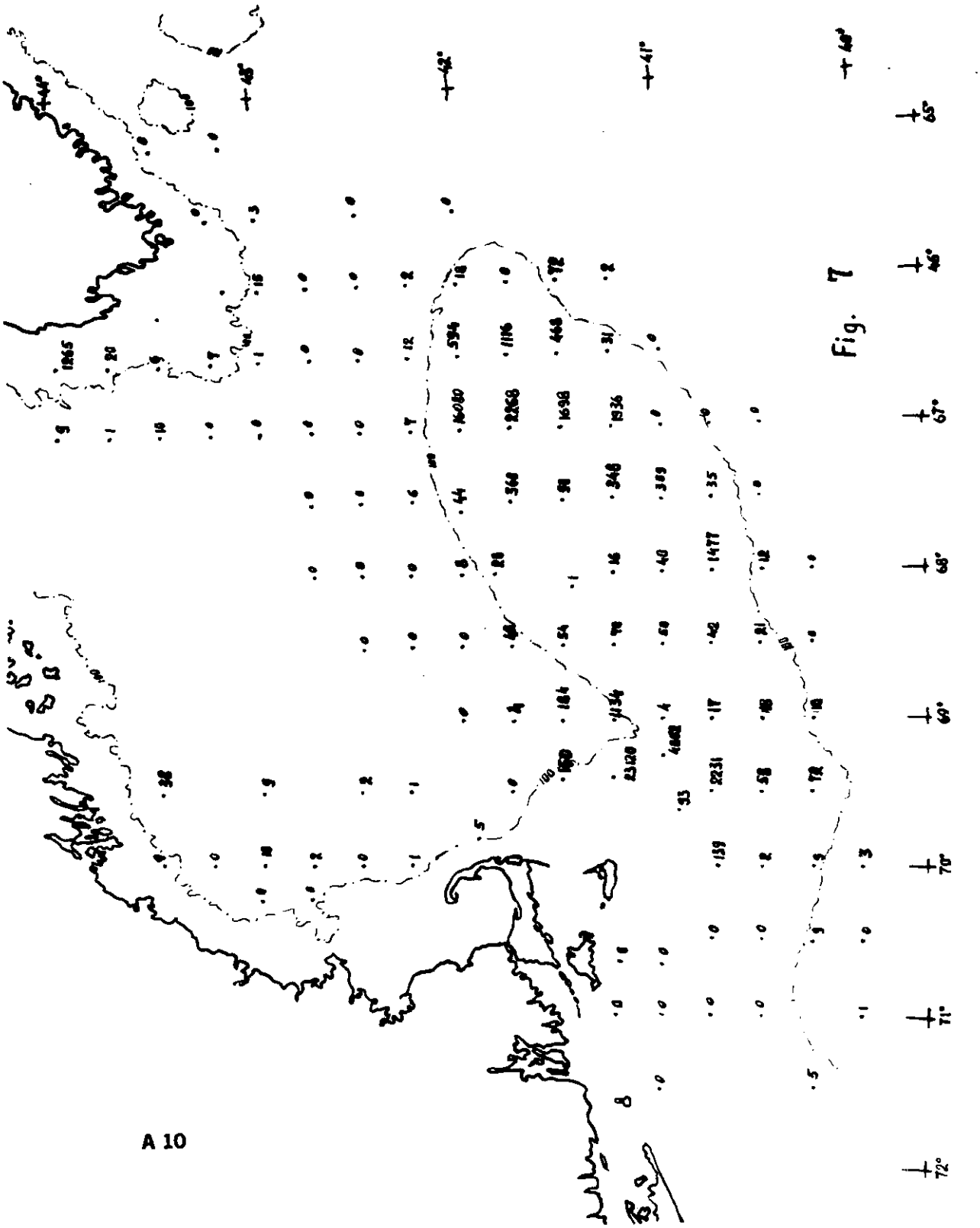

Fig. 7. Herring larvae distribution, 15 October - 1 November 1973.

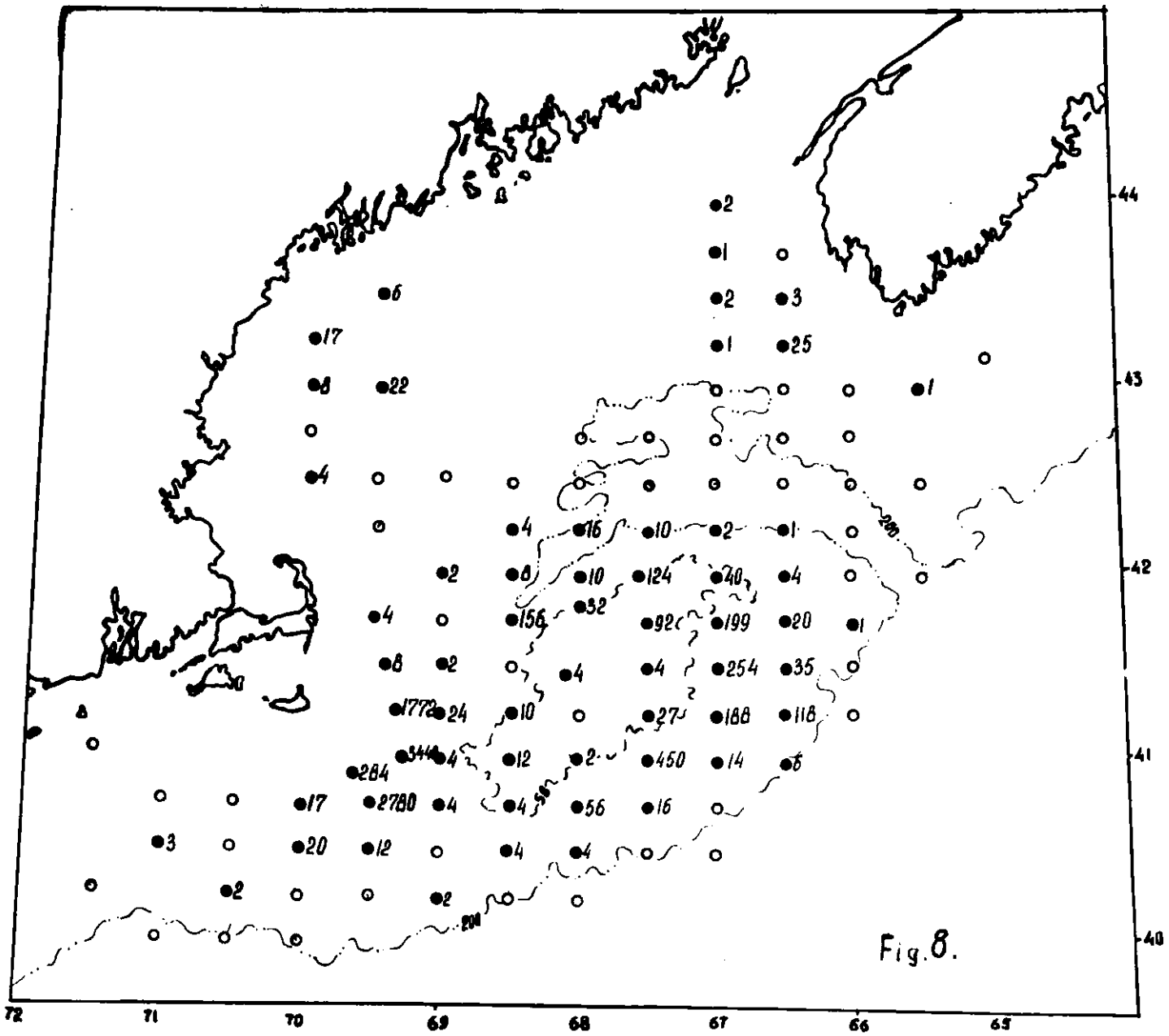

Fig. 8. Herring larvae distribution in October 1972.