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Yngelundersøkelser - 1985.

HAVFORSKNINGSINSTITUTTETS EGG- OG LARVEPROGRAM (HELP)

YNGELUNDERSØKELSER - 1985

av

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FORORD

Denne rapporten består av følgende tre delrapporter:

Undersøkelsene over sildelarver på Møre - Trøndelagskysten i mars-april og over fordelingen av fiskeyngel på norskekysten i mai ble begge startet opp i 1985. Disse har fra 1986 fortsatt under HELP. For at rapportserien fra disse undersøkelser skal være komplett er derfor året 1985 inkludert i HELP-rapportene.

HAVFORSKNINGSINSTITUTTETS EGG- OG LARVEPROGRAM (HELP)

HERRING LARVAE OFF WESTERN NORWAY IN APRIL 1985

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ABSTRACT

The recruitment to the Norwegian spring-spawning herring have during the last twenty years been on a very low level. However, the size of the spawning stock has increased in recent years and in 1983 a rich year class was produced. The increase of the stock as well as development of new gears and methods was the background for a new project to study the recruitment mechanisms. The present report presents some preliminary results from a pilot study in April 1985. It deals with the horizontal and vertical distribution of herring larvae in relation to physical conditions as well as growth and diet.

INTRODUCTION

During the sixties the Norwegian spring-spawning herring was reduced to a minimum. Except for 1983, the recruitment to this stock during the last twenty years has been on a very low level (TORESEN 1985). Only the year classes 1966, 1973, 1979 and 1984 may be rated slightly above the average if the 1983 year class is deleted. However, the size of the spawning stock of the Norwegian spring-spawning herring has gradually increased and in 1983 the stock produced a rich year class (RØTTINGEN 1984).

After 1959 the Norwegian spring-spawning herring have been spawning along the western coast of Norway north of 62^0N. The main spawning area is found between 62^0 and 65^0N at depths of 70-150 m. The spawning last for 4-6 weeks with a maximum intensity during the first part of March. The incubation time is 18-24 days depending on the actual temperature (DRAGESUND *et al.* 1980).

Sampling of herring larvae along the coast of Norway has been carried out for a long period (e.g. WIBORG 1960, DRAGESUND 1970, BJØRKE 1981). The increase of the stock in more recent years as well as the development of new gears and methods, actualized the formulation of a project to study survival and growth of herring larvae and thereby the recruitment mechanisms. Data on development of hatching, feeding conditions, predation and larval drift in relation to physical conditions will be collected. The following questions will be attempted answered during the project period:

1. Is the concept of a "critical larvae stage" valid?

2. Is the recruitment to the stock based on the whole larvae population or only on a specific part of it with a high survival rate?

3. Are the larval population split into a northern and southern component and if so, what is the driving mechanism?

4. Are there special retention areas for the larvae and how do these influence the survival rate?

5. What is the major factor governing the larval survival rate; predation, feeding conditions or environmental variability?

Among problems that arises from these general questions are the vertical distribution and migration of the herring larvae.

In 1986 the project on the Norwegian spring-spawning herring was included in a national program to study the consequences on fish eggs and larvae of oil exploration north of 62^0N (FØYN and BJØRKE 1986).

The present report gives some preliminary results from the investigation in 1985. This is regarded mainly a pilot study and a thoroughly discussion of the results is considered to be beyond the scope of this paper.

MATERIALS AND METHODS

The study was carried out during the period 10 - 18 April with the main survey during 10 - 16 April (Fig. 1). On each station herring larvae were sampled with modified conical nets of 0.5 m^2 opening and 375 µm mesh size (ELLERTSEN et al. 1984), from 150 m (or 5m above the bottom) to the surface, and the vertical hydrografic distributions observed by CTD casts. Two Argos satellite-tracked, drifting buoys were deployed (Fig. 1). These were equipped with a 9 m^2 window blind drogue attached to the buoys via a 30 m elastic nylon tetherline.

The herring larvae were preserved in 2% formaldehyd in 10%. sea water for morphometric measurements and gut content analysis. Because of gut content voidance in herring larvae during catching and fixation (HAY 1981, BLAXTER and HOLLIDAY 1963, ROSENTHAL 1969) only a qualitative analysis were performed with the gut content.

On board the ship, standard length (SL) measurements of up to 50 herring larvae per station were taken to the nearest mm below. In the laboratory a material of 1077 herring larvae was analysed. Up to 20 larvae from each station were staged according to DOYLE (1977). Larvae with standard length <10mm were measured to nearest 0.1mm below, while larger larvae were staged to the nearest 0.5mm below.

If food organisms could be recognized through the epithelium of the gut, they were dissected out and classified into one of the following groups, copepod egg, copepod nauplii or copepodite. No other prey organisms were found. The larvae were rinsed in fresh water, dried to constant weight and weighed on a Cahn electrobalance to the nearest µg.

The vertical distribution study was carried out during a 48 hours period near Buagrunnen 16-18 April 1986 (Location B,Fig.1). A drifting drouque was placed at 30 m depth in a larvae consentration. Sampling was done with a 1 m^2 Mocness sampler (WIEBE et al. 1976) with 20 m depth intervals starting at 160-140 m. Around 30 m^3 was filtered at each interval. Sampling was made each second hour. After 30 hours of sampling the number of larvae caught fell drastically, indicating a drift of the drouque away from the larvae consentration. Sampling was then continued at the point where the droque was released. Light measurements were made at the surface before each haul.

RESULTS AND DISCUSSION

Hydrography

The typical vertical hydrographic structure of the investigated area is shown in Fig. 2. The Coastal Water ($t^0 < 7$, $S < 35$) form a wedge above the underlying Atlantic Water. The bottom temperature was between 7.5^0 and 8^0C and the bottom salinity about 35.2 for the whole area. Surface temperatures and salinities were 4-6^{0}C and 32.5 - 34.0 respectively. There was a pycnocline between 30 and 50 m, seen in the distribution of temperature as well as in salinity. The bottom topography of the area is rather complicated and influence strongly the circulation pattern. One of the most conspicuous bathymetric features is the shallow bank of Buagrunnen (Fig. 6) with a minimum depth of about 50 m.

The temperature and salinity distribution in 30 m (Figs. 3 and 4) give some indications of the currents above the pycnocline. Coastal Water of temperature and salinity below 5^{0}C and 33.5 respectively, intrudes the area from southwest. This water seems to follow mainly the western edge of Buagrunnen. Northwest of this bank, water of Atlantic origin is penetrating eastward. There is indications of an anticyclonic circulation around Buagrunnen. Also in the salinity distribution in 100 m (Fig. 5) the intruding Atlantic Water north of Buagrunnen is clearly seen. This feature is therefore most likely a result of topographic steering of the current which during the winter/spring situation is reflected in the upper layer circulation. Close to the shore in the southern part of the area, a southward transport is indicated (Figs. 3 and 4).

Fig. 6 shows the track of the two Argosbuoys with the drogues in 30 m depth. Position is indicated for each five days period. The most near-shore buoy (dotted line) was drifting southward to about 61^{0}50'N, then west and northwest and entered the investigated area again around 20 May. It needed about 40 days to pass the investigation area. During 15 of these it was circulating over Buagrunnen. The more off-shore buoy (whole line) used approximately 20 days to pass the area. Both tracks indicate the anti-cyclonic movement around Buagrunnen and they leave the area close to the coast in the northern part. They both ended up in the Lofoten area around 67^{0}N after 90 and 112 days.

Horizontal larvae distribution

The horizontal distribution of herring larvae of four different length groups is shown in Figs. 7-10. The distribution of the youngest larvae (< 9 mm) clearly indicate two separated spawning areas; Buagrunnen and Runde (Fig. 7). From the Runde area, most of the larvae are drifting northwards. A minor part, however, seems to be drifting toward the south. This southward drift is also indicated on the distribution of larger larvae (Figs. 8 and 9) and is in accordance with the drift of the most near-shore Argos buoy (Fig. 6). The drainage of the youngest larvae from Buagrunnen (Fig. 7) is following closely the route of the Argos buoys (Fig. 6).

For the older larvae the horizontal distributions get more complex and the patchiness increase (Figs. 8 - 10). However, it seems possible to deduce the following drift pattern for the herring larvae:

Most of the larvae from the Runde area are drifting northwards around the western edge of Buagrunnen. Here they merge with the drift from this spawning area, flow eastward and northwards along the coast. The more western distribution of the older larva in the northernmost area (Figs. 8-10) is probably due to an offshore movement of the Coastal Water. This is indicated in Fig. 4 as well as by the Argos drifters just north of $63^0 30'$N.

The amount of newly hatched larvae is much higher at Buagrunnen than at the Runde area (Fig. 7). For the older larvae, however, no such feature is evident (Figs. 8-10). This observation invites to several interpretations. It can be a result of differences in spawning time and intensity as well as increased mortality of the larvae from Buagrunnen. The available data offer no preferable explanation.

During the survey, a 38kHz echosounder coupled to an echo integrator was used. Fig. 11 shows the distribution of the echo abundance classified as plankton. As can be seen, the maximum values are found in the same areas as where the spawning took place (Fig. 7). Most likely, this is not recordings of larvae as these at this stage of development do not have swim-bladder (BLAXTER _et al._ 1981). More probably, it is concentrations of zooplankton like krill and _Calanus finmarchicus._ Further study of the plankton samples from the vertical net haul and comparison of these with the plankton echo recordings may elucidate this question.

Vertical larvae distribution

DRAGESUND (1970) found that the larvae of Norwegian spring-spawning herring soon after hatching rose into the upper water layers (50-0m) and were scarce in the depth range 50 to 70m. This was partly in correspondance with earlier findings (DRAGESUND and WIBORG 1963, DRAGESUND 1965, DRAGESUND and HOGNESTAD 1966). Based on these studies the procedure established during previous annual herring larvae surveys was continued, during which only the upper 75 m were sampled. None of these experiments, however, included depths of more than 80m. In 1976 a Gulf III sampler (ZIJLSTRA 1970) was introdused and the sampling took place in the upper 60m.

SELIVERSTOV (1974) found that the larvae of the Norwegian spring-spawning herring could reach an amplitude of diurnal vertical migration of 75-100m. He also found newly hatched larvae of depths of 200m.

Fig.12 shows the vertical distribution of different length groups of herring larvae during a 48-hours sampling period. Few larvae <9 mm were caught and this length group is omitted in the figure. The daytime larvae were caught between 0900 and 1500 hour and the nighttime larvae between 2100 and 0200 hour. Fig. 12 seems to indicate a downward extention of the vertical distribution of all the three length groups. This is not in correspondance with observations made by DRAGESUND (1970) who found that larvae were most abundant in the upper 20 m by night and between 20 an 40 m by day.

Fig.13 shows the percentage distribution of all herring larvae during a 48-hour period, under varying light conditions. No clear migration pattern is evident. The highest concentrasions of larvae were found between 20 and 80 m, and less than 5 % were found below 120 m.

Fig.14 shows the mean vertical distribution of all larvae during the

48-hour period, in addition to salinity and temperature.The highest abundance of larvae were found in the middle of the pycnocline. More than 65 % of the herring larvae were caught in the upper 60 m, while 20 % were caught below 70 m. This means that if herring larvae are to be caught quantitatively the sampling depth must be extended down to at least 150 m.

It should be stressed that these results are preliminary and that further investigations are necessary before any valid conclusions can be made concerning the vertical distribution and migration of herring larvae.

Condition of the larvae

The material consists of 1077 herring larvae of standard length 8-18 mm. A length (SL)/dry weight plot is shown in fig.15.There is a strict relationship between the length (SL) and the dry weight with a exponential correlation coefficient of r^2=0.81. There seem to be very few "runts" in the population and most of the larvae are growing at a steady rate from yolk-sac resorption, corresponding to a mean standard length of 10.3 mm.

The larvae material was staged according to DOYLE (1977). The standard length,dry weight and number of larvae in each stage are shown in Table 1. If all larvae are growing at the same rate, DOYLE's morphometric criteria can be used as an index of age. The following indications of constant growth was seen in the present material

- a strong correlation in the length/weight relationship.
- little standard deviation in dry weight of the larvae resorbing the yolk-sac.

To verify that the growth rate is constant, time consuming daily increment counting is necessary.

Table 1. The mean standard length and dry weight of the larvae in the different stages.

	Mean length		Mean dry weight		
Stage	SL(mm)	SD	DW(μg)	SD	N
1 a	8.2	0.9	144	35	62
1 b	9.0	0.7	120	27	118
1 c	10.2	1.1	135	34	87
1 d	10.3	1.2	142	38	193
2 a	13.0	1.2	248	71	632
2 b	16.4	0.9	486	91	45
2 c	17.0	-	700	-	1

The length frequency distribution of the larvae in the different stages is given in in Fig.16. This figure gives additional information of a larval population in growth.

Laboratory experiments with larvae of Norwegian spring spawning herring were performed in Fløcdevigen, to calibrate DOYLE'S results. (MOKSNESS,pers comm.). A size hierarchy was present in the lab experiments, and there was some overlap between the stages > 1d. The mean duration of the larval substages 1a - 2b after DOYLE(1977),MOKSNESS(pers comm.),ØIESTAD(1983) and MAC LACHLAN et al. (1981) are presented in Table 2.

Table 2. The mean duration of the different substages, (MOKSNESS,pers comm.,DOYLE 1977,ØIESTAD 1983 and MAC LACHLAN et al.1981).

Stage 1a	Stage 1b	Stage 1c	Stage 1d	Stage 2a	Stage 2b
3 days	4 days	3 days	2 days	11 days	5 days

In Fig. 17, the diet of the herring larvae in the substages 1a-2b corresponding to a age of 0-28 days post hatching (Table 2) is shown. The dominant prey organism in number in all size groups of larvae was copepod nauplii and this prey organism constituted 90% of the gut content of the herring larvae investigated. The youngest larvae found with gut content were in the age group 4-7 days old. In the gut of these larvae a few copepod eggs and copepod nauplii were found, and the relative importance of copepod eggs as food items was higher than in older larvae. The highest number of copepod eggs was found in 8- 10 days old larvae. The importance of copepod eggs as a food item decreased in larvae older than 10 days, when the yolk-sac was resorbed.

The highest number of copepod nauplii was found in larvae between 11-23 days old, later on this food item will be replaced by copepodites.

Copepodites are sporadically found in the larval guts from 9 days of age, but they are of minor importance until the larvae are about one month old, and larger than 15 mm (SL).

BJØRKE (1978) found a high percentage of copepod eggs in the diet of young larvae. His conclusion was that a large amount of copepod eggs in the gut of the herring larvae could be an expression of mismatch between the first feeding of herring larvae and of their prey. The present material with its high impact of copepod nauplii can be seen as an expression of successful first feeding.

From the mean length and stage duration data, Table 1+2, the growth rate can be calculated. A mean growth rate of 0.36 mm d^{-1} in the period of 1-25 days post hatching was found. The growth rate in the yolk-sac period is somewhat slower with 0.23 mm d^{-1}, and the growth in the post yolksac period 0.42 mm d^{-1}. This results is in accordance with previous results based on the same stock (DRAGESUND and NAKKEN 1973), and results with larvae from other stocks (LOUGH et al. 1982, WOOD and BURD 1976). CHRISTENSEN (1985) reviewed information about field studies on growth rates of North Sea herring. These ranged from 0.16-0.35 mm d^{-1}.

Dry weight can be fitted to the exponential growth equation to estimate the specific growth rate (SGR), k , of the larvae (WARREN 1971).

$$W_2 = W_1 . e^{k(t_2 - t_1)}$$

W_2 = dry weight at time 2
W_1 = dry weight at time 1
t_1 = time 1/ days
t_2 = time 2/ days

The spesific growth rate from day 5 post hatching, when the larvae had the lowest dry weigth, to day 25 was found to be 6.8%. This is an underestimate because of the shrinkage in dry weight due to preservation, but in accordance with the theoretical values calculated by BEYER and LAURENCE(1979) on first feeding herring larvae.

A mixture of larvae from the two spawning components is present at Buagrunnen, while the larval population outside Runde (Fig. 1.) comes from the southern spawning stock. Length /dry weight plots from the larval population in these two areas are shown in Fig.18. No growth differences can be seen between the mixture of larvae and larvae from the southern stock components.

CONCLUSIONS

The circulation pattern of the investigated area seem to be highly influenced by the bottom topography.

The drift of the larvae is in reasonable accordance with the circulation pattern deduced by hydrography and Argos drifters.

If herring larvae are to be caught quantitatively the sampling volume must a least include the upper 160 m. No clear vertical migration pattern was evident during changing light conditions. The highest abundance of larvae was found in the middle of the pycnocline.

The vertical distribution of three length groups, 9-10 mm, 11-12 mm and >13 mm indicated a downward extension during nighttime.

4-7 days old larvae were found with gut content, and the herring larvae had recovered their hatching weight at yolk resorption.

The larval diet was dominated of copepod nauplii; copepod eggs were found in the smallest larvae and copepodites in the larger ones.

A daily growth rate of 0.36 mm and a spesific growth rate of 6.8 % were calculated.

No growth differences was observed between the larvae from the southern and northern stock component.

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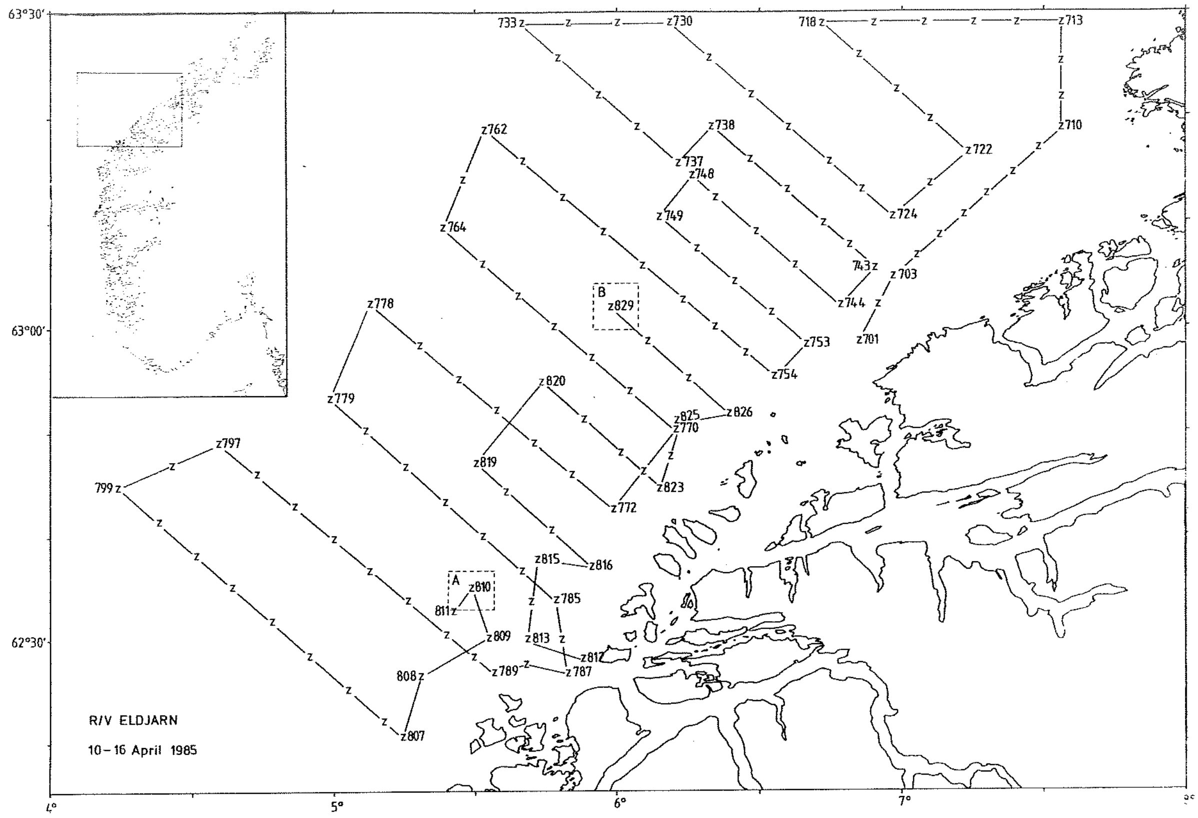

Fig. 1. Investigated area and grid of stations.

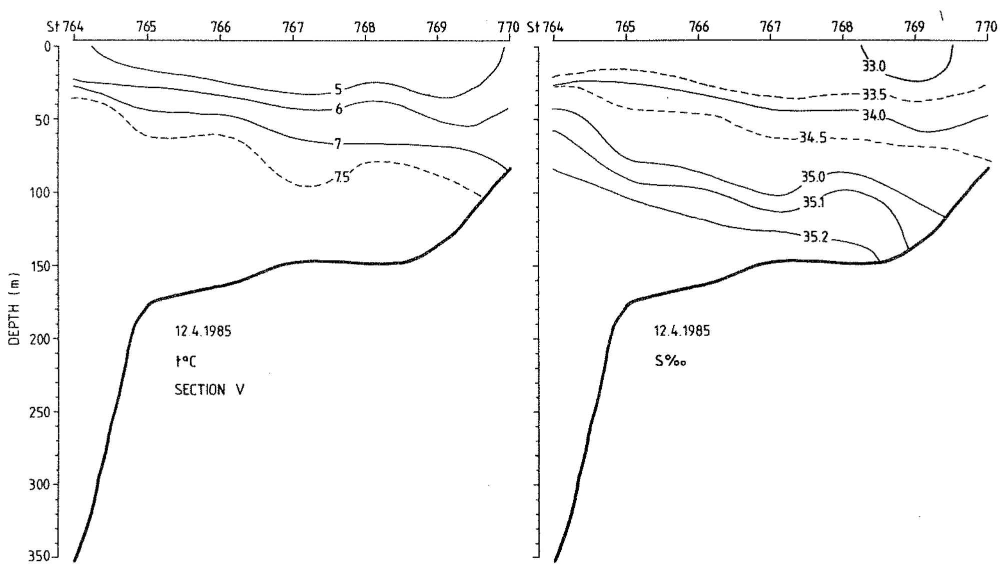

Fig. 2. Vertical distribution of temperature and salinity in the central part of the area.

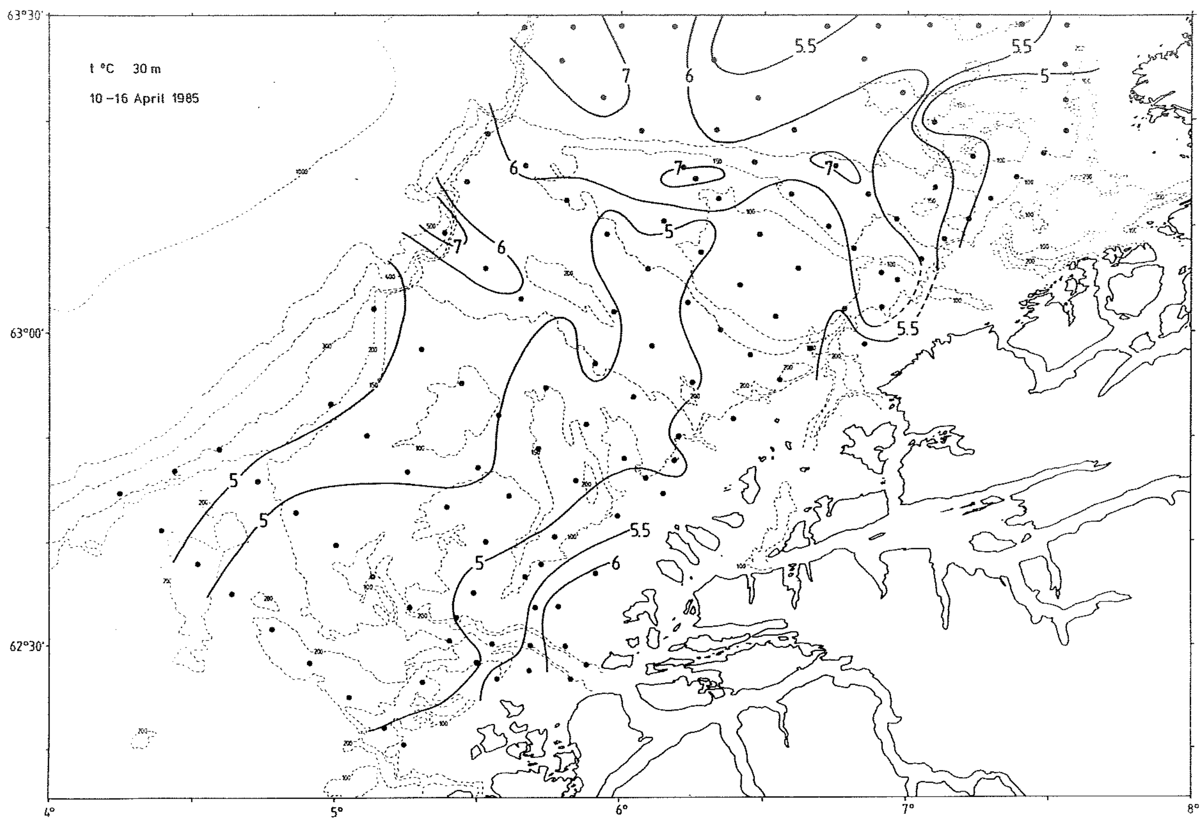

Fig. 3. Distribution of temperature in 30 m depth.

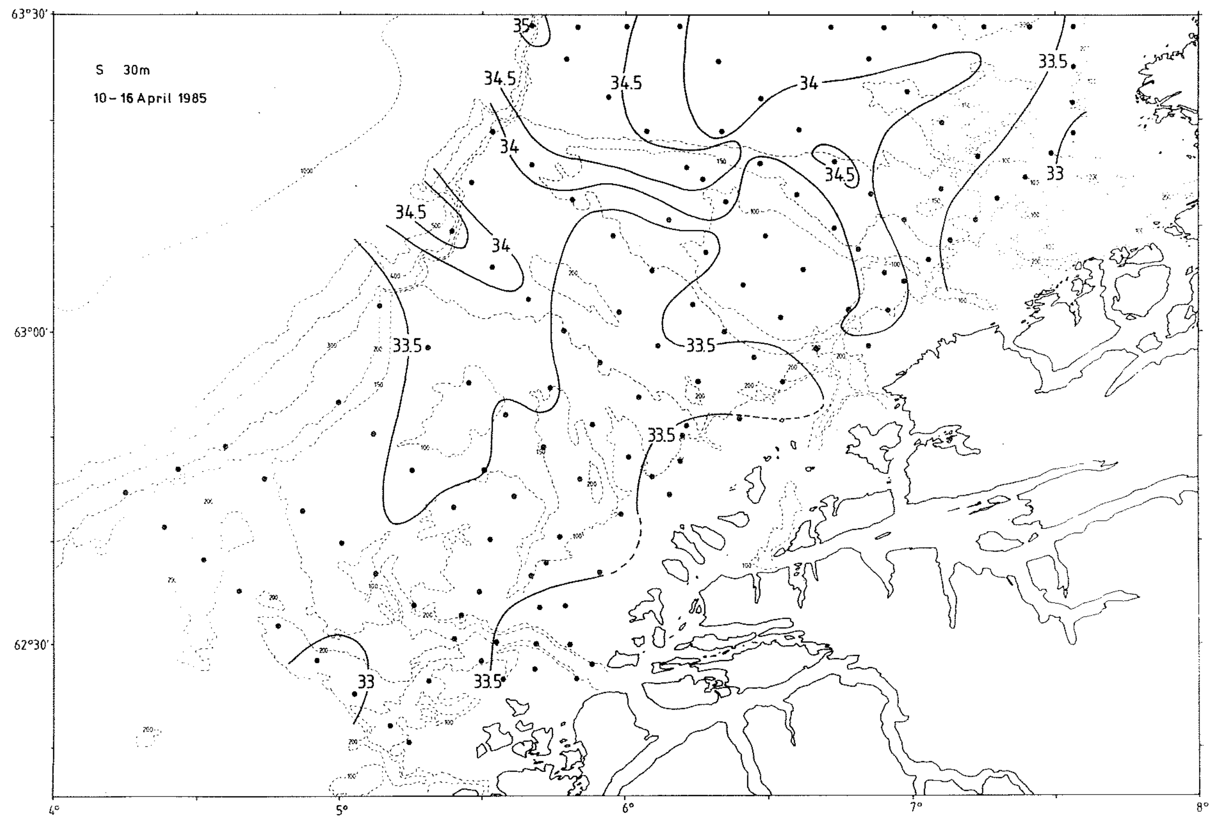

Fig. 4. Distribuiton of salinity in 30 m depth.

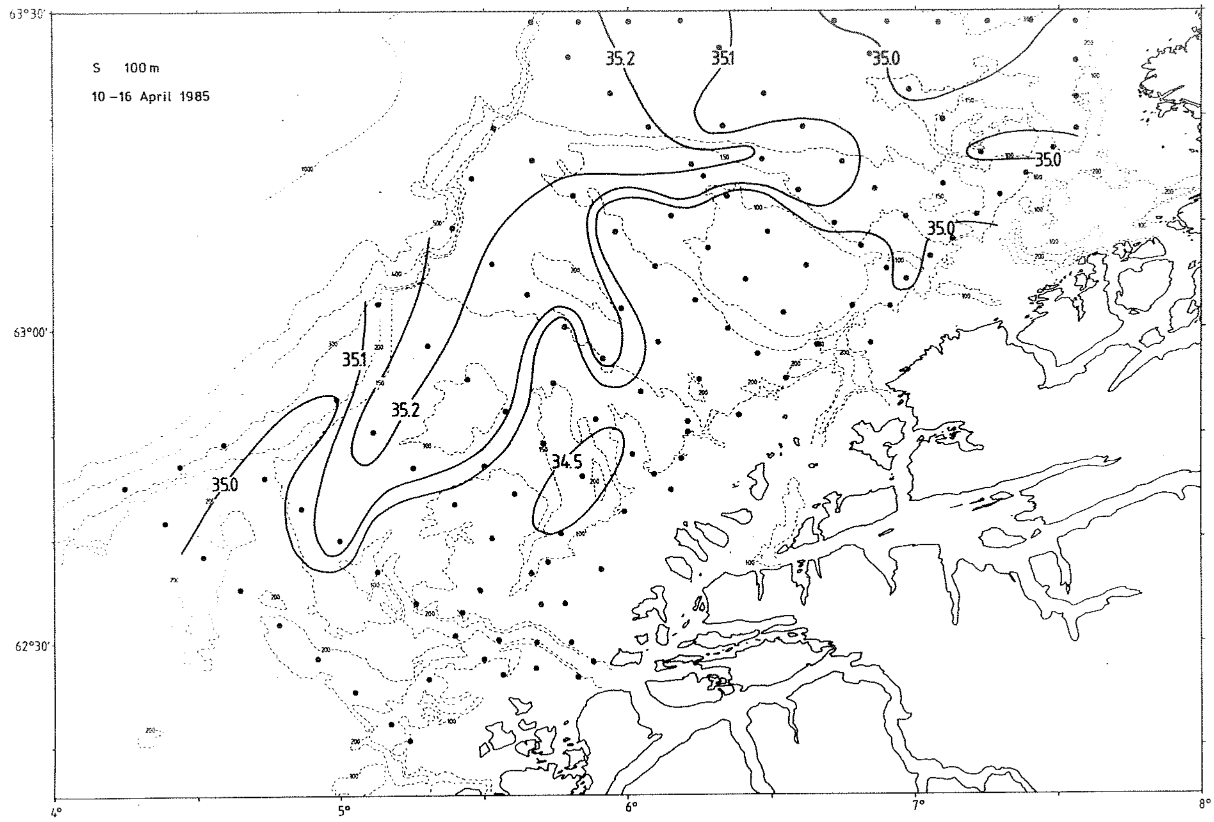

Fig. 5. Distribution of salinity in 100 m depth.

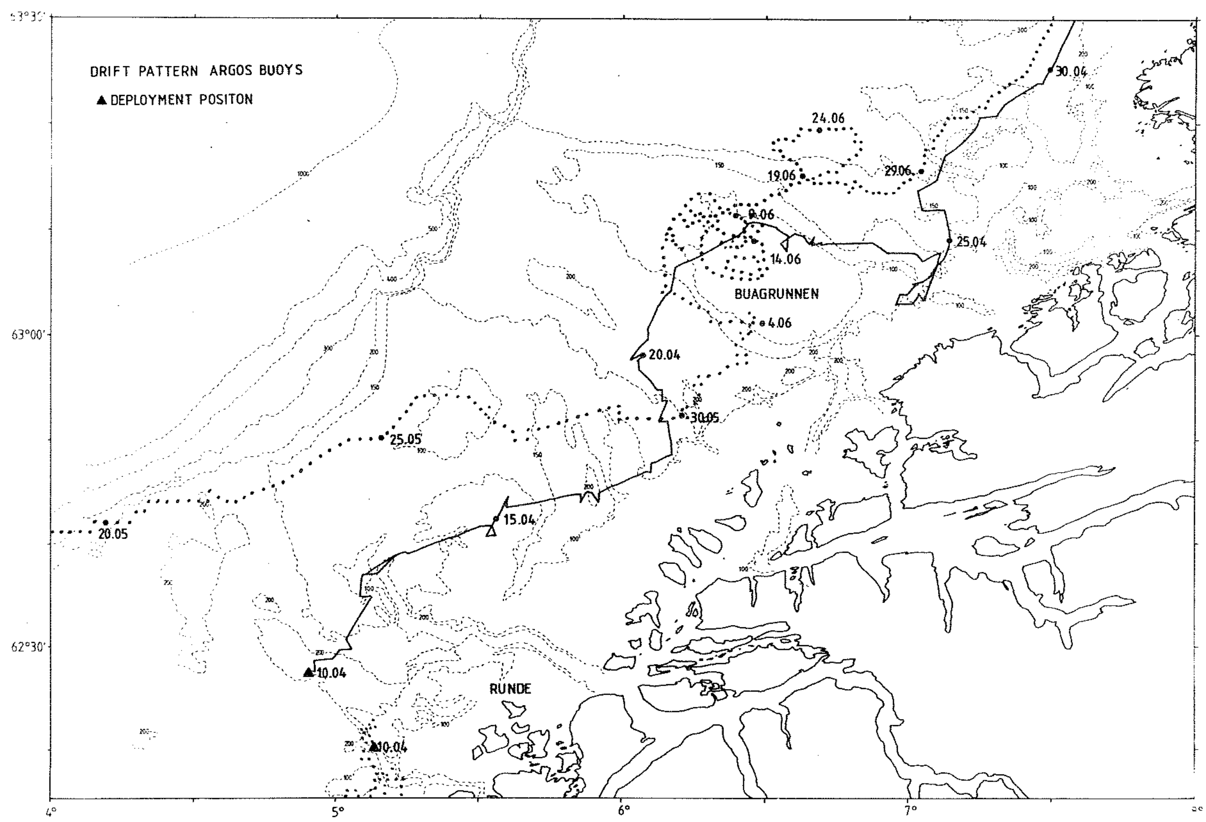

Fig. 6. Track of the drifting Argos buoys drogued at 30 m depth.

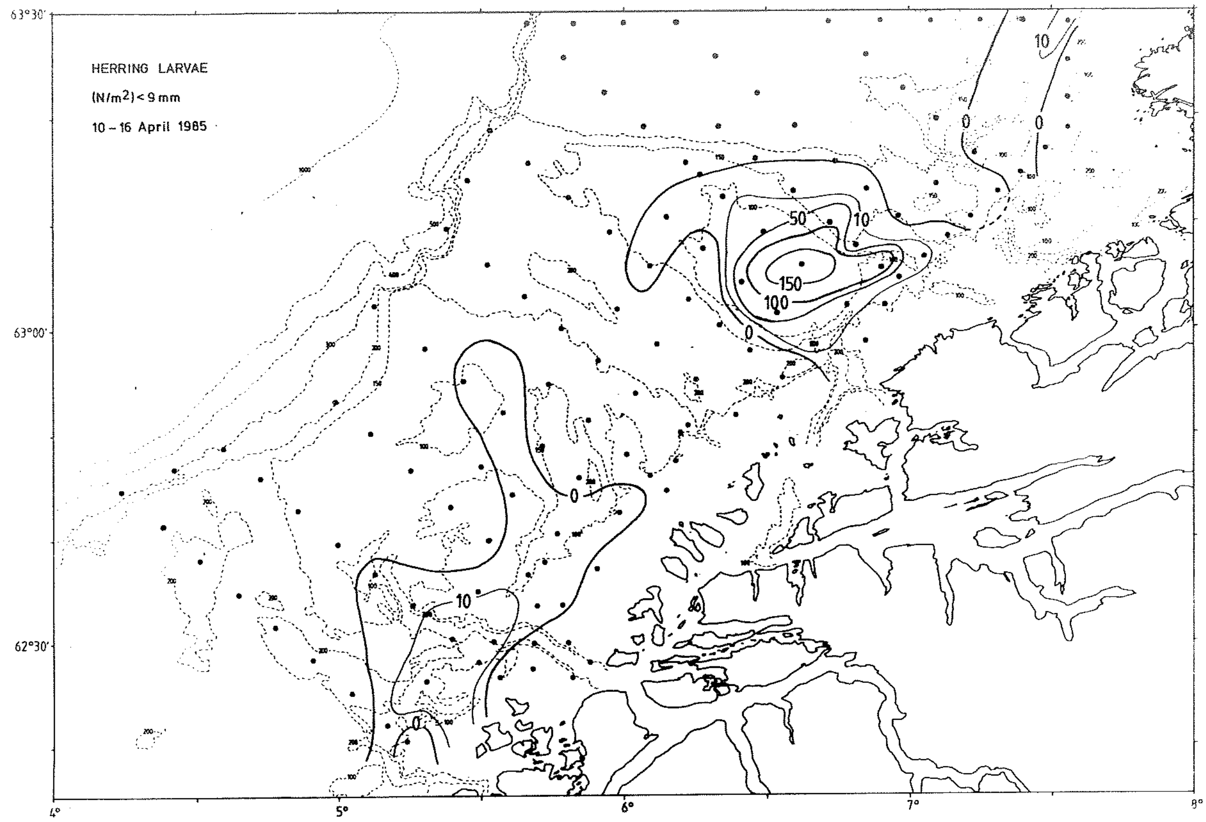

Fig. 7. Distribution of herring larvae < 9 mm ($N.m^{-2}$).

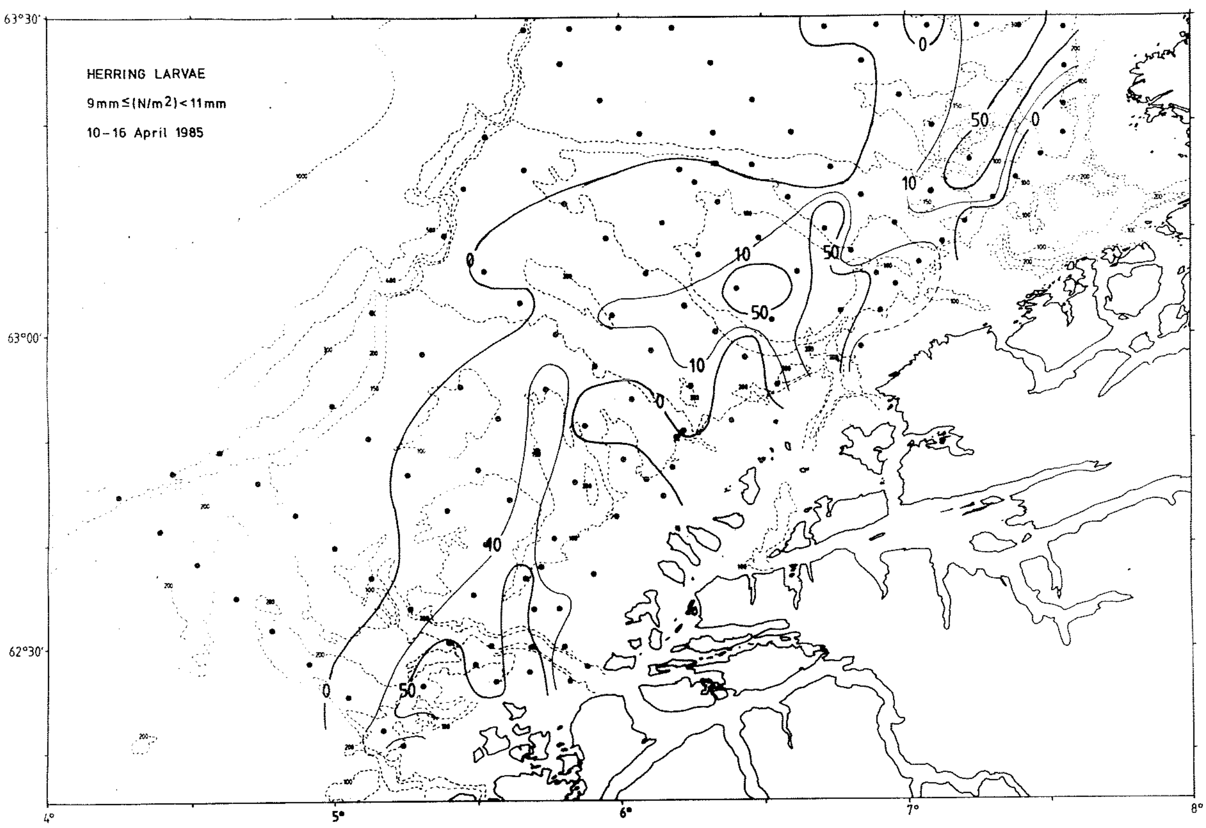

Fig. 8 Distribution of herring larvae between 9 and 11 mm ($N.m^{-2}$).

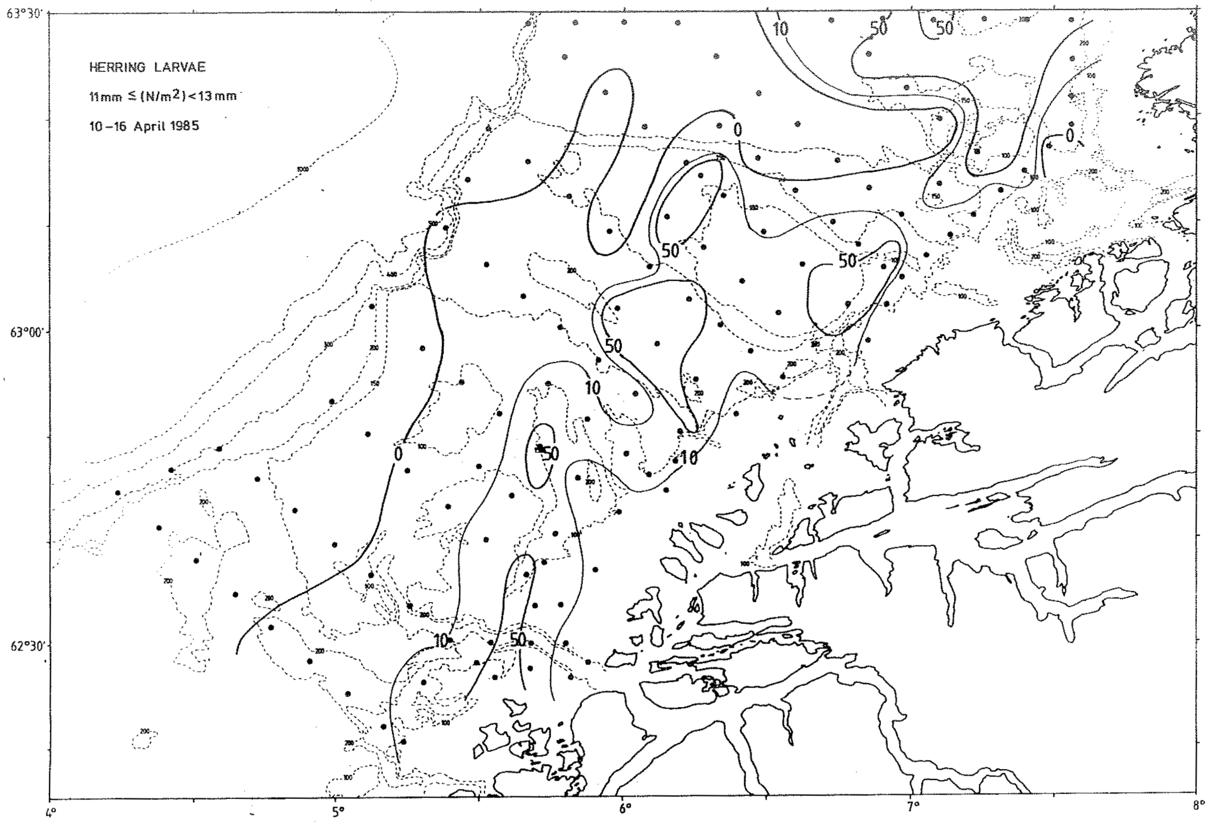

Fig. 9. Distribution of herring larvae between 11 and 13 mm ($N.m^{-2}$).

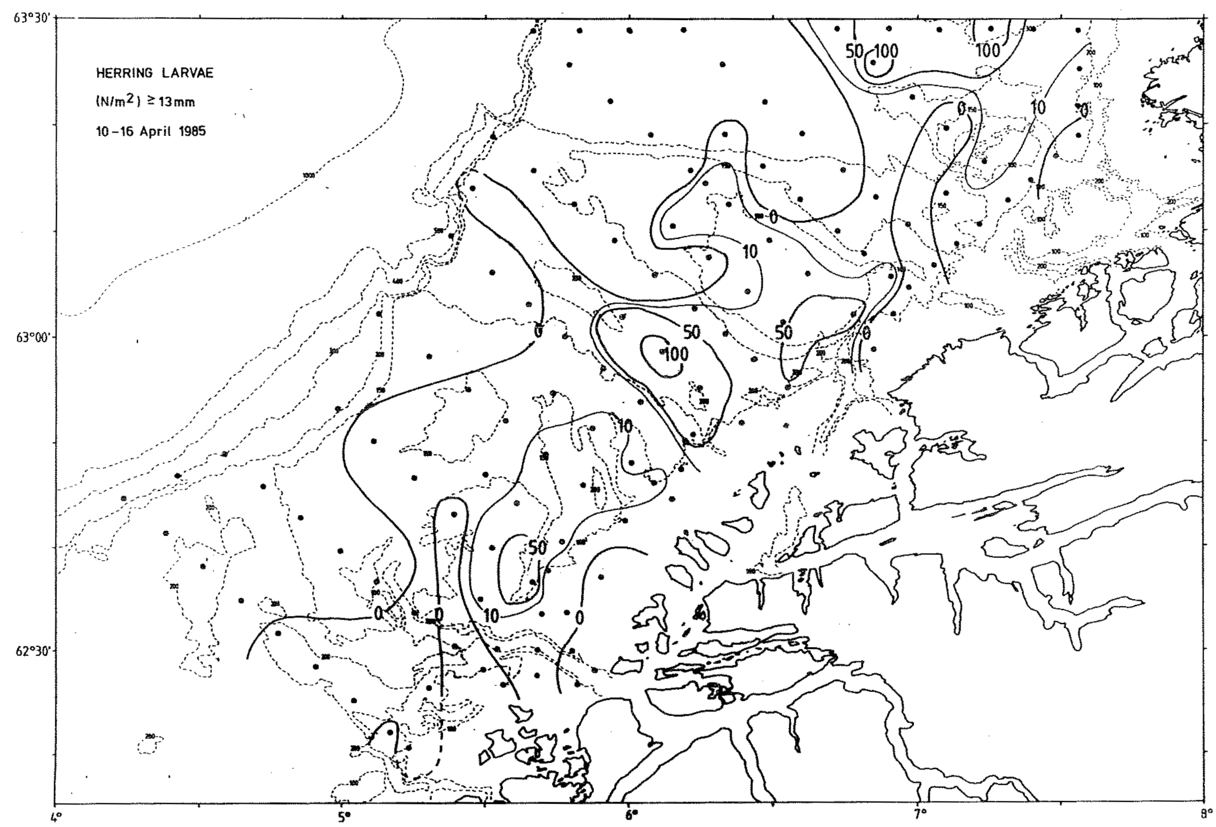

Fig. 10. Distribution of herring larvae >13 mm ($N.m^{-2}$).

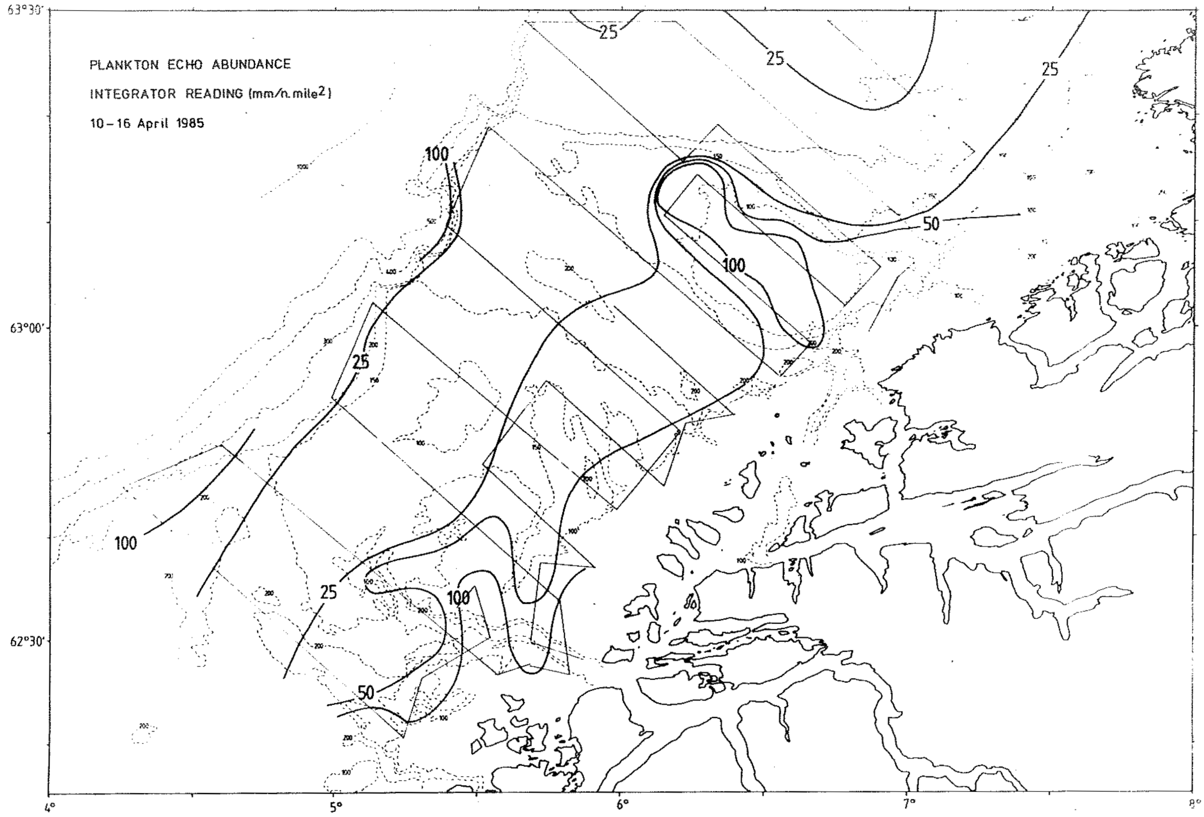

Fig. 11. Plankton echo abundance from the 38 khz echosounder.

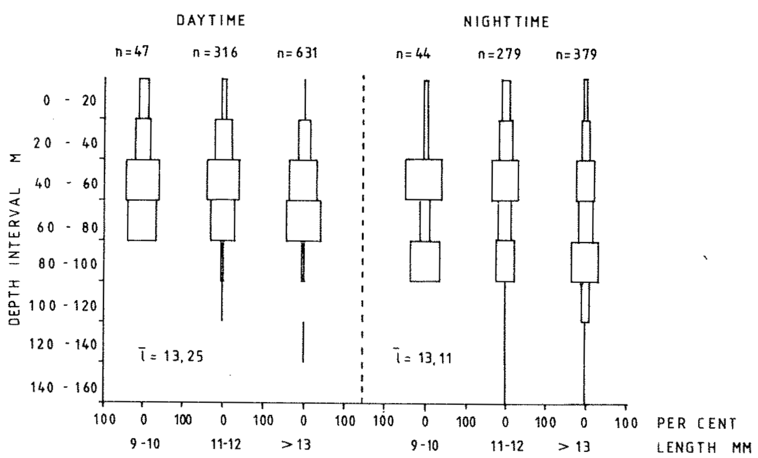

Fig. 12. Vertical distribution of different length groups during day and night. n = numbers of larvae.

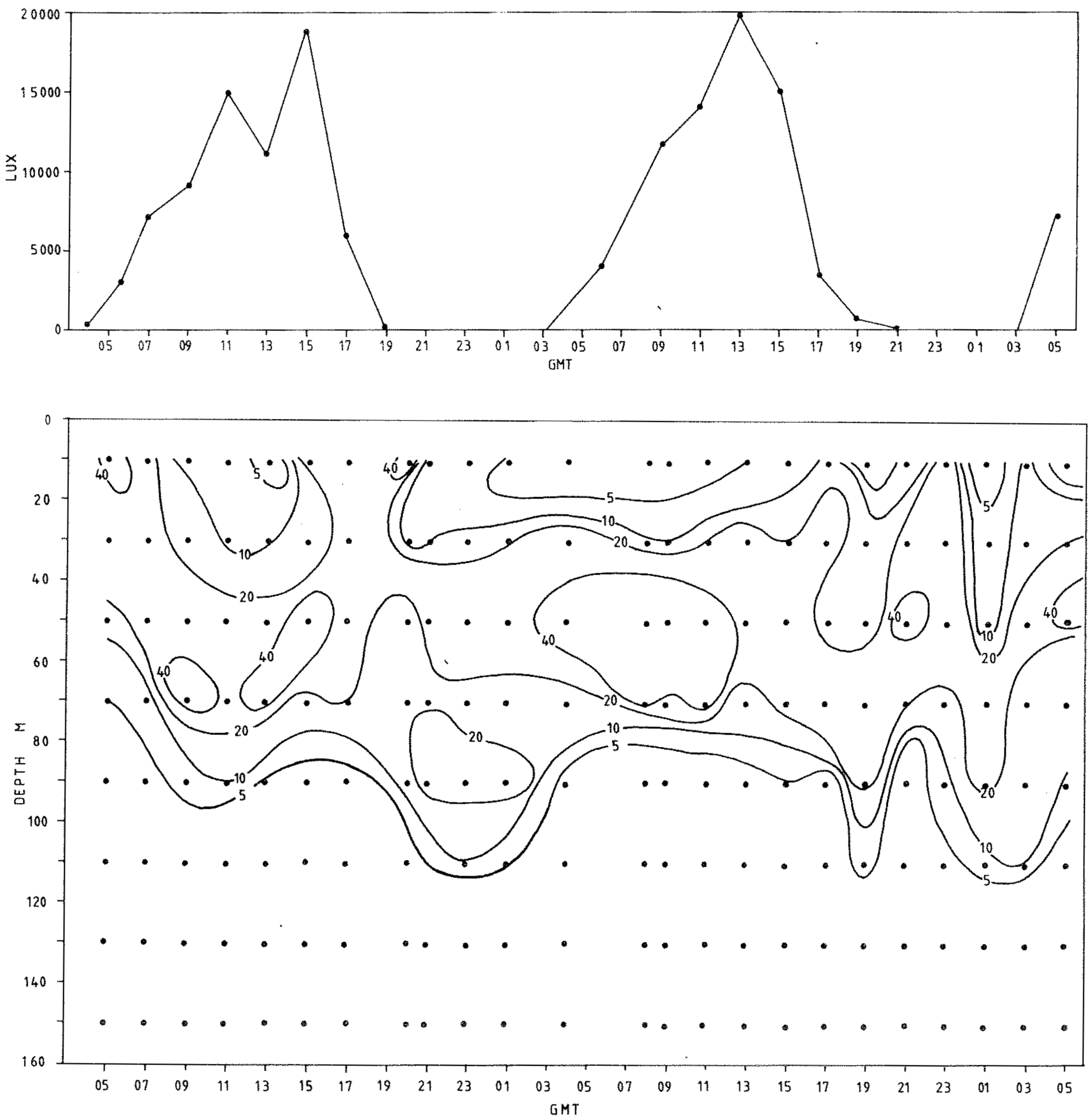

Fig. 13. Top: Light intensity at surface.
Below: Percentage vertical distribution all length groups during 48 hours.

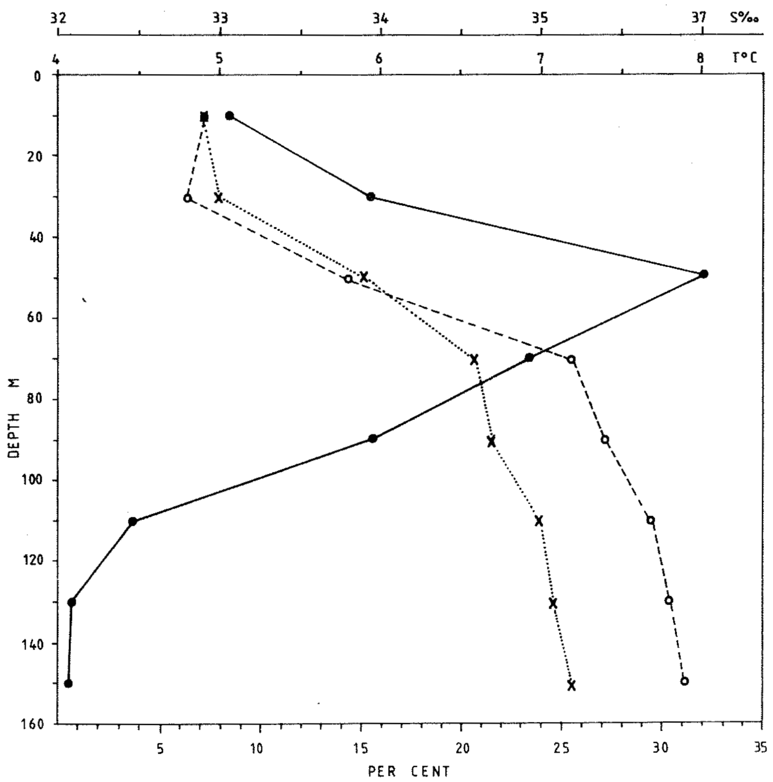

Fig. 14 Mean vertical distribution of larvae and hydrographic parameters.

. ___ . Percentage of larvae

x.....x Salinity

o --- o Temperature

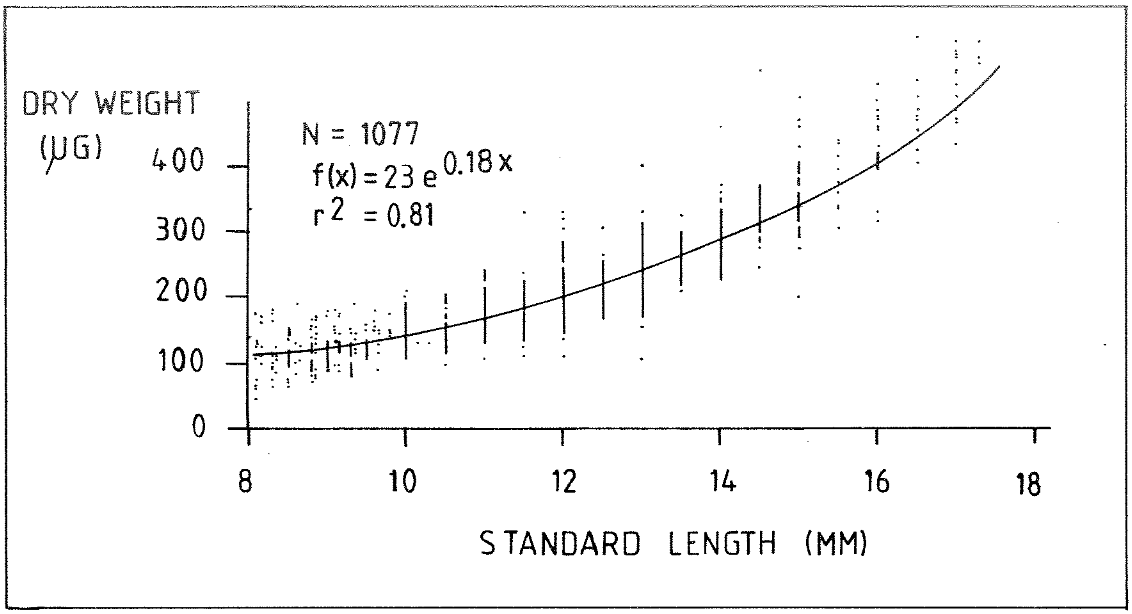

Fig. 15. A length/dry weight plot of the present herring larvae material.

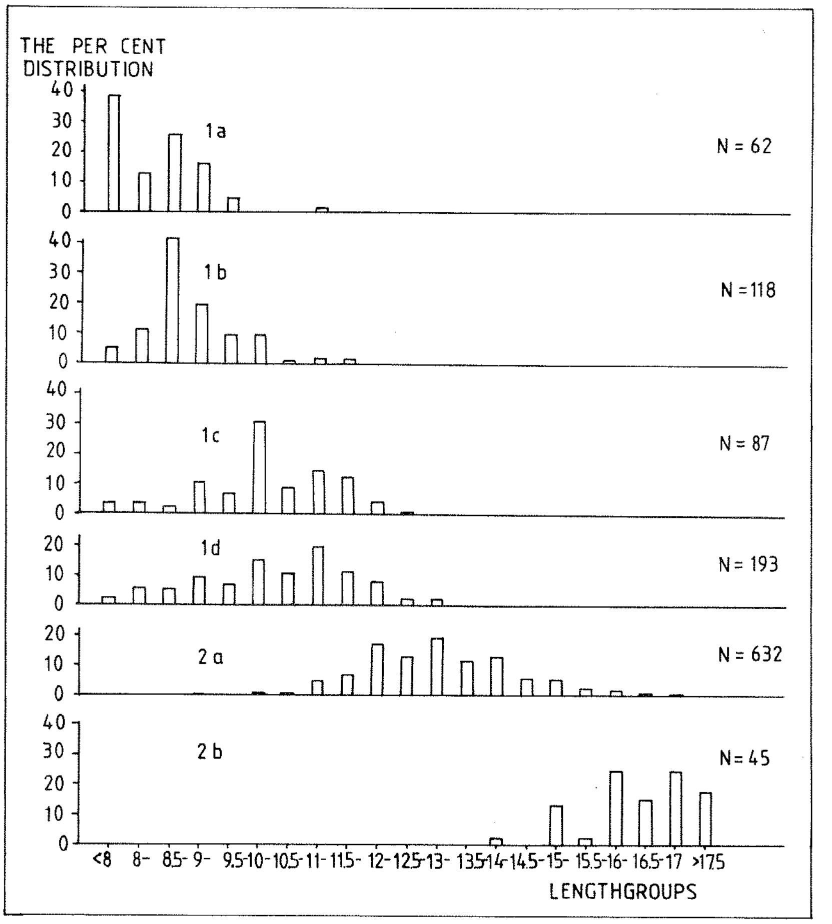

Fig. 16. The percentage length distribution of the larvae in the different substages (Doyle 1977).

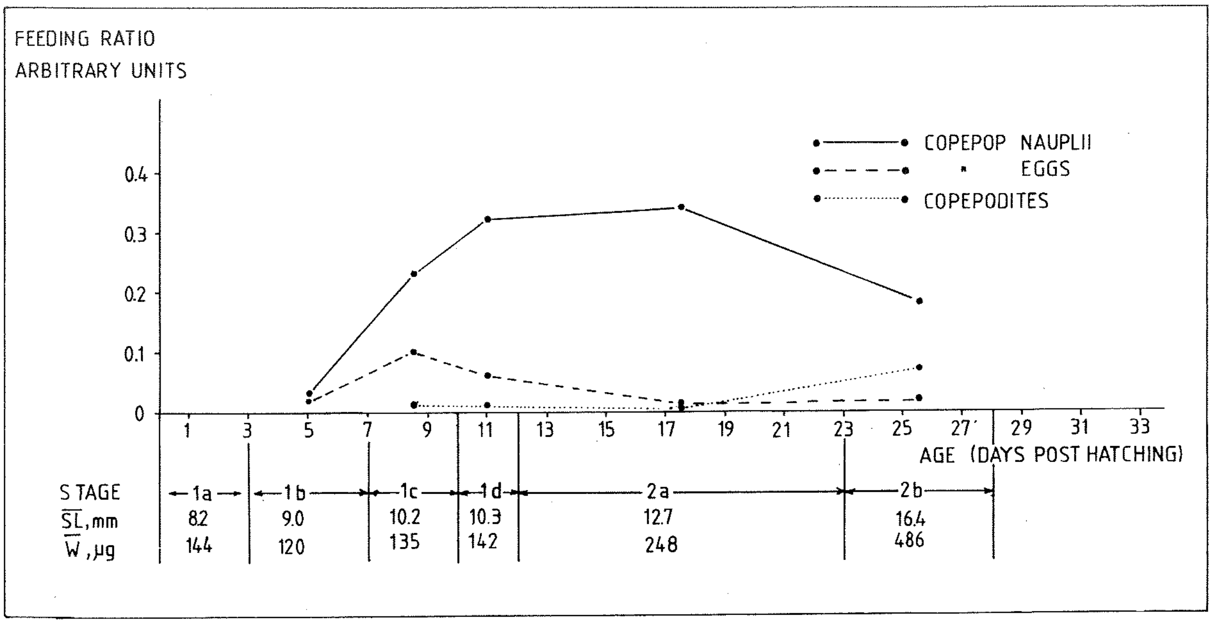

Fig. 17. The diet of the herring larvae in the "age" group 4-29 days post hatching.

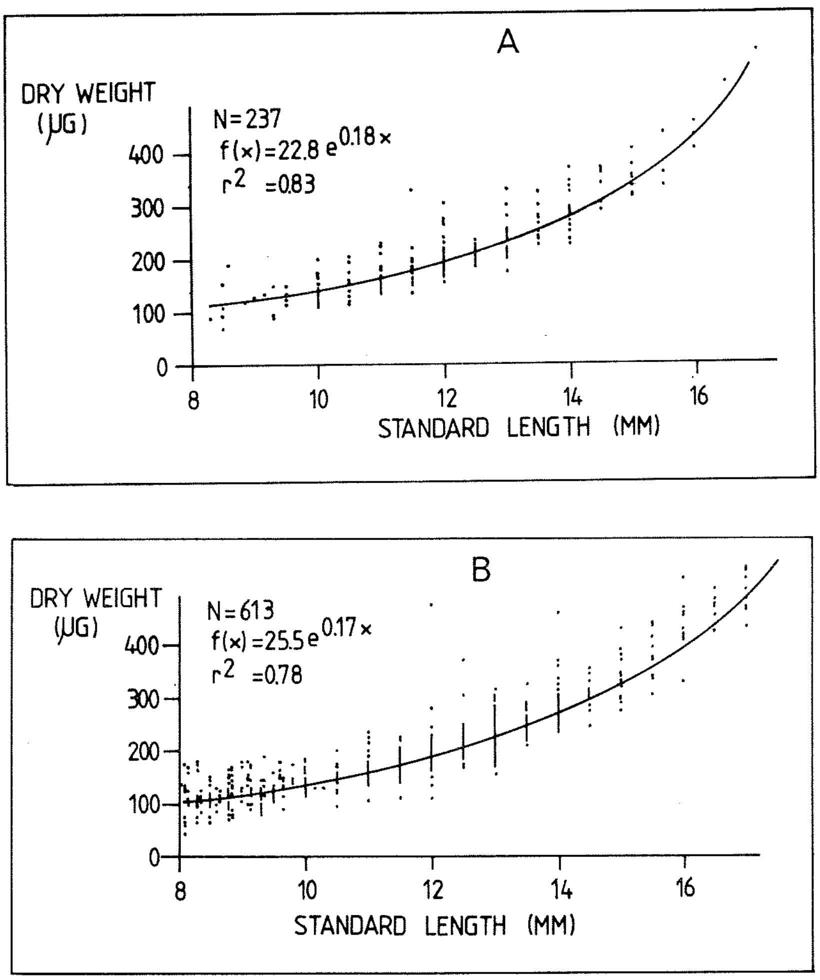

Fig. 18. A length dry weight plot of the larvae off Runde (A) and on the Buagrund (B).

HAVFORSKNINGSINSTITUTTETS EGG- OG LARVEPROGRAM (HELP)

O-GROUP SAITHE OFF THE NORTHERN NORWEGIAN COAST IN MAY 1985

By

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ABSTRACT

From 11 May to 31 May 1985 a pelagic trawl survey was carried out outside the Norwegian coast north of 62^{0}N. The purpose of this pilot survey was to examine the possibility of getting useful information about the year class strength of the North-East Arctic saithe before too many of the postlarvae had drifted or migrated inshore. Attempts at this have so far not been successful for any saithe stock, and recruitment estimates are badly needed for the catch projections.

The sampling was carried out with a mid-water trawl and the results are promising. There are also interesting biological aspects. Some systematic size differences of the saithe postlarvae seemed to appear within the investigated area. Distribution charts and tables of postlarvae of different species have been presented. An index of the year class strength of saithe has been calculated.

INTRODUCTION

The North-East Arctic saithe spawn at 150-200 meter depths outside the Norwegian coast. North of 62^0N the main spawning grounds are on the banks off Møre, Haltenbanken, and in the Lofoten area.

It is well known that alevins and postlarvae drift, or as they grow larger, probably migrate inshore. However, we have so far not been able to arrive at the understanding of what physical or biological mechanisms that are involved. From a size of 2-4 cm until becomming 3-6 years old, oldest in the northern part of Norway, the saithe stay inshore. Above a minimum size the saithe are during this period exposed to a considerable purse seine fishery.

While the saithe stay inshore it is almost impossible to measure the strength of the year class, and before it is possible to get any information about the recruitment, the stock is exposed to fishing. Therefore the aim of this pilot survey was to bound the area of distribution and to try to get a measure of the year class strength before the alevins or postlarvae reached the coast.

Hitherto very little has been done on this subject. DAMAS (1909) described the distribution of fry and alevins of saithe off Møre. WIBORG (1954,1956,1957,1960a,1960b,1961,1962) and DRAGESUND AND HOGNESTAD (1966) have described the occurrence of fish eggs and larvae in Norwegian coastal and offshore waters. BJØRKE (1983) has done some research on the distribution of eggs and larvae of gadoid fishes from Stad to Lofoten during April 1976-1983, and on postlarvae of gadoid fishes north of Lofoten in June and July (internal survey reports). However, most of these reports present the results from surveys carried out either too early or too late to give a reliable measure of the abundance of 0-group saithe.

MATERIALS AND METHODS

A mid-water capelin trawl with a 10 meter fine meshed (8 mm stretched mesh) net inside the cod-end, was used as the main gear in this survey. Height and depth sensors from SCANMAR A/S together with sensors measuring the distance between the wings of the trawl, gave information about the trawl geometry.

The trawl was towed with 3 knots for 10 minutes with the headrope at the surface, then 10 minutes in 20 meter, and 10 minutes in 40 meter. Six 70´´ bladders were fastened to the headrope. It took some time to stabilize the trawl in these depths. The total sailed distance therefore became 1.8 nautical miles as a mean, with a total towing time of about 36 minutes. The trawl survey was carried out both day and night.

The known spawning grounds of the saithe and a calculated drift of the larvae up to the beginning of the survey, were used as the basis for how far south it was necessary to go. However, the southernmost track gave no satisfactory southern limit of the abundance of saithe, and it was therefore decided to do some trawling further south on the return to Bergen. These trawl- and hydrographical stations were consequently taken later in time.

The actual area was covered by a rectangular survey grid (Figure 1). The distance between the main tracks, which have been numbered by Roman numerals I-XII, was 30 nautical miles, and the distance between two stations on the same track was 15 nautical miles.

The catch was shaked down in a tub with water and filtered out. Afterwards the whole cod-end was thoroughly shaked and the remainder swept up from the deck. The entire catch was sorted, and the length of each fish species or category measured.

Because of the uncertainty concerning the choice of the best sampling device, another two sampling gears were tested. The catch efficiency of Isaacs Kidd (9 m^2) and MOCNESS (1 m^2) midwater trawls were on respectively five and two stations compared with the bigger capelin trawl. The Isaacs Kidd trawl was lowered down to 60 meter, and the MOCNESS was hauled through 1000 m^3 seawater in each of the four depths 10, 20, 30, and 40 meter.

In order to try to estimate acousticly the abundance of alevins and postlarvae an EK-400 (Simrad), connected to a Nord 10 ekkointegrator with a Simrad QX preprocessor, was used. However, it was impossible to separate the postlarvae from krill and zooplankton, and the acoustic estimate was therefore judged to be unreliable as a measure of the postlarvae abundance.

RESULTS

Hydrography

Hydrographical observations were normally made on each trawl station along all the survey tracks (Figure 2). Horizontal temperature distribution is shown for 0, 25, 50, and 100 meter (Figures 3-6). Figure 7 shows some temperature sections with the number of saithe postlarvae caught on each station recorded in the right relative position in the section. The horizontal distribution of the salinity in 25 meter is shown in Figure 8.

Distribution and abundance of 0-group fish

Trawl stations with and without catch are for three species given on the distribution charts in Figures 9, 11 and 13. Isolines have been drawn to better visualize the distribution.

An abundance index has only been calculated for 0-group saithe, the target species of the survey. With the aid of hydroacoustic equipments from SCANMAR A/S the height and width of the trawl entrance was found, and the volume, V_1, of a haul was calculated.

V_1 = 0.0108 nm (height of the entrance=20 meter) 0.0108 nm (width of the entrance=20 meter) 1.8 nm (distance towed) = $\underline{2.0995\ 10^{-4}\ nm^3}$

Around each trawl station a square of 15 x 30 nautical miles has been drawn with the station itself in center. Knowing the maximum depth of trawling, 58 meter when the headrope is in 40 meter, the volume, V_2, of such a constructed block can be found.

V_2 = 15 nm 30 nm 0.0313 nm (maximum depth=58 meter) = $\underline{14.09\ nm^3}$

Calculation of the index, I:

I= V_2/V_1 x = V_2/V_1 x , where x is the number of 0-group saithe caught during a haul of 1.8 nm on station i.

Saithe, Pollachius virens.

The geographical distribution of 0-group saithe is shown in Figure 9. It shows many similarities with the horizontal distribution of the temperature, especially in 25 and 50 meter. Areas with temperature equal or above 7^0C turned out to contain the greatest numbers of 0-group saithe (Figure 7). Far north in the investigated area where the temperature did not become that high, the greatest catches of 0-group saithe were done in the warmest water.

Very little can be said about the vertical distribution of the postlarvae. In addition to the two experiments using the MOCNESS trawl (see that paragraph), the capelin trawl was on trawl station 238 only towed at the surface for ten minutes, on station 239 only in 20 meter, and on station 240 only in 40 meter. The trawl was unfortunately also towed through the water column to and from these depths. This only experiment showed least postlarvae in 20 meter (Table 3). The horizontal distributions of the temperature or the salinity in several depths may also tell something about the vertical distribution of saithe postlarvae since they seem to stay in water masses of a certain temperature or salinity.

The length distributions of 0-group saithe caught on each survey track have been shown in Table 1. On the first eight tracks (I-VIII) the mean lengths varied between 27.7 mm and 29.5 mm. On tracks IX, X, and XI the mean lengths are somewhat less, 25.1 - 26.6 mm. The six postlarvae caught on the northernmost track, track XII, were larger. The mean length was 31.3 mm. Trawl stations 236 - 247 were taken on the return to Bergen at the end of May, and it is therefore natural that these postlarvae were larger. The mean length was 35.0 mm.

Between inner and outer stations on the same track there were more pronounced length differences of the 0-group saithe. In order to illustrate this the five southernmost tracks (I-V) were divided into an inner, a central, and an outer part with 1/3 of the trawl stations in each part. Figure 10 shows the length distribution of 0-group saithe from each of these three parts. The postlarvae on the inner stations were larger than on the outer stations indicating a drift or migration inwards to the coast.

An index of the abundance of 0-group saithe has been calculated:

Number of 0-group saithe within the area covered by the regular survey tracks, I_1:

$I_1 = V_2/V_1 \quad x = 14.09/2.0995\ 10^{-4}\quad 8462$ saithe = $\underline{567.9\ 10^6 \text{ saithe}}$

The triangular area south of the southernmost track with trawl catches of 100 0-group saithe or more covered an area of 5,610 nm^2. With a depth of 58 meter or 0.0313 nm the volume is $V_3 = \underline{175.6\ nm^3}$.

Number of 0-group saithe within this "triangle", I_2:

$I_2 = V_3/V_1 \quad x = 175.6/2.0995\ 10^{-4}\quad 322$ saithe (mean per station)
$= \underline{269.3\ 10^6 \text{ saithe}}$

The volume of the area with catches less than 100 saithe per station south of the southernmost track, $\underline{V_4 = 96.6\ nm^3}$.

Number of saithe within this area, I_3:

$I_3 = V_4/V_1 \quad x = 96.6/2.0995\ 10^{-4}\quad 311$ saithe (mean per station)
$= \underline{5.1\ 10^6 \text{ saithe}}$

The number of 0-group saithe, I, within the total investigated area is used as the index of abundance of the 1985 year class of North-East Arctic saithe north of 62^0N:

$$I = I_1 + I_2 + I_3 = \underline{842.3\ 10^6}$$

Herring, *Clupea harengus*.

The geographical distribution of herring larvae before metamorphosis is shown in Figure 11. The area of distribution was neither in the south nor in the north satisfactory limited, and no abundance index has therefore been calculated.

The two experiments considering the vertical distribution of herring larvae gave two different distributions (number larvae) as shown below.

Depth in meter	MOCNESS St.no.135	Capelin trawl St.no.238-240
0	-	1220
10	0	-
20	1	20
30	8	-
40	14	2

There were rather small length differences between herring larvae caught on different stations. For three areas (A,B,and C) with a catch of 10 larvae or more per station, separate length distributions have been presented to show the most pronounced differences (Figure 12). Area A include six stations as shown in Figure 11. Area C include the stations south of the southernmost track, and area B the rest of the stations with 10 or more larvae per station. The herring larvae in area A were somewhat smaller than in the other areas.

Catfish, Anarhichas lupus

Scattered catches of catfish postlarvae were done all over the surveyed area (Figure 13). The concentrations were small, only on six stations it was caught 10 postlarvae or more. The length distribution of all the catfish postlarvae is given in Table 2.

Gonatus fabricii (Lichtenstein):

Figure 14 shows the geographical distribution of the ten armed pelagic squid Gonatus fabricii. The length distributions from trawl stations no. 151 and 218 have been summarized and presented in Table 2. The area of distribution and the size composition in the catches showed many similarities with observations done by WIBORG (1979,1982) and WIBORG,GJØSÆTER AND BECK (1984).

Other species

An overview of all species or fauna categories caught on each trawl station is given in Table 3.

Pearlsides, Maurolicus muelleri, were only caught around midnight. At this time the pearlsides gathered above 50 meter, and were clearly visible on the echo sounder.

Redfish postlarvae were regulary caught from outside Lofoten and northwards. Two size groups of these postlarvae appeared. Up to station no. 226 the length of the redfish postlarvae was between 8 and 13 mm, while from station no. 229 the postlarvae were 15 mm or more. Table 2 shows the total length distribution. Many of the redfish postlarvae were probably too small for the trawl to catch them quantitatively well.

In the entire surveyed area only four postlarvae of haddock were caught, all of them west of Haltenbanken. Postlarvae of cod were not recorded at all.

Comparison and judging of gears

On five stations in the beginning of the survey the catch efficiency of an Isaacs Kidd mid-water trawl and the capelin trawl was compared. The overview below shows the catch taken by these gears.

St.no.	Capelin trawl	Isaacs Kidd
100	Catfish: 10	Catfish: 1
	Sculpin: 1	
103	Catfish: 4	No catch
108	Herring: 11	No catch
110	Saithe: 4	No catch
	Catfish: 2	
	Herring: 3	
114	Saithe: 331 (22-43 mm)	Saithe: 3 (32,36,38,mm)
	Catfish: 2	
	Gonatus sp.: 19	
	Norway pout: 1	

The results show that the capelin trawl was the best gear for the purpose of the survey, and this gear was therefore used in the continuation.

On station no. 135 the MOCNESS mid-water trawl caught 1 saithe postlarvae while the capelin trawl caught 76. On station no. 147 the MOCNESS caught nothing while the capelin trawl caught 748 specimens.

The MOCNESS was considered not suitable for catching saithe postlarvae of this size, but it seemed to be a better gear for catching smaller and weaker herring larvae.

CONSIDERATIONS

The capelin trawl seemed to be a suitable gear for catching 2-3 mm postlarvae of saithe and other fishes. However, considering the permeability of the cod-end, it may be better to use a single fine meshed net instead of a standard cod-end net with a fine meshed net inside.

To what extent it is possible to tell whether the index of abundance will show the right picture of the year class strength, a time series of such indices is needed. Then it will be possible to compare the index with the number of saithe of that year class entering the fishery. Nevertheless, this pilot survey was promising.

There were also interesting biological aspects. Size differences of the saithe postlarvae may tell something about the spawning and the mechanisms for the inshore drift or migration. The bulk of the saithe postlarvae stayed in the warmest water.

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Table 1. Length distributions (%) of saithe postlarvae.

Length-group mm	Track I st.no. 110-124	Track II st.no. 125-139	Track III st.no. 140-154	Track IV st.no. 155-168	Track V st.no. 169-180	Track VI st.no. 181-190	Track VII st.no. 191-197	Track VIII st.no. 198-203	Track IX st.no. 205-210	Track X st.no. 211-216	Track XI st.no. 217-222	Track XII st.no. 223-230	St.no. 236-247
10-14													
15-19	1.6	2.8	0.3	0.2	0.7	4.8	2.0	0.2	7.1		11.1		0.1
20-24	17.6	16.6	17.7	10.2	16.3	7.2	20.8	11.1	28.6	71.4	48.1		3.2
25-29	30.5	30.0	52.8	51.6	45.6	42.2	29.7	55.3	23.2		11.1	16.7	15.1
30-34	34.3	32.3	23.1	31.6	29.4	38.6	35.6	31.7	39.3	14.3	18.5	83.3	32.4
35-39	15.0	15.3	5.4	6.0	6.9	3.6	11.9	1.4	1.8		11.1		27.1
40-44	1.0	2.5	0.6	0.4	1.2	3.6		0.2		14.3			12.8
45-49		0.4	0.1										6.2
50-59													3.1
Number	1939	1127	1843	2239	607	83	101	425	56	7	27	6	1964
Mean length	29.28	29.47	27.74	28.63	28.29	29.12	28.31	28.26	26.61	25.14	25.48	31.33	35.04
St.dev.	4.90	5.48	3.78	3.72	4.19	4.79	5.01	2.98	4.95	8.03	5.96	1.63	6.43

Table 2. Length distribution (%) of C.fabricii, catfish, and redfish.

Length gr. mm	G.fabricii	Catfish	Redfish
5- 9			13.8
10-14	1.0		24.1
15-19	5.9		27.6
20-24	6.9	10.6	31.0
25-29	16.7	34.3	3.4
30-34	37.8	22.4	
35-39	24.1	16.1	
40-44	6.2	8.7	
45-49	1.3	4.7	
50-54		2.0	
55-59		1.2	
Number	878	254	58
Mean length	31.88	32.80	16.33
St.dev.	6.58	7.61	5.45

Table 3. Catch in numbers of different species or categories on each trawl station. Catches of specimens older than 0-group have been marked.

St.no.	Time(GMT)	Notes	*Gonatus* sp.	Catfish	Yarrel´s blenny	Haddock	Pearlside[4]	Lumpenus	Lump-sucker	Saithe	Sand-eel	Herring	Redfish	Sculpin	Krill (ml)
100	16			7	1										
101	20			10										1	
102	22	No catch													
103	02			4											
104	05			7											
105	09			2											
106	13								1						
107	18	No catch													
108	23											11[1]			
109	04					1[1]				1		6			50
110	08			2						4		3			
111	11			1						9					
112	14	1 Blue-mouth		5	6					495		384			
113	16		3	5						4					
114	18	1 Norway pout	19	2						331					60
115	22	2 Gr.silver smelt		2			7200		1	118					8400
116	00		16				400		1	335					900
117	03		2	1						96		1			
118	05		3	1						169		7			100
119	08		3							274		29			100
120	11		44							13		1			20
121	14		2							73		1			30
122	17		19	1					1	11	1	2			40
123	19		35							7					30
124	23		340				4								5
125	03		384							3		1			30
126	05		214						1						35
127	08		29							9					10
128	10		18	1						45		26			80
129	12		14	1						2					5
130	15		1		1					171		60			25
131	18									26		50			35
132	20		46	1			2			210		61			100
133	22		3				13			41					1200
134	01									57		16			1950

Table 3. continue

St.no.	Time(GMT)	Notes	*Gonatus* sp.	Catfish	Yarrel´s blenny	Haddock	Pearlside[4]	Lumpenus	Lump-sucker	Saithe	Sand-eel	Herring	Redfish	Sculpin	Krill (ml)
135	03				1					76	1	780			120
136	07			1				1		36		317[2]			8
137	10		1	4					2	52		1140			
138	12		1	6	1					379		28	1		
139	14									20		1			2
140	18									3		7			
141	20				1					15		15			90
142	23						2	4		10		204			4000
143	01		3	1	3			3		53		73			30
144	03		9							10		125			
145	06		2					3	1	52		30			
146	11									80		58			1000
147	18	1 *Callionymus* sp.	47							748		10			450
148	22	1 Garfish	250				4			411		3			100
149	00		46	2			3			104		1			10
150	03		42							222		5			90
151	05		162							128		208			180
152	08		411	1	1					1					15
153	10		102						1	1					10
154	13		97	1						5		1			25
155	16		508[2]						1			1			30
156	19		1579[2]							1					
157	21		627				16								
158	23		86				15			1					10
159	02		578							2					
160	04		88							17					
161	07		120						1	876					80
162	09		70	3						672		1			20
163	11		4							555		5			50
164	14		2							42		1			10
165	16		8	2				2		58		64			8
166	18		4	1				1		11	1	150			
167	20		1		1					2		11			170
168	22									2					3000
169	02									1		21			40
170	05		4	1						1		485			

Table 3. continue

St.no.	Time(GMT)	Notes	Gonatus sp.	Catfish	Yarrel´s blenny	Haddock	Pearlside[4]	Lumpenus	Lump-sucker	Saithe	Sand-eel	Herring	Redfish	Sculpin	Krill (ml)
171	07				1					3		22			
172	09		2							10		11			
173	12		1	1						77	1	75			
174	15		9	1						114		5			50
175	17	1 Salmon (58 cm)	8							360		1			130
176	20	1 Salmon (55 cm)	64	1	2					37		108	1		35
177	23		150	1			20			1					10
178	01		227				206			1		1			
179	04		160	2			3			2					
180	08		53						1						15
181	13		35	1	1				1	10		2			180
182	15		148	6					1	9		1			120
183	18		533	9						7		2			5
184	20		45	1						6		205			5
185	23		120	2			1			25		10			4800
186	01		10	1						12		16			20
187	03		4	1					1	11		130(+3 large)			
188	06									2		2			
189	08											3			
190	11									1		4			
191	15											7			
192	17									3		13			20
193	19			1						31		13			15
194	21								1	21		31			20
195	00		7	4						43		124			650
196	02									3	1	15			50
197	04	1 Jellycat	34	11					1			3			16
198	08		125	6	1					2		1	1		200
199	10	1 Salmon (47 cm)	5	4				1	1	329		17			
200	13		6	3				1	2	90		39			60
201	15									2		22			30
202	17								1	2		13			10
203	20					1[1]						2(+3 large)			
204	22	1 Cod (70 cm)										1			
205	01											25			
206	03		3					1		5		8			

Table 3. continue

St.no.	Time(GMT)	Notes	*Gonatus* sp.	Catfish	Yarrel´s blenny	Haddock	Pearlside[4]	Lumpenus	Lump-sucker	Saithe	Sand-eel	Herring	Redfish	Sculpin	Krill (ml)
207	05		42	4				2		5		2	1		12
208	07								1	28		259			50
209	10		6							17		143			10
210	12		10	5						1		13	2		80
211	17														
212	19		17	3						5		44			220
213	22		482[2]		1				1			1	1		
214	01			1					1	2		3			
215	03		3												
216	05			3	1							2			
217	17									8		2			
218	19		716	1	2			1	1	12(+1 big)		26			
219	22		62	7	1			2		2		9			15
220	00		289	11	2			3		4		2	4		
221	02		24	1					1	1		1			
222	05		34	3				2	2			2	8		240
223	10		8										1		
224	13		3	5									1		
225	16		13										1		
226	19		8	3								10	1		110
227	22		136	7			4					108			20
228	01		39	2											3600
229	03		3	4					1	5			2		420
230	05		1	4	2			5		1		6	3		125
231	07		14	29	1			7	1			13	25		10
232	10		17	14	1	2[1]		3		1		8[3]	4		30
233	14		3	12				1				5	1		5
234	04	No catch													
235	07			1										2	
236	08								2	121		309			180
237	12		2					1	1	231	1	174			500
238	16	0 meter only								140		1220			10
239	17	20 meter only		1		2				17	3	20			5
240	18	40 meter only	2							199		2			5
241	21					1		7	1	472	3	3333[2]			900
242	00			1		1		23		111	1	1131			450
243	04							1		17		325			
244	08			2	6			7	2	640		330[2]			
245	12							1	2	10		44			
246	14									6		10			
247	18	No catch													

[1] Larger fish, not 0-group [2] The trawl net itself was covered by this species, and it was difficult to quantify the catch [3] + 1 large herring
[4] The lengths of the pearlsides were between 25 and 40 mm.

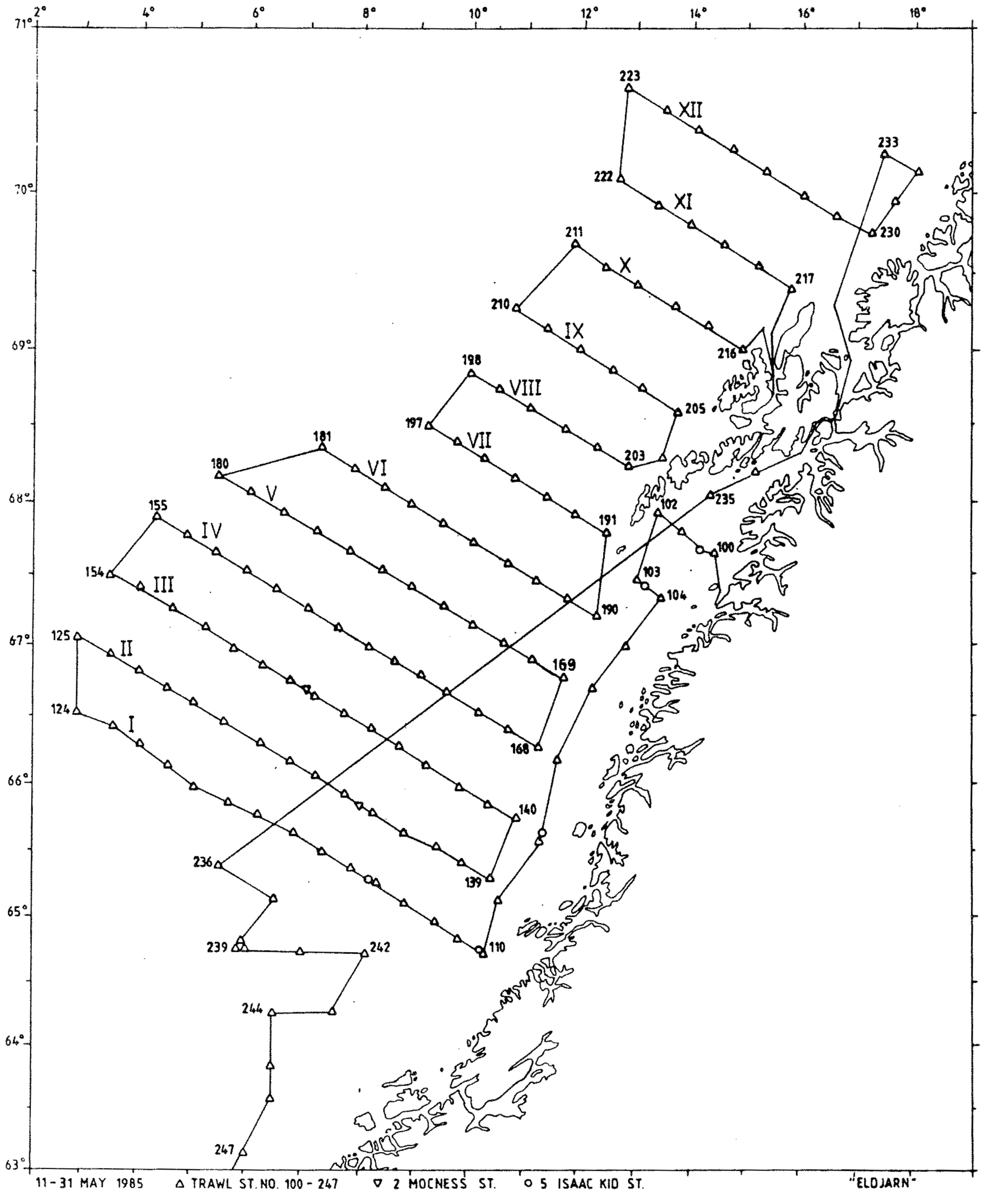


Fig. 1. Survey tracks and the grid of trawl stations. The main tracks have been numbered by Roman numerals I-XII.

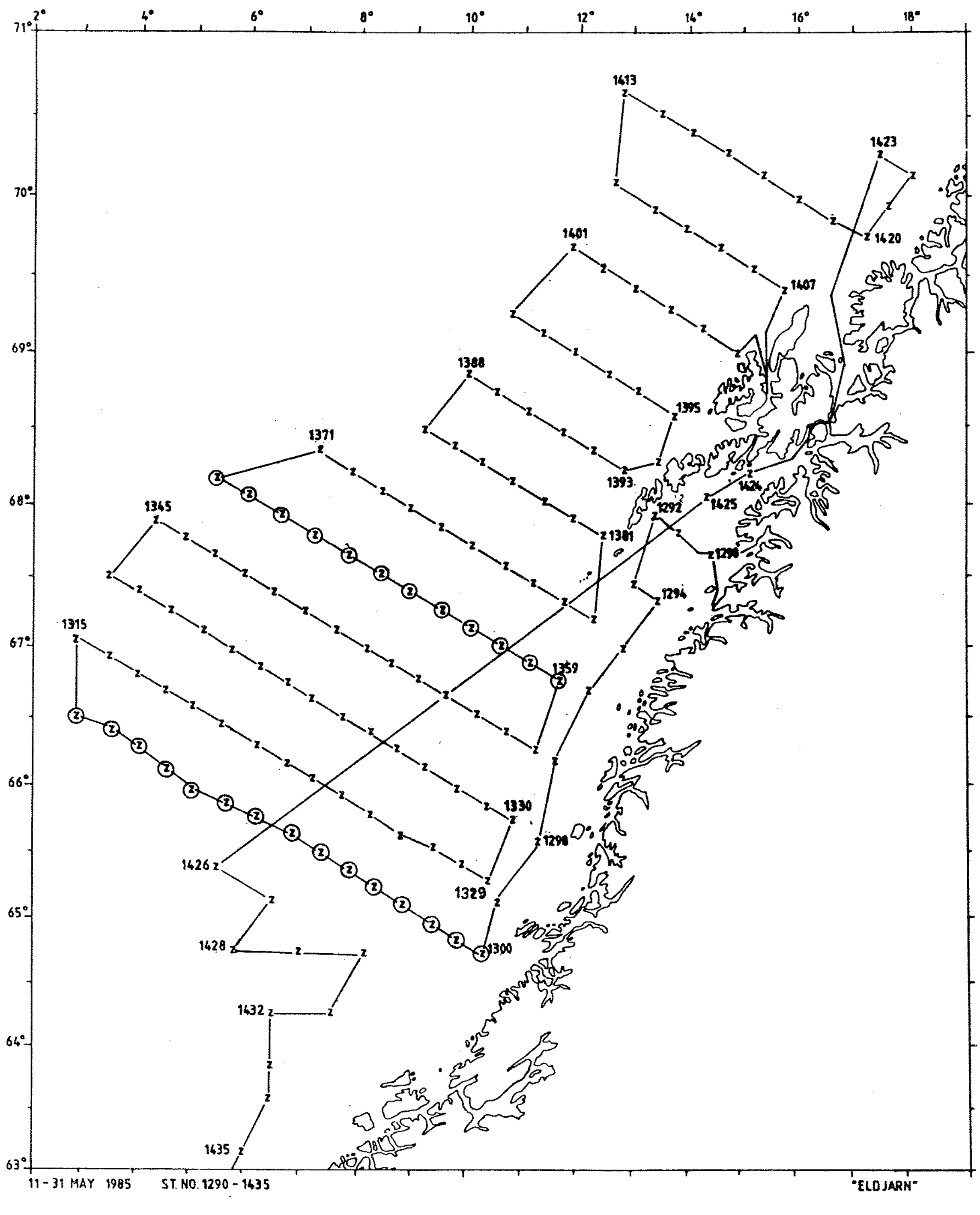


Fig. 2. Survey tracks and the grid of hydrographic stations. On the encircled stations the CTD-sonde was lowered to the bottom or maksimum 1500 meter. On the other stations the sonde was lowered down to maksimum 500 meter.

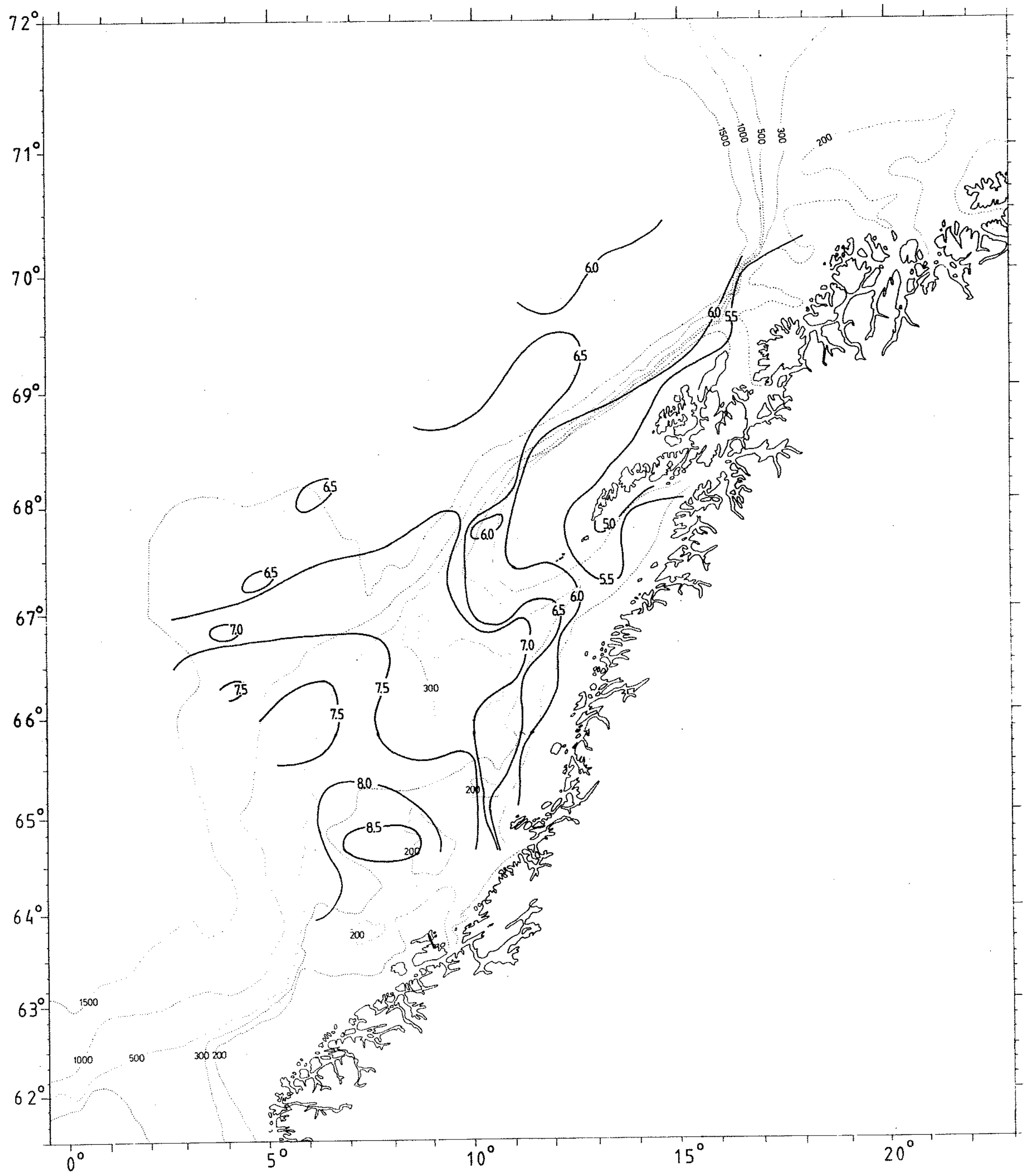


Fig. 3. Distribution of temperature (°C) at the surface.

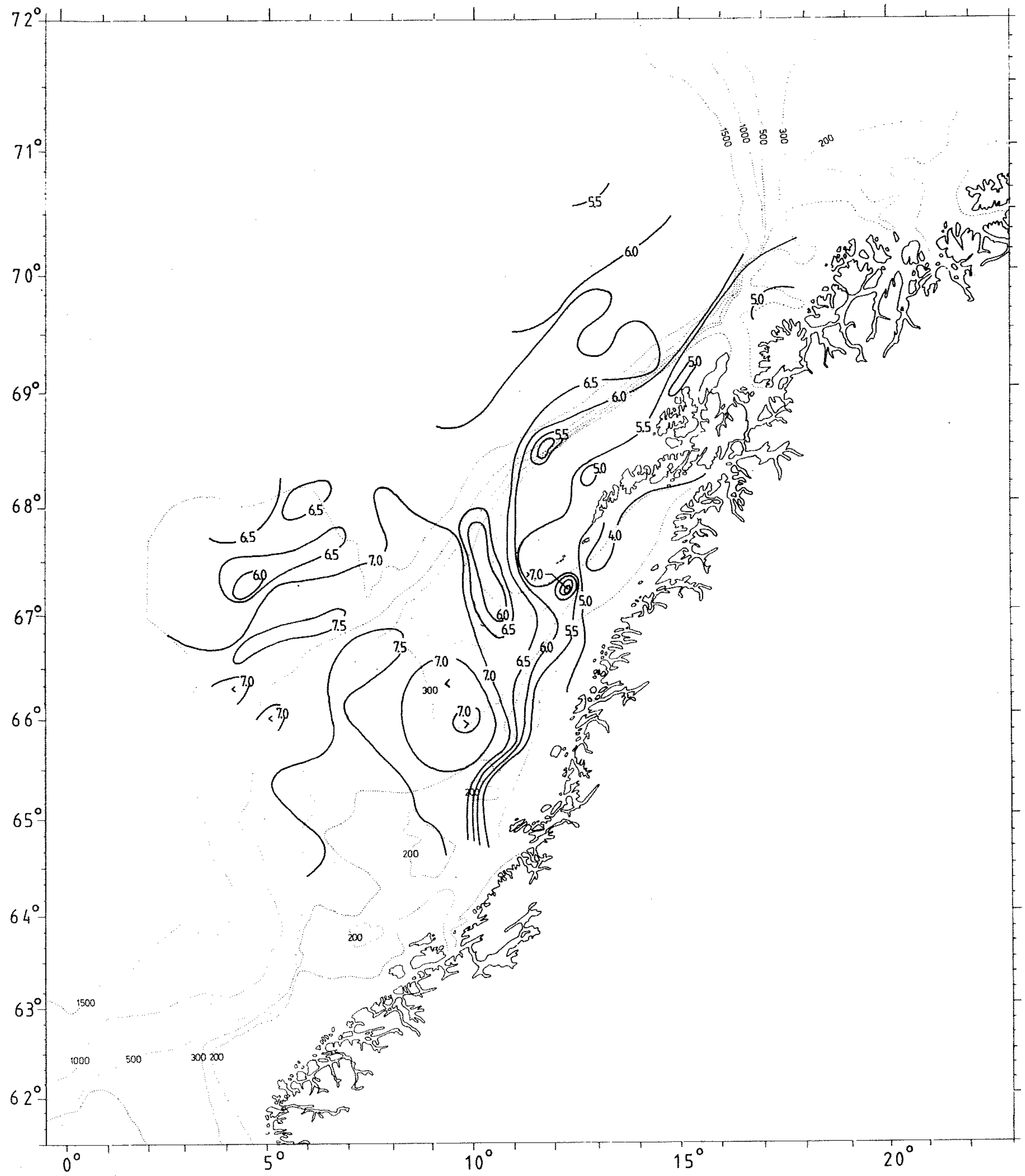


Fig. 4. Distribution of temperature (^{o}C) in 25 meter depth.

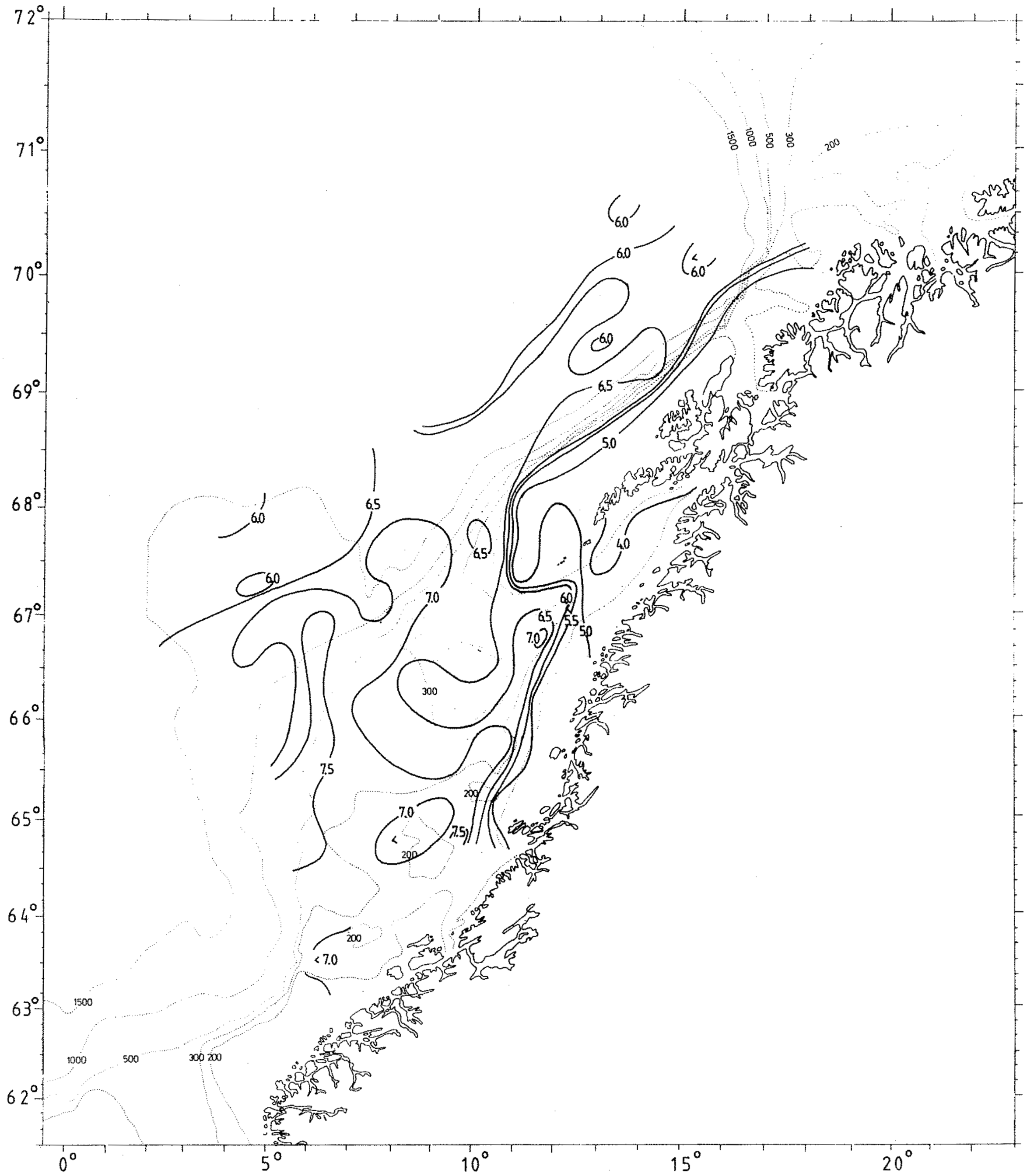
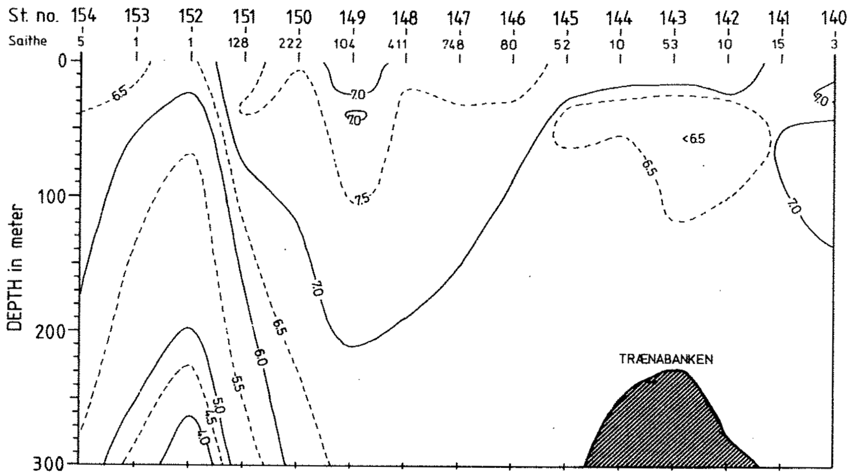


Fig. 5. Distribution of temperature (°C) in 50 meter depth.

Fig. 6. Distribution of temperature (^{O}C) in 100 meter depth or at the bottom where the bottom depth was less than 100 meter.

Survey track III:



Survey track I:

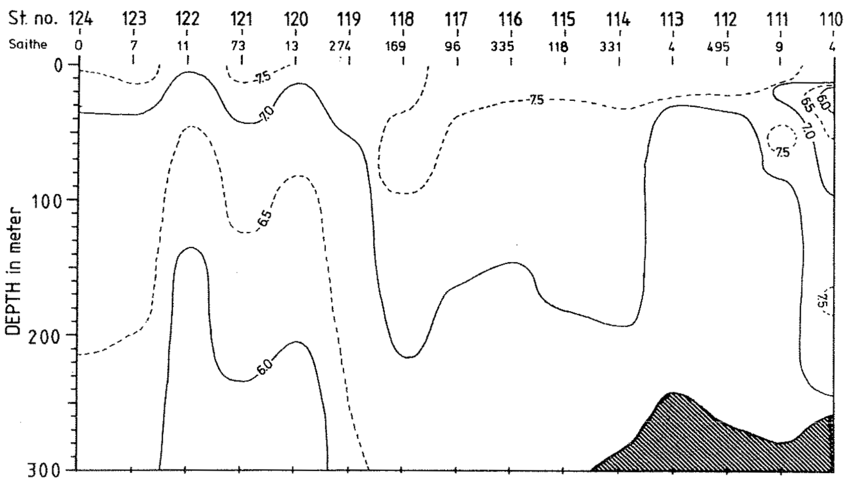
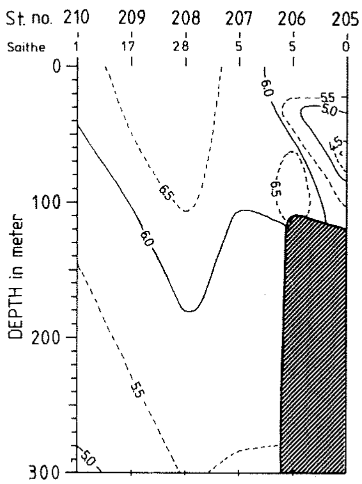
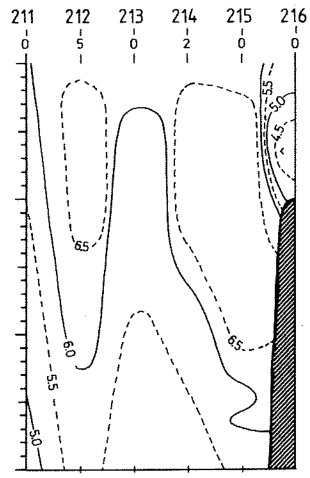


Fig. 7. Hydrographical sections from some of the survey tracks showing the vertical distribution of temperature. Station numbers with the corresponding catch of 0-group saithe have been recorded in the right relative position.

Survey track IX



Survey track X:



Survey track V:

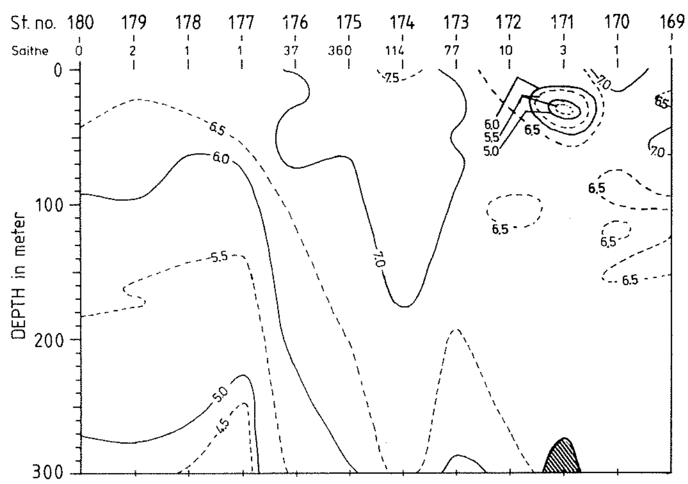


Fig. 7 continue. Hydrographical sections.

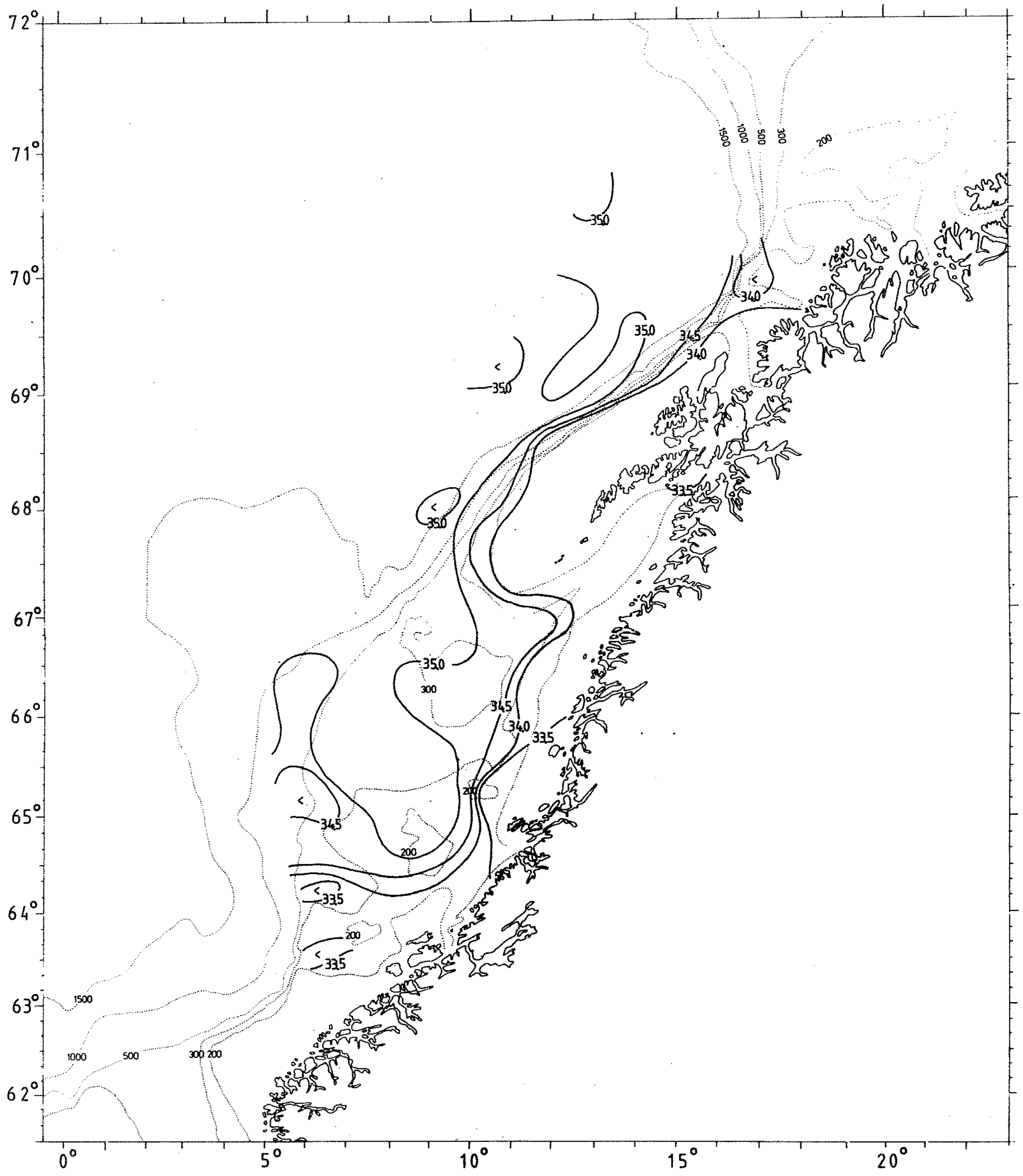


Fig. 8. Distribution of salinity in 25 meter depth.

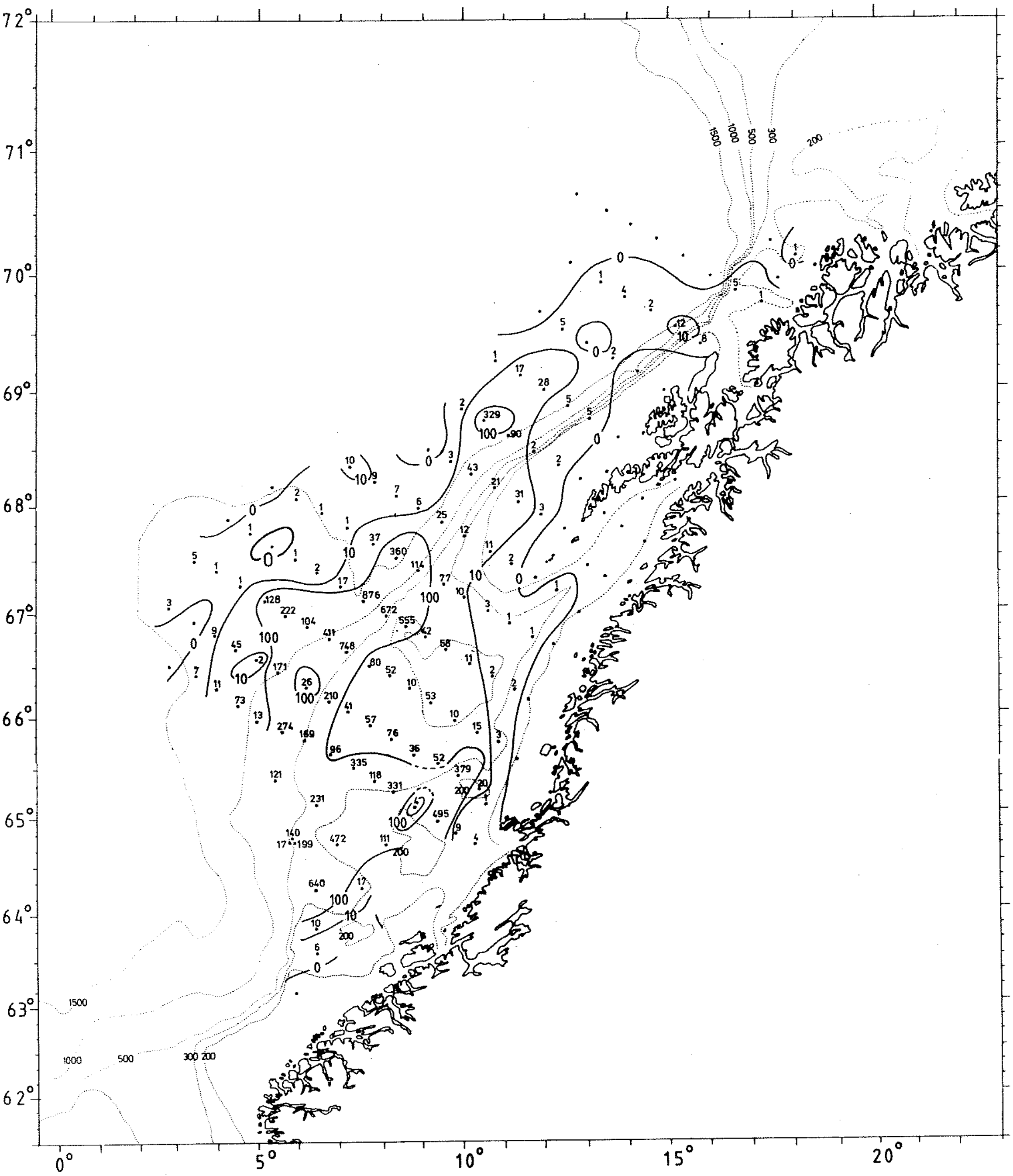


Fig. 9. SAITHE. Distribution of saithe postlarvae. Number per 1.8 nautical miles. Stations without catch have only been marked.

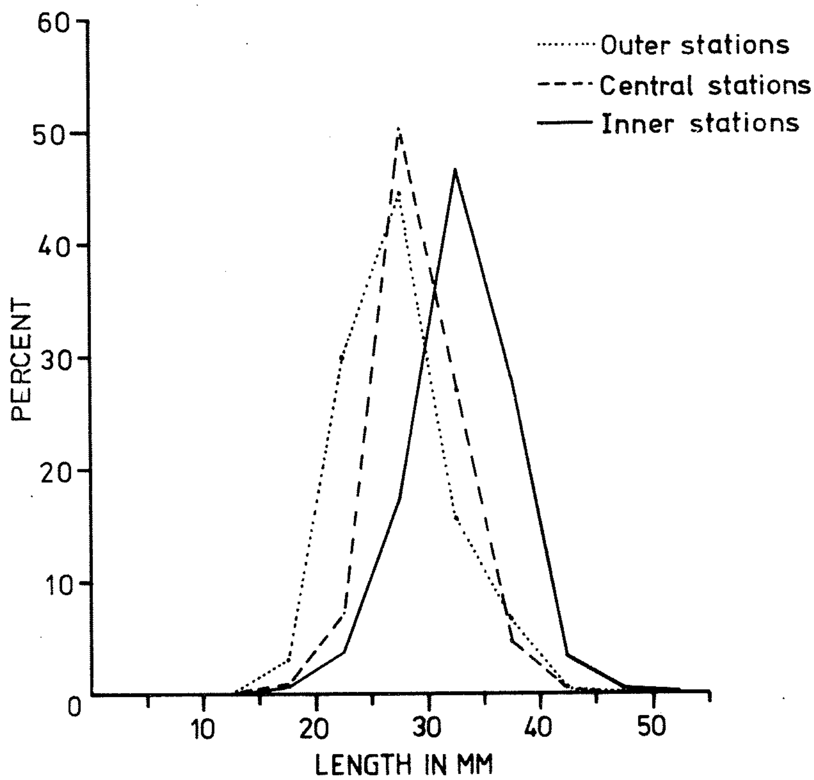


Fig. 10. Length distribution of saithe postlarvae on the outer (western), central, and inner (eastern) third of the five southernmost tracks.

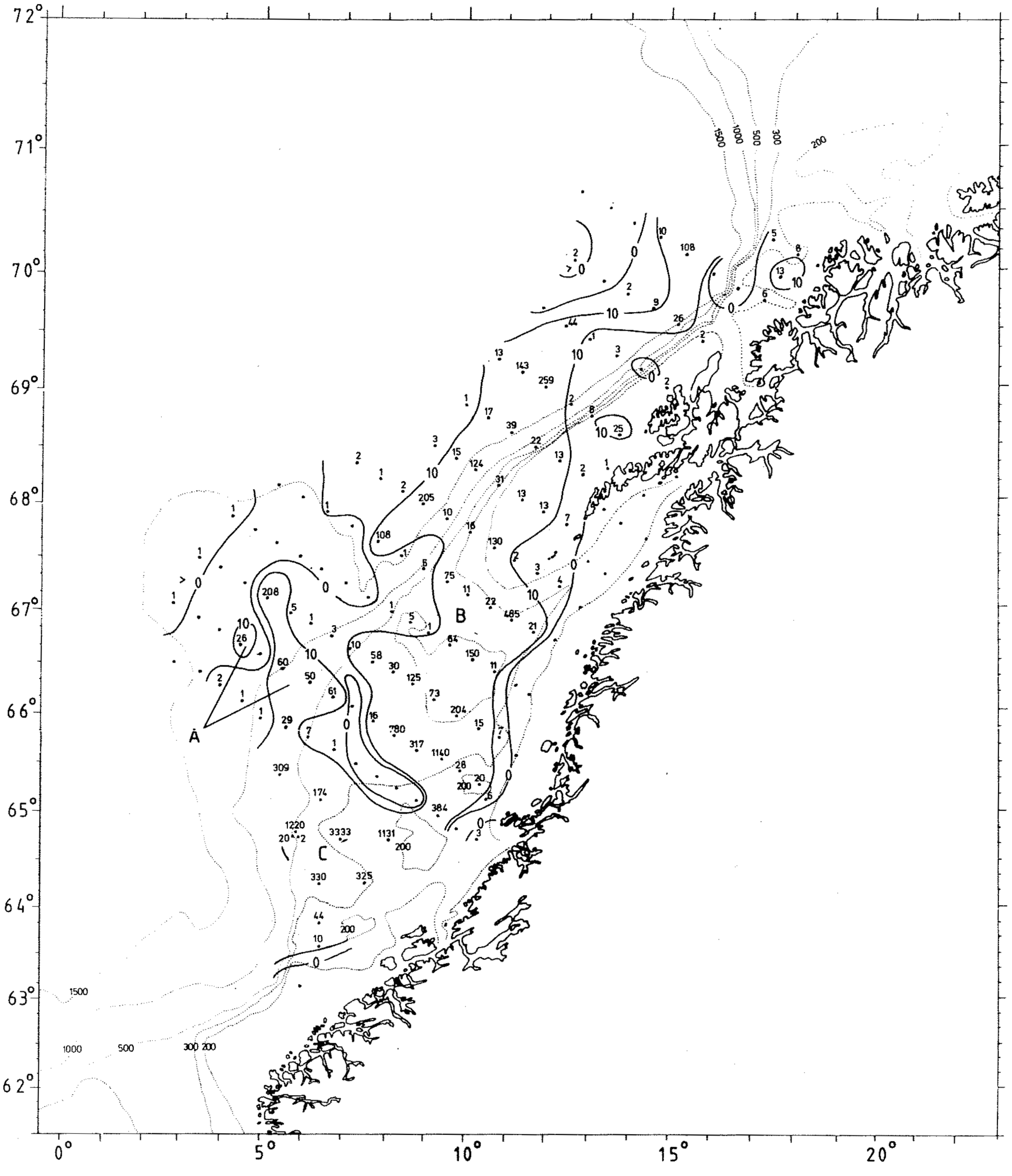


Fig. 11. HERRING. Distribution of herring larvae. Number per 1.8 nautical miles. Stations without catch have only been marked. Separate length distributions of larvae from each of the areas A, B and C have been presented in fig. 12.

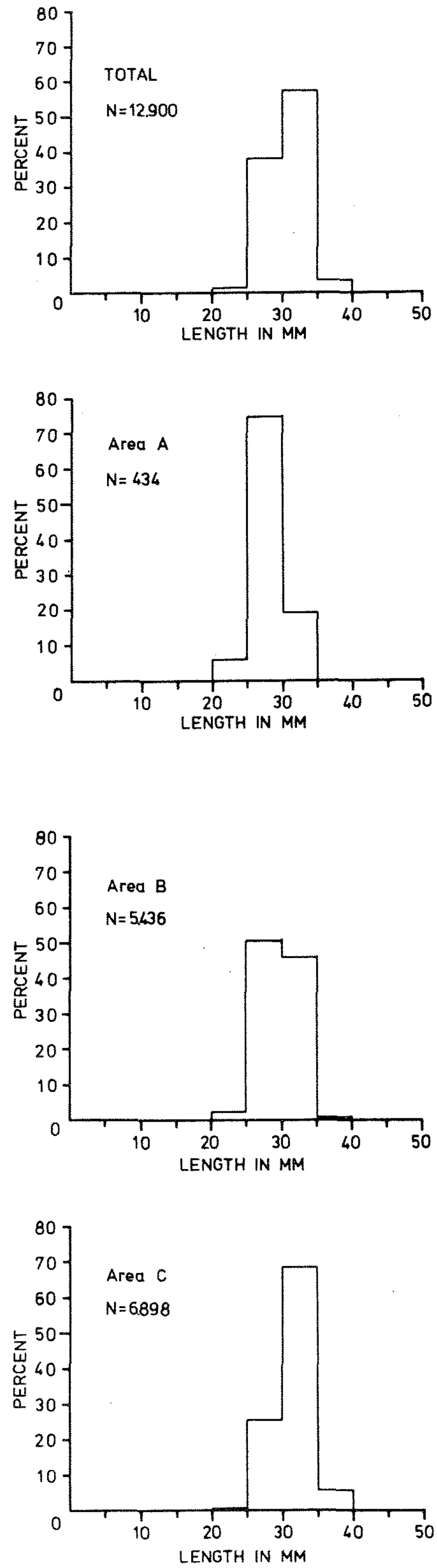


Fig. 12. Length distribution of herring larvae from the total surveyed area and from the subareas showed in Fig. 11.

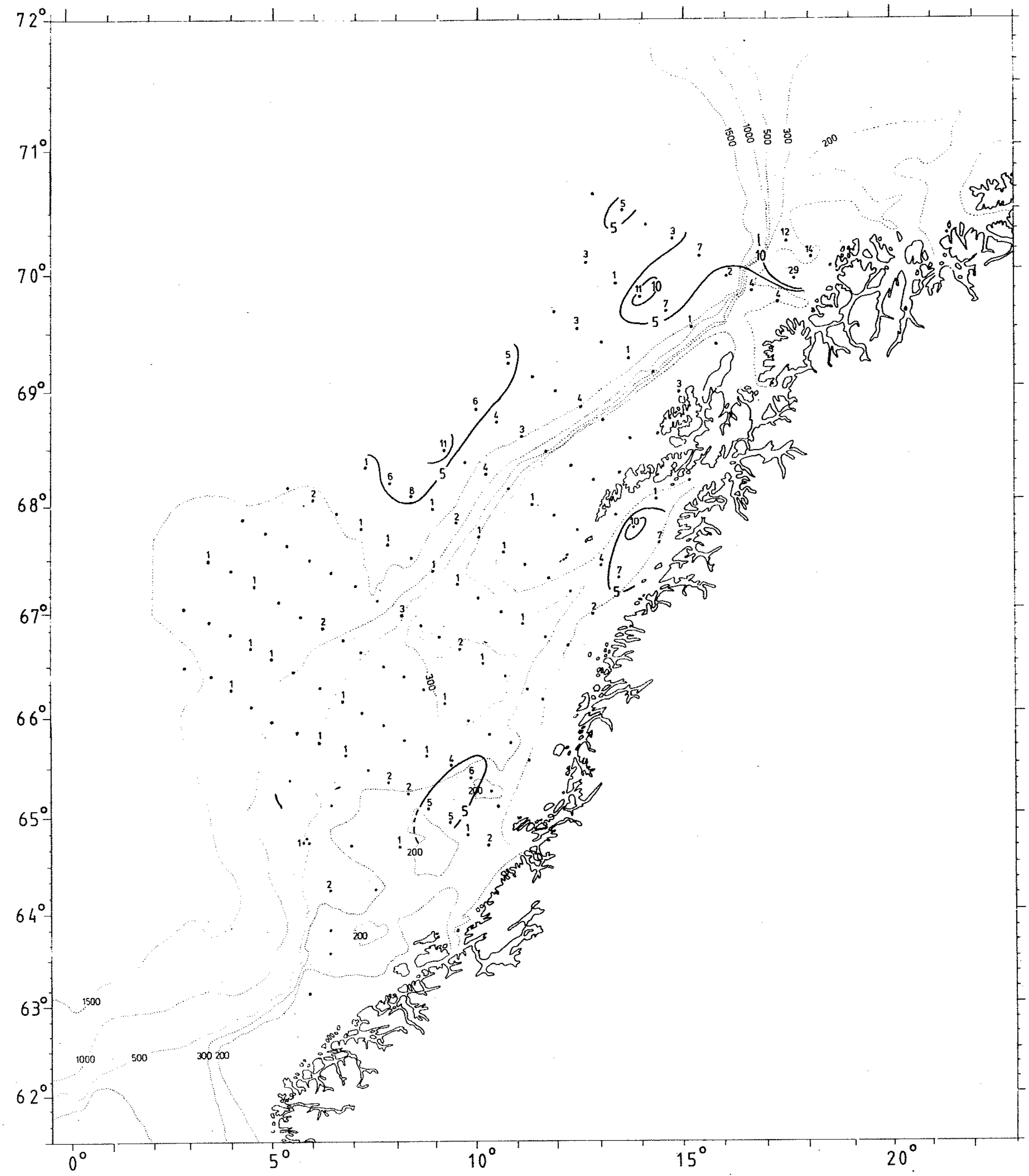


Fig. 13. CATFISH. Distribution of catfish postlarvae. Number per 1.8 nautical miles. Stations without catch have only been marked.

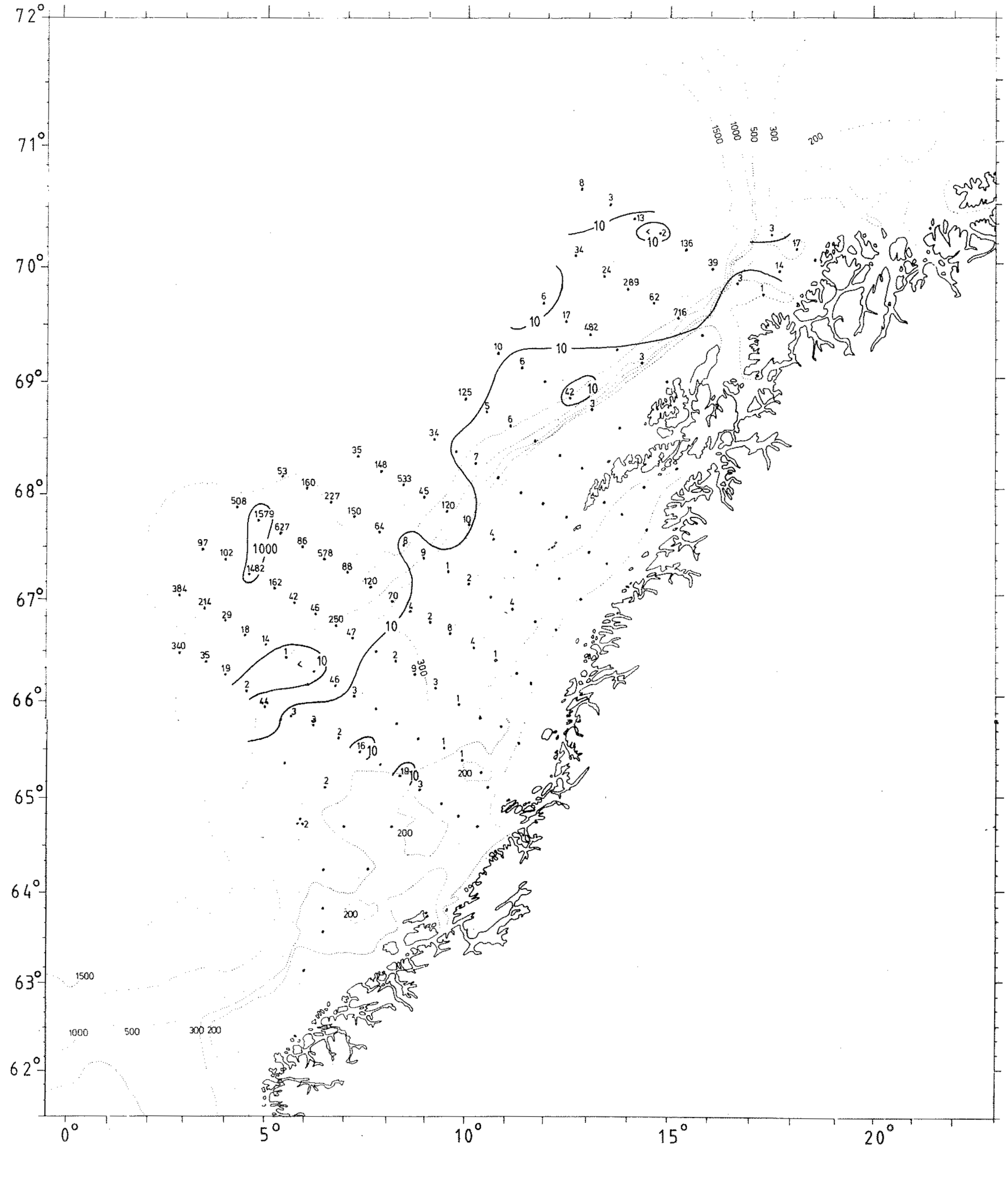


Fig. 14. Gonatus fabricii. Distribution of this ten armed squid presented as number per 1.8 nautical miles. Stations without catch have only been marked.

HAVFORSKNINGSINSTITUTTETS EGG- OG LARVEPROGRAM

POSTLARVEUNDERSØKELSER-JUNI/JULI 1985

av

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Fiskeridirektoratets Havforskningsinstitutt

Postboks 1870, 5024 BERGEN

SAMMENDRAG

I området utenfor Finnmark og Troms er fiskelarver blitt innsamlet i juni/juli siden 1977. Innsamlingen har foregått med pelagisk trål i de øvre 60 m og hensikten har vært å se på fordelingen av larver og om mulig få et mål for årsklassens styrke av enkelte arter. Etter 1983 har innsamlingen konsentrert seg om fordelingen av torskelarver, og det har vist seg at mengden av torsk funnet på dette toktet gjenspeiler mengden av torsk funnet i august/september. Mengden av torsk i 1985 er ca 2/3 av det som ble funnet rekordåret 1983.

GJENNOMFØRING

Fig. 1 viser kurser og stasjoner. Toktet ble ikke værhindret. Trålen brukt på tidligere postlarvetokt ble slitt vekk under første forsøket på sammenlignende trekk. Tråltrekkene ble tatt med en Harstadtrål med åpning på 16x16 favner. De bakerste fire metrene av posen var dekket med tobisnett med maskevidde 8 mm (strukket maske). Når trålen kom ombord ble delen med tobisnettet først ristet godt og fangsten tatt ut. Etterpå ble denne delen spylt godt med sjøvann. Deretter ble den bakre delen av trålen vasket i åpen tilstand i 2-3 minutt mens båten gikk i marsjfart.

FOREKOMSTEN AV DE VIKTIGSTE ARTENE

Følgende arter ble funnet (Totalt antall pr. tråltime i parantes): Uer (614 586) lodde <40 mm (127 000), torsk (124 874), sild (64 370), sei (8 740), langebarn (5 550), gapeflyndre (4 897), tobis (1 608), steinbit (1 335), blåkveite (202), hyse (140) og hornkvabbe (100). I mindre antall ble det funnet tangsprell, ringbuk, panserulke, vanlig ulke og laksesild.

<u>Uer</u> (Fig. 4). Som tidligere år ble bare den østlige delen av utbredelsesområdet for uerlarvene dekket da de største forekomstene finnes ute i Norskehavet vest for egga. I år ble det imidlertid funnet forholdsvis store mengder inn over Tromsøflaket og over de dypere områdene rundt Tromsøflaket.

<u>Lodde</u> (Fig. 5). Loddelarver mindre enn 40 mm ble funnet over kontinentalsokkelen i omtrent samme område som i fjor, d.v.s. hovedsaklig på bankområdene Tromsøflaket og Nordkappbanken.

<u>Torsk</u> (Fig. 6). Sammenlignet med rekordåret 1983 er fordelingen av torskelarver i mye sterkere grad spredt utover i Ingøydjupet, Bjørnøydjupet og nordover mot vestkysten av Vestspitsbergen. Likevel er 57 % av larvene fordelt på Tromsøflaket (innenfor 300 m koten). Andre store konsentrasjoner finner en på Nordkappbanken og over Ingøydjupet. Årsaken til den spredte fordelingen i år (som i fjor) kan ligge i at en forholdsvis større del av eggene er gytt utenfor det

konsentrerte Lofot-området. Den store spredningen har også sammenheng med at kystvannet ser ut til å ha en særlig mektig utbredelse ut over Tromsøflaket (Fig. 2 og 3).

Sild (Fig. 7). Sildelarver ble funnet i størst mengde over Tromsøflaket og Fugløybanken, men forholdsvis høye konsentrasjoner ble også funnet ute i Norskehavet. De åpne isolinjene mot sør viser at på langt nær hele utbredelsesområdet for sildelarver ble dekket. Utbredelsen i det dekkede området er stort sett som i fjor.

Sei (Fig. 8). Seilarver ble i år som i fjor funnet over et stort område. Konsentrasjoner ble funnet utenfor Sørøya og Nordvestbanken og i Norskehavet. Utbredelsen ligner for øvrig den en fant for sild.

Gapeflyndre (Fig. 9). Gapeflyndrelarver ble funnet i den nordøstlige delen av undersøkelsesområdet med en konsentrasjon mellom Tromsøflaket og Nordkappbanken.

Hyse (Fig. 10). Hyselarver ble funnet i lite antall mellom annet over Tromsøflaket.

Tobis (Fig. 11). Tobislarver ble funnet nær land ved Sørøya og i en konsentrasjon i Norskehavet.

SAMMENLIGNING MED TIDLIGERE ÅR

I år ble det benyttet en 16x16 favners Harstadtrål mens det tidligere år er brukt en 10x10 favners Harstadtrål. Det ble forsøkt å gjøre parallelle hal med de to trålene, men den minste trålen revnet under utsetting. Det eneste en da har å holde seg til under utregning av en sammenlignende indeks er forholdet mellom åpningene på trålene. Det forutsettes da at tråldørenes størrelse er tilpasset de to trålene. Åpningen på den største trålen er da 2,56 ganger støre enn på den minste. Unvikelsesmulighetene for larvene minker med økende åpning på trålen. Dersom vi antar at en torskelarve i den aktuelle størrelsen vil kunne være istand til å flytte seg ca. 1 m når den merker at kanten på trålen nærmer seg og at larven vet hvilken retning den skal flykte til, vil forholdet mellom fiskeeffektivitetene for den store og den lille trålen være 2,8 : 1. Dette forholdet er her brukt for å kunne sammenligne årets mengde av torskelarver med tidligere verdier. Tabell 1 viser indeksen for tidligere år. I 1982 var stasjonsdekningen for dårlig i forhold til torskelarvenes utbredelsesområde. For perioden 1977-81 er indeksberegningene noe usikre, mens dekningen i 1983 og 1985 må regnes som god. I 1984 ble dekningen i Bjørnøya-området for dårlig.

For 1985 får en således en indeks som ligger midt mellom 1984 og 1983.

Det uvanlige ved årets undersøkelse var de små mengdene av maneter som ble funnet.

LENGDEMÅLINGER

Lengdefrekvensmålinger av sild, torsk og hyse nord for 68 grader er vist i Tabell 2. Tiden for innsamlingene er stort sett den samme som for alle tre årene. Tabell 3 viser gjennomsnittslengden for de samme tre artene sammen med 0-gruppeindeksen som viser relativ mengde av larver i august/september. I fjorårets toktrapport ble det antydet en mulig sammenheng mellom postlarvenes lengde og 0-gruppeindeksens høyere verdier for torsk og hyse for 1983 og 1984 enn for 1982 da indeksen var middels eller under middels for disse artene. Indeksen for sild gjennom denne perioden fremkom først i år og den viser større gjennomsnittslengde og høyere indeks for 1983 og 1984 i forhold til 1982. Gjennomsnittslengden for torsk i 1985 er derimot svært liten selv om 0-gruppeindeksen for torsk er den største siden undersøkelsene startet i 1965. En forklaring kan være at selv om 10x10 favnerstrålen har den samme oppbygging og maskevidde som 16x16 favnerstrålen så fanger den største trålen av en eller annen grunn flere små larver. En interessant ting er at 0-gruppe torsken hadde nesten samme gjennomsnittslengde i 1985 som i 1984 dvs. 74 mm. Dersom lengdemålingene på postlarvestadiet er sammenlignbare de to siste årene må torskelarvene ha hatt en uvanlig kraftig vekst etter postlarvetoktet.

Tabell 1. Mengdeindeks for torsk fra postlarveundersøkelsene. dldeksen er fremkommet ved at antall larver/tråltime er plottet på kart, isolinjer tegnet og deretter planimitrert. Enhet for indeksen er antall larver/tråltime x kvadratkm x 1 000 000.

År	1979	1980	1981	1982	1983	1984	1985
Indeks	7,1	0,4	15,4	-	74,7	23,5	56,5

Tabell 2. Lengdefrekvensfordeling av sild, torsk og hyse. x = middellengde, n = antall målt.

Lengde mm	Sild			Torsk			Hyse		
	1983	1984	1985	1983	1984	1985	1983	1984	1985
10 - 14				0,1	+	0,6	2,1	1,8	1,5
15 - 19			0,2	3,3	1,0	16,9	24,2	12,4	73,2
20 - 24	0,4	+	0,8	13,0	5,5	57,2	32,6	18,6	5,8
25 - 29	13,7	2,4	6,4	19,0	12,6	20,2	10,5	18,6	1,5
30 - 34	37,1	20,4	25,4	25,0	27,5	4,2	4,2	5,2	4,3
35 - 39	26,0	18,2	42,4	22,5	31,1	1,0	3,2	2,5	4,3
40 - 44	12,4	23,0	22,5	11,5	16,1	+	1,1	1,4	0,7
45 - 49	6,9	11,4	2,4	4,4	4,7	+	5,3	0,8	1,5
50 - 54	3,0	17,9	0,2	0,9	1,0	+	1,5	0,5	1,5
55 - 59	0,5	6,3	+	0,2	0,3		2,1	0,2	
60 - 64		1,0	+	0,1	+			0,5	2,9
65 - 69		+			+		2,1	0,9	
70 - 74					+		2,1	3,2	1,5
75 - 79					+		4,2	2,0	1,5
80 - 84		+					1,1	5,9	
85 - 89							2,1	9,7	
90 - 94							2,1	7,5	
95 - 99								3,2	
100 - 104								3,6	
105 - 109								1,1	
110 - 114								0,7	
n	1220	1-365	1-337	2504	3-397	2-920	95	872	32
x	35,6	37,9	35,8	32,4	35,3	22,8	32,3	49,4	34,3

Tabell 3. Gjennomsnittslengden av postlarver og 0-gruppeindeksen i perioden 1982-85. 0-gruppeindeksen er i en logaritmisk skala.

År	1982	1983	1984	1985
Art				
SILD				
Gj.snl.	30,8	35,6	35,3	35,8
0-gr.ind.	0,00	1,77	0.34	0.23
TORSK				
Gj.snl.	27,3	31,7	35,3	22,8
0-gr.ind.	0,59	1,69	1,55	2,46
HYSE				
Gj.snl.	26,7	32,3	49,4	34,3
0-gr.ind.	0,38	0,62	0,78	0,27

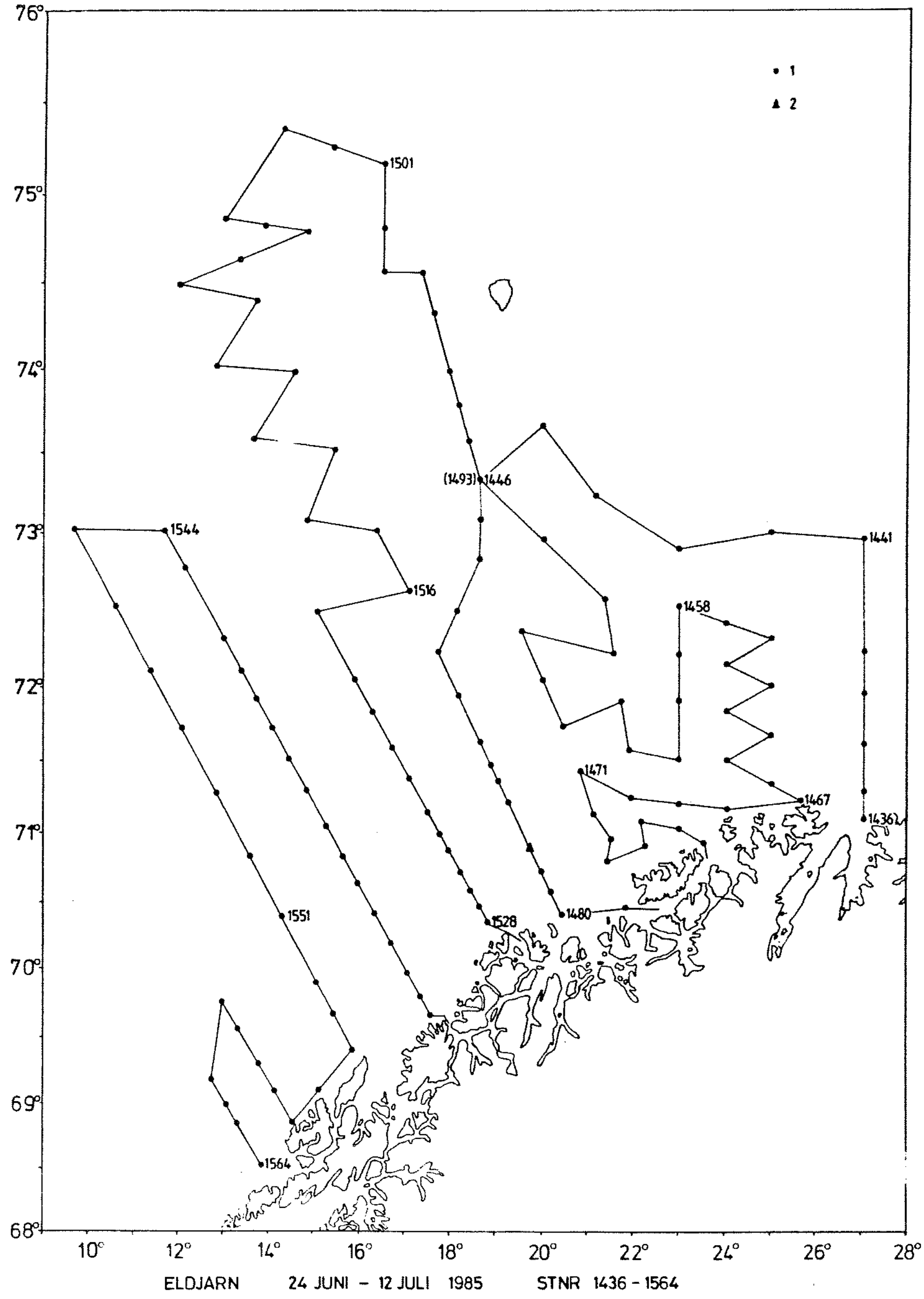

Fig.1. Kurser og stasjoner. 1) Harstadtrål og CTD-sonde. 2) Harstadtrål.

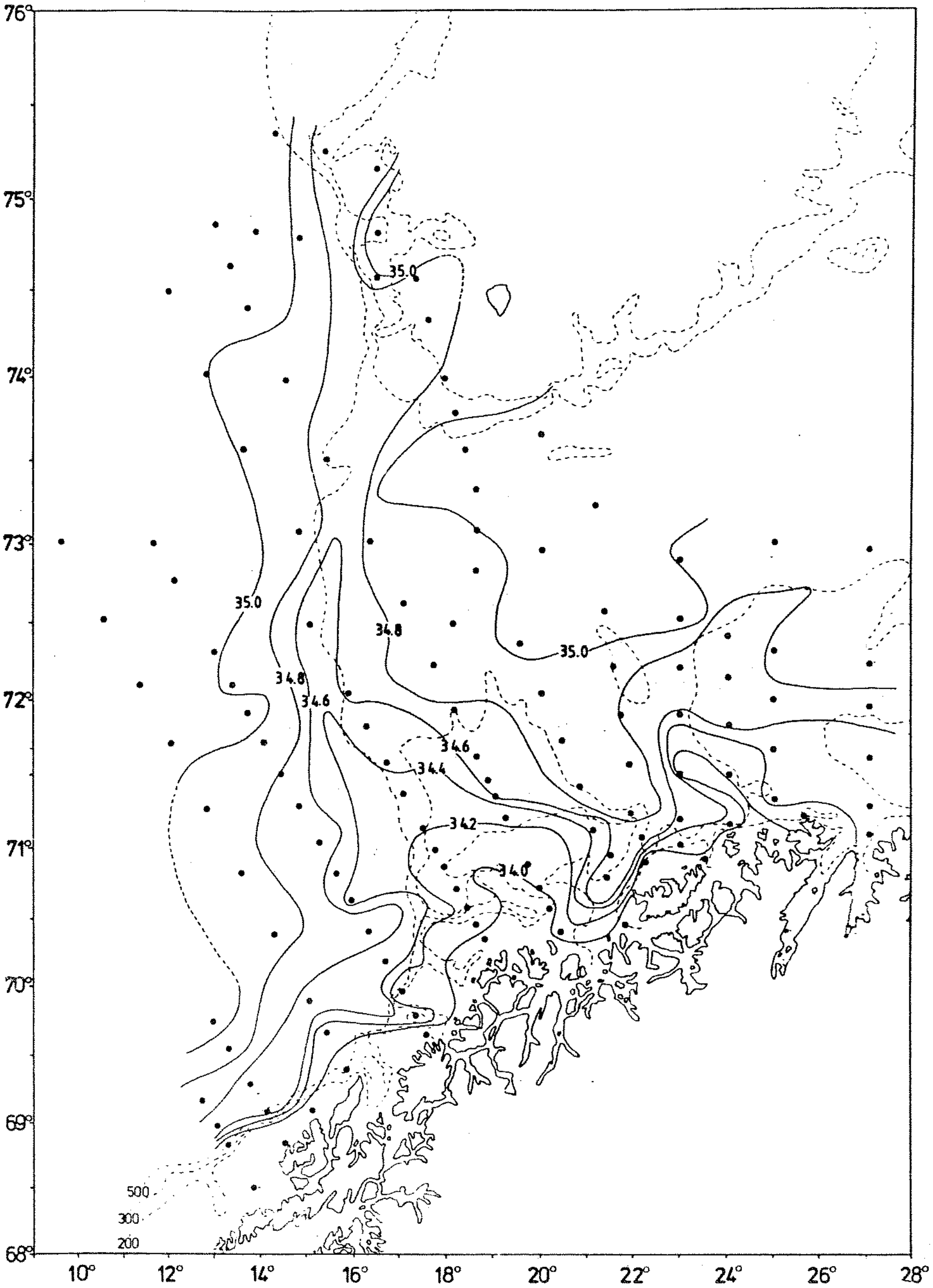

Fig.2. Saltholdighet i 20 m dyp.

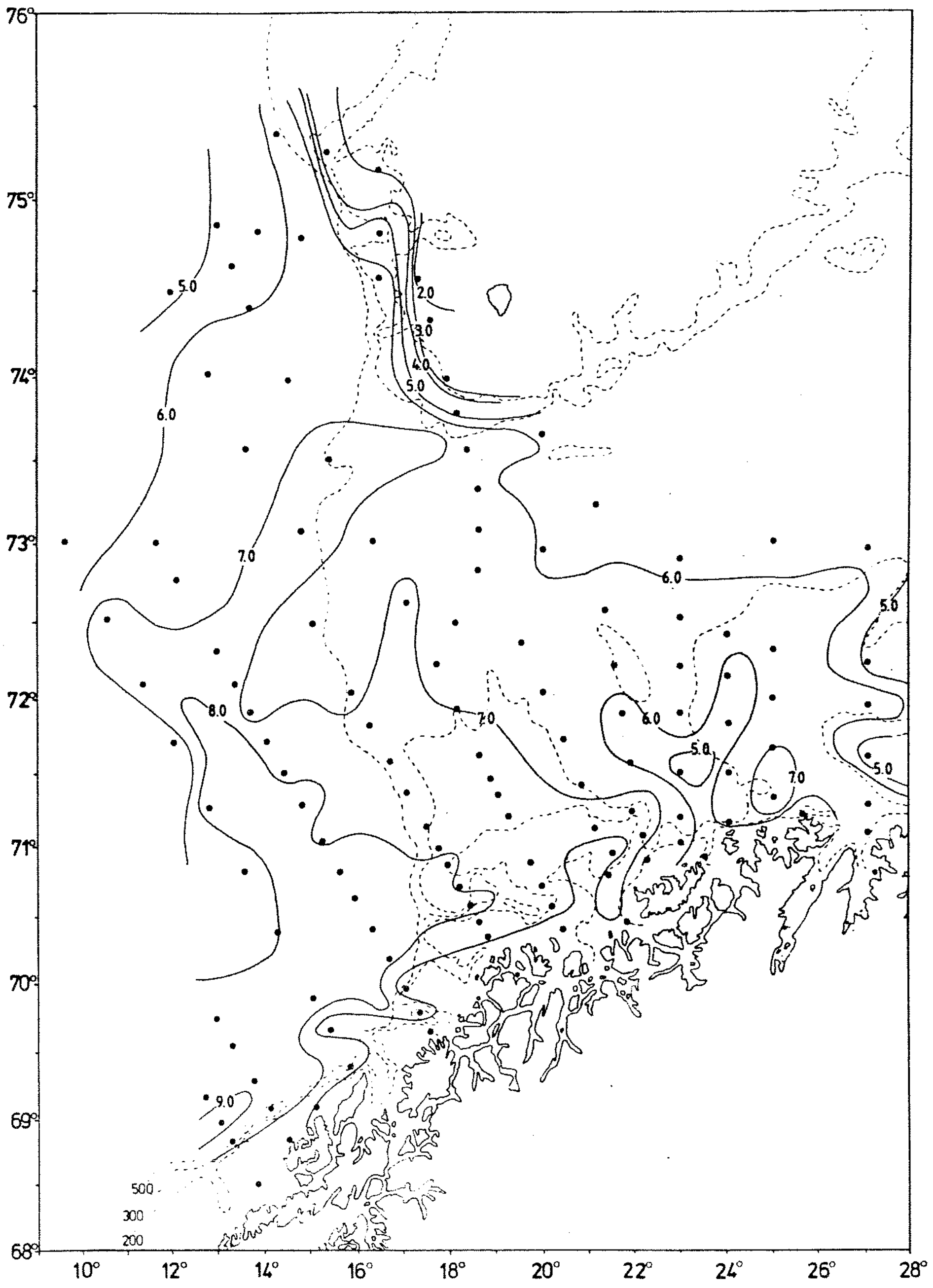

Fig.3. Temperatur i 20 m.

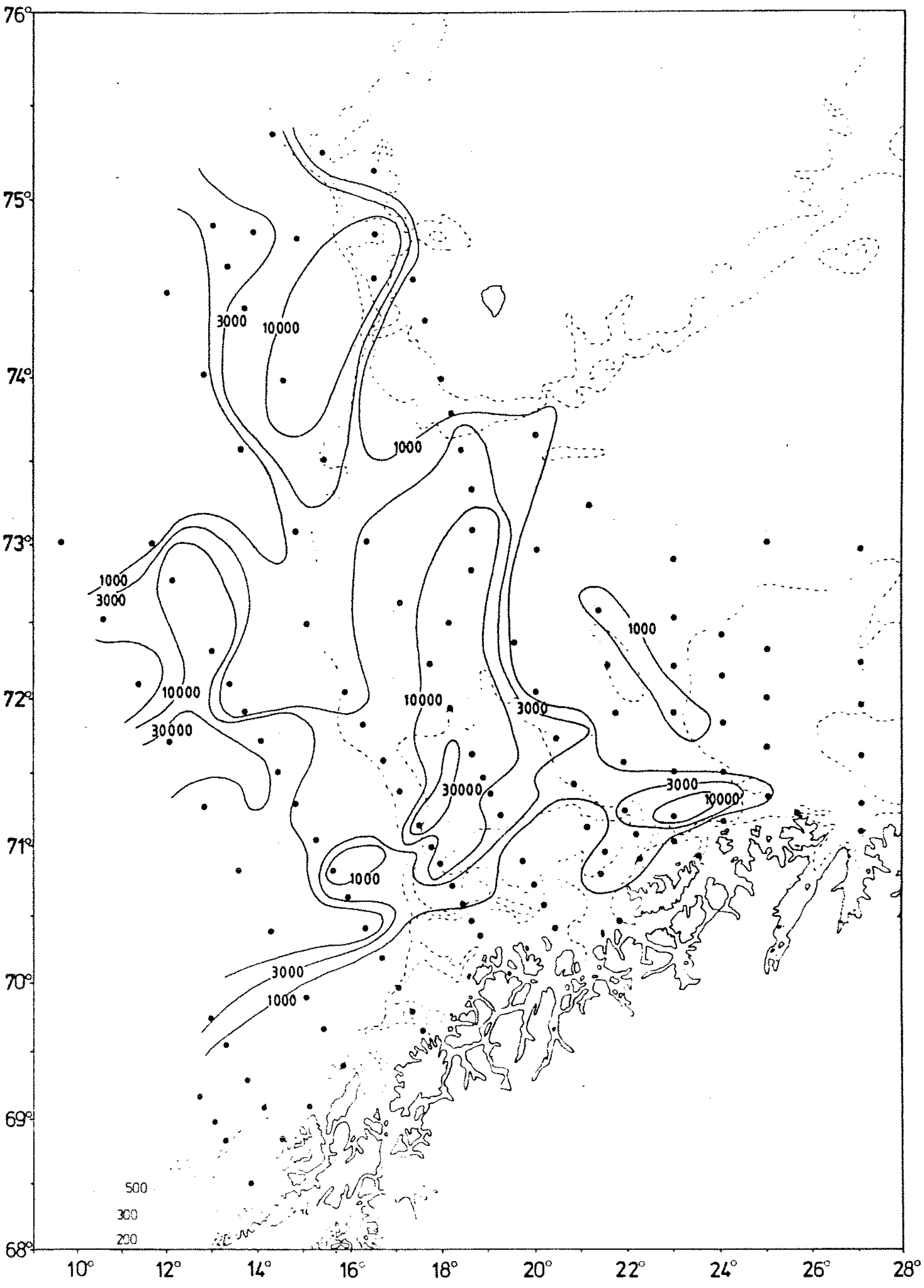

Fig.4. Utbredelsen av uerlarver. Antall/tråltime.

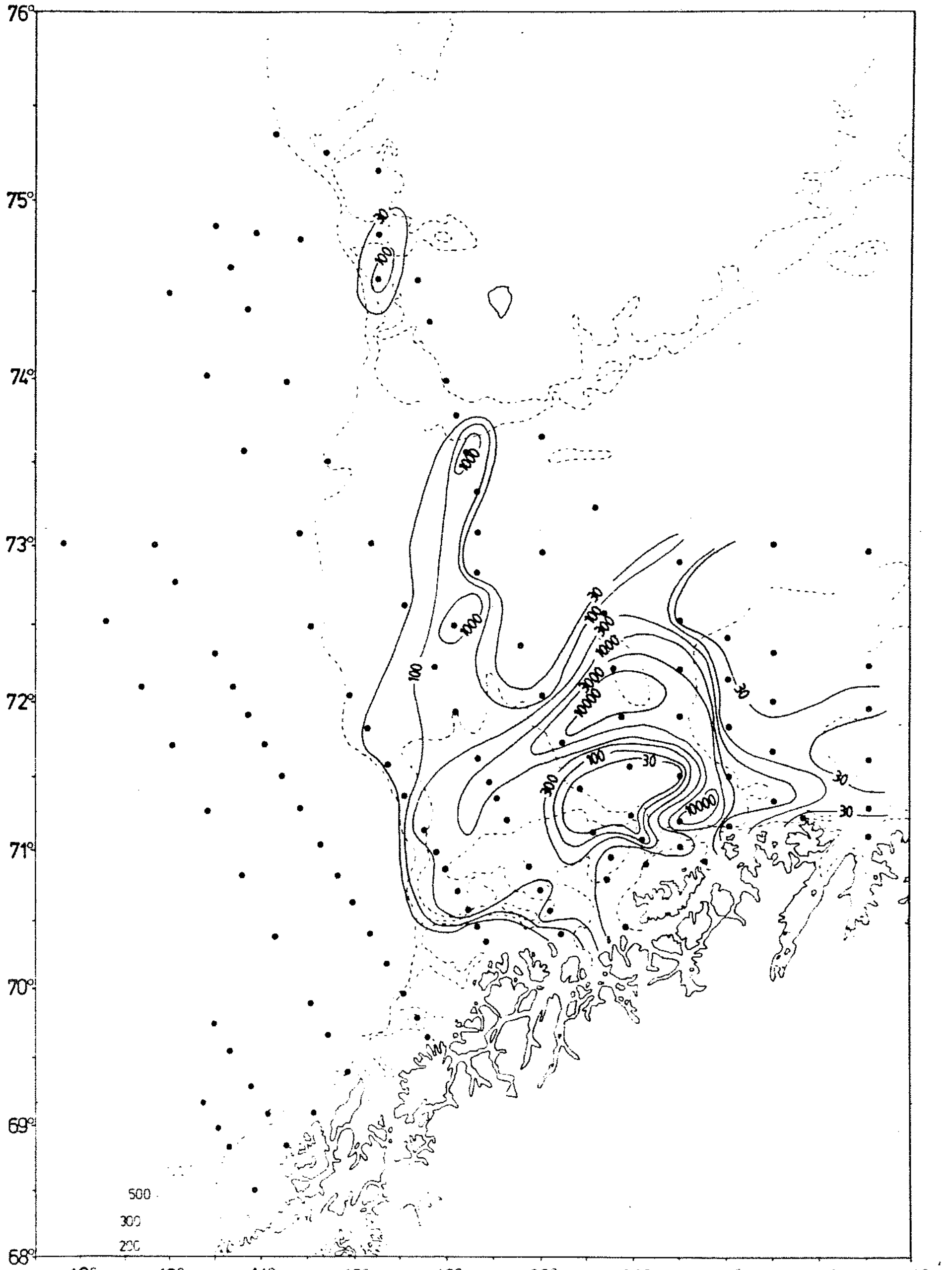

Fig.5. Utbredelsen av loddelarver. Antall/tråltime.

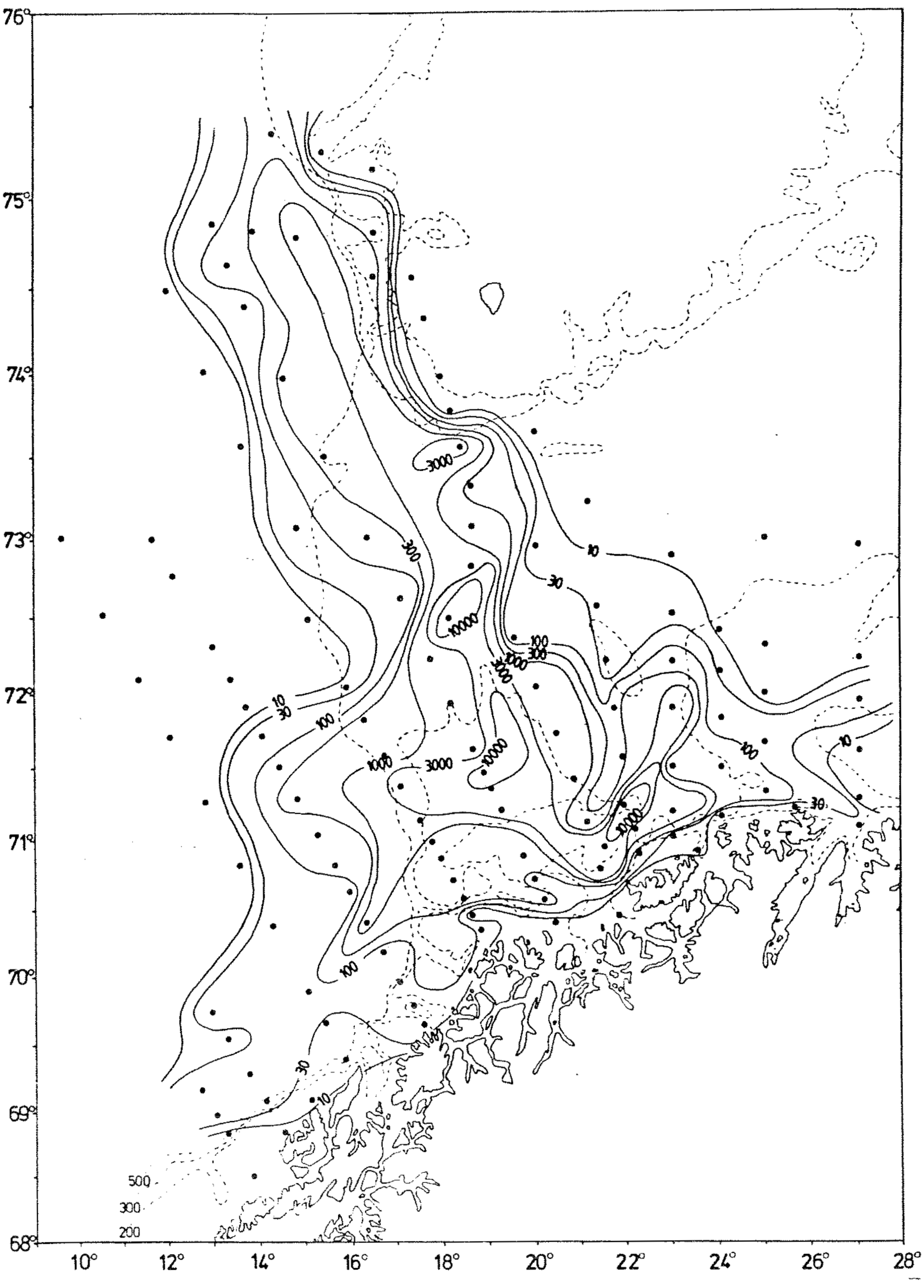

Fig.6. Utbredelsen av torskelarver. Antall/tråltime.

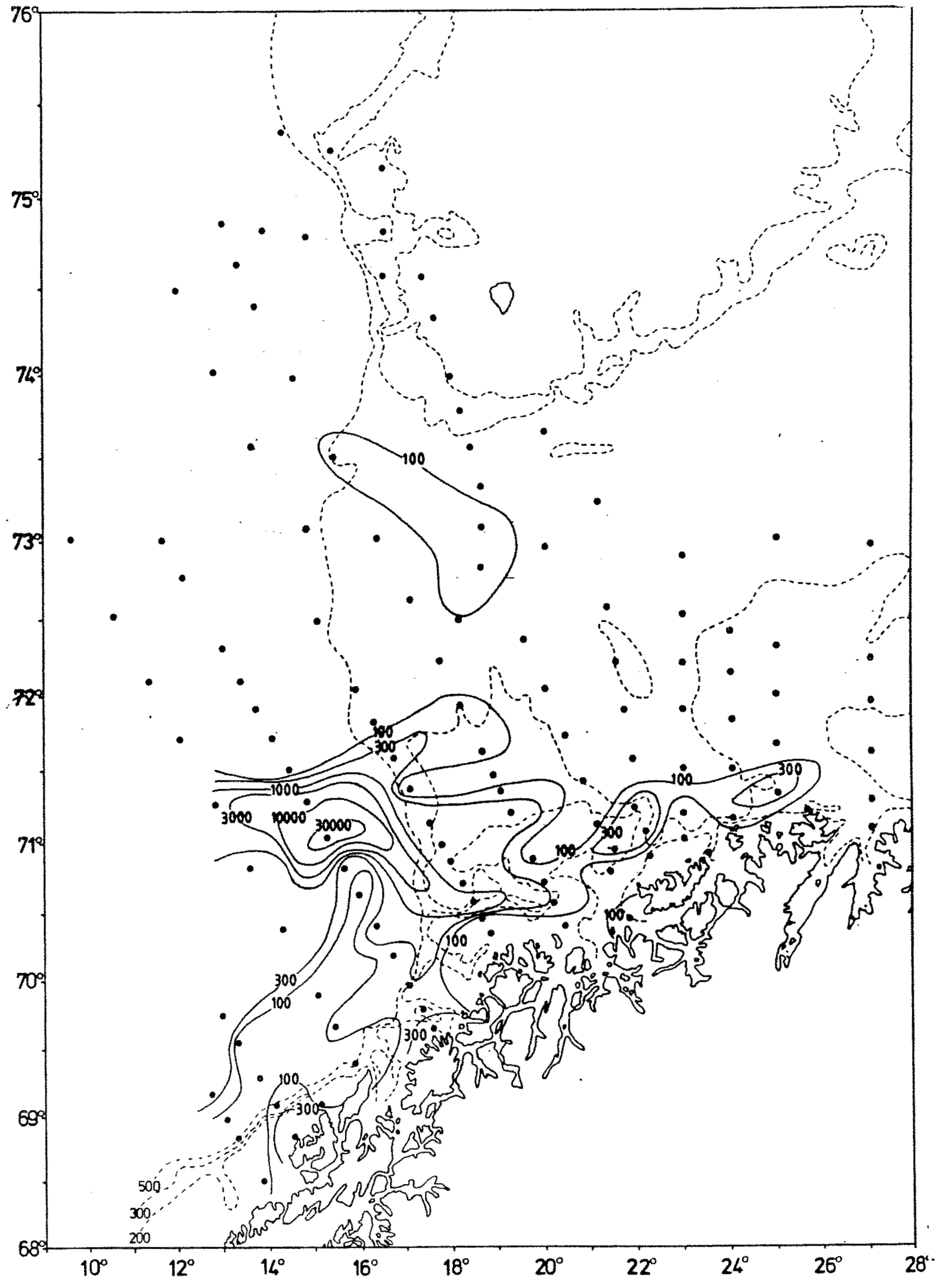

Fig.7. Utbredelsen an sildelarver. Antall/tråltime.

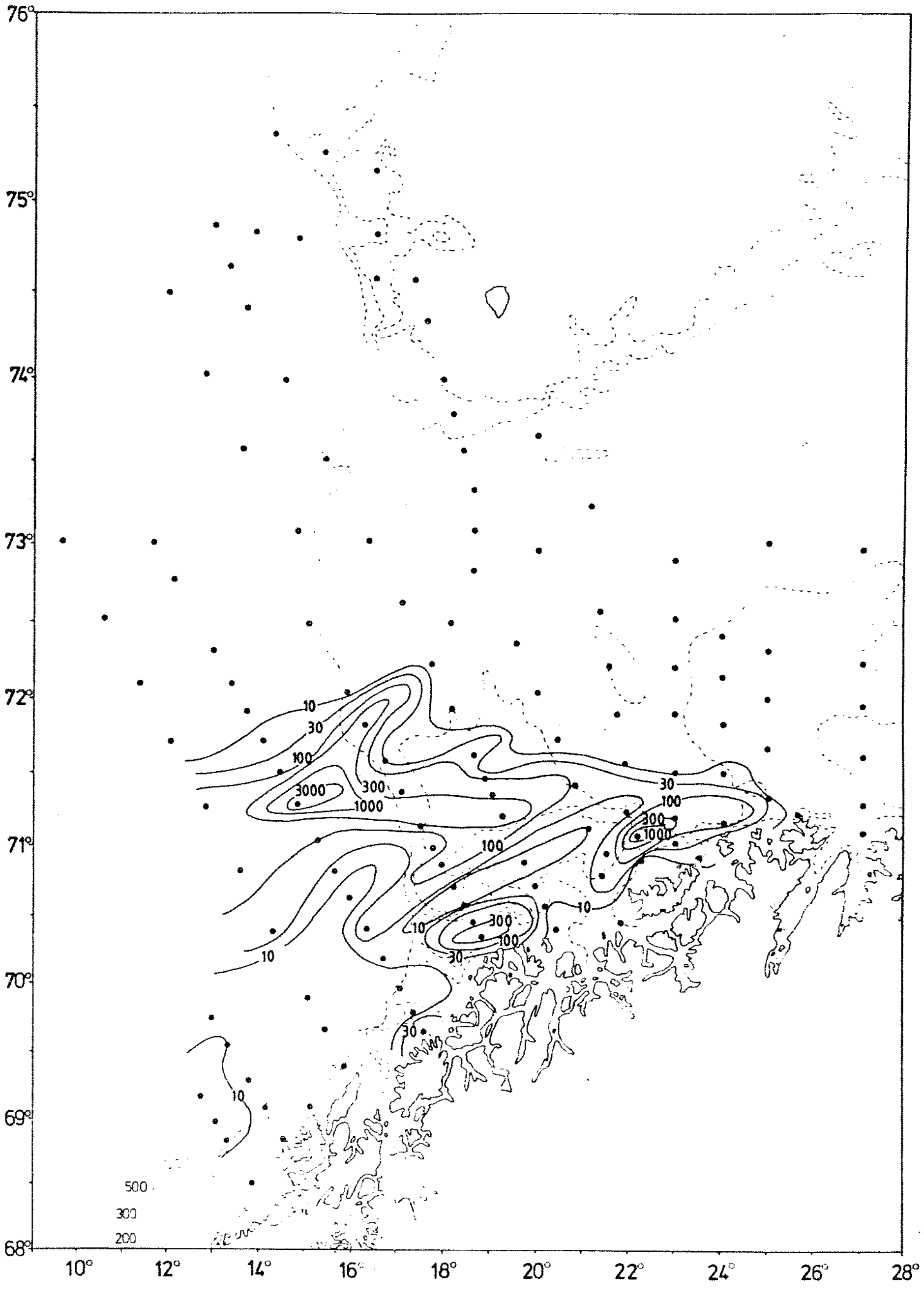

Fig.8. Utbredelsen av seilarver. Antall /tråltime.

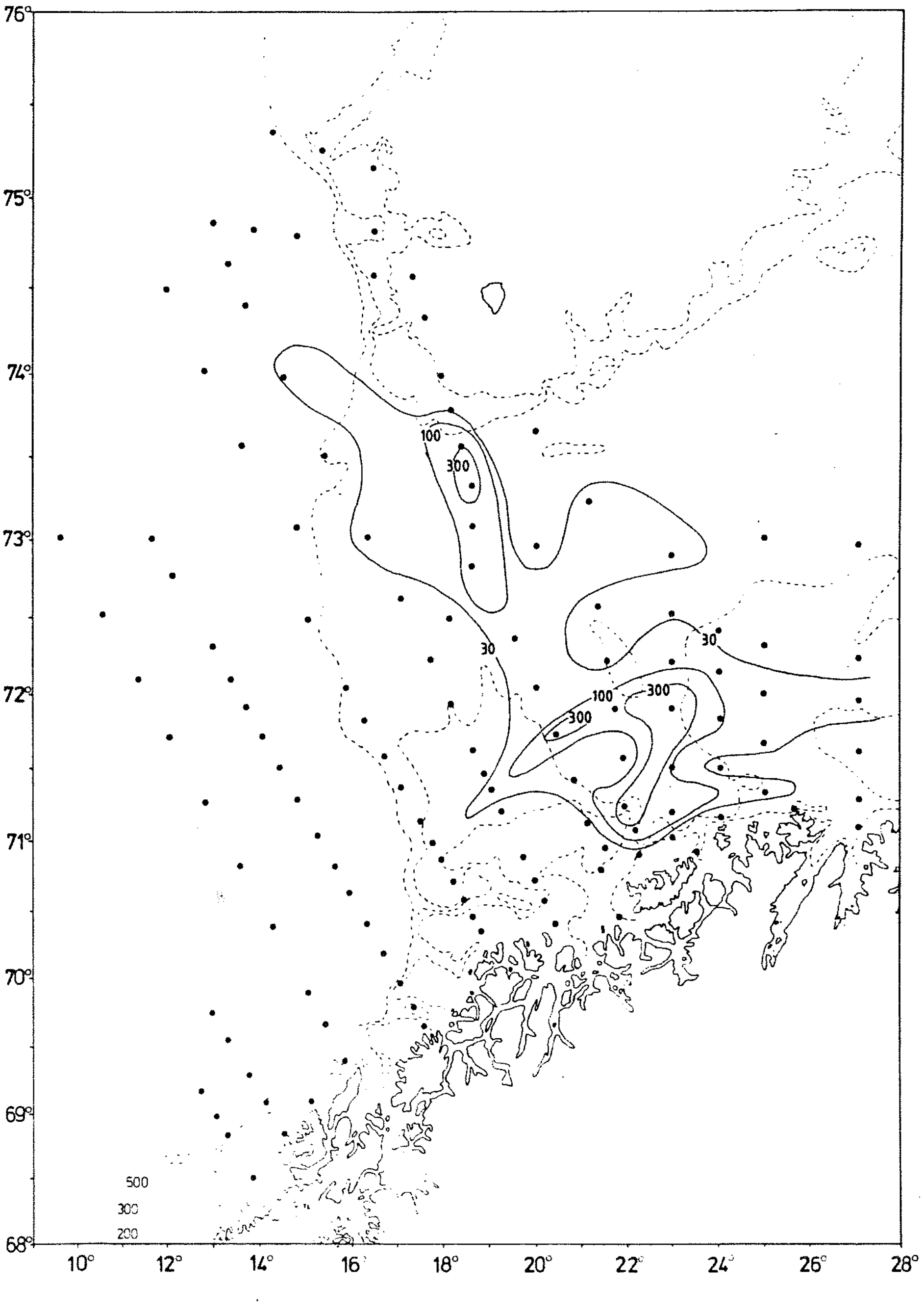

Fig.9. Utbredelsen av gapeflyndrelarver. Antall/tråltime.

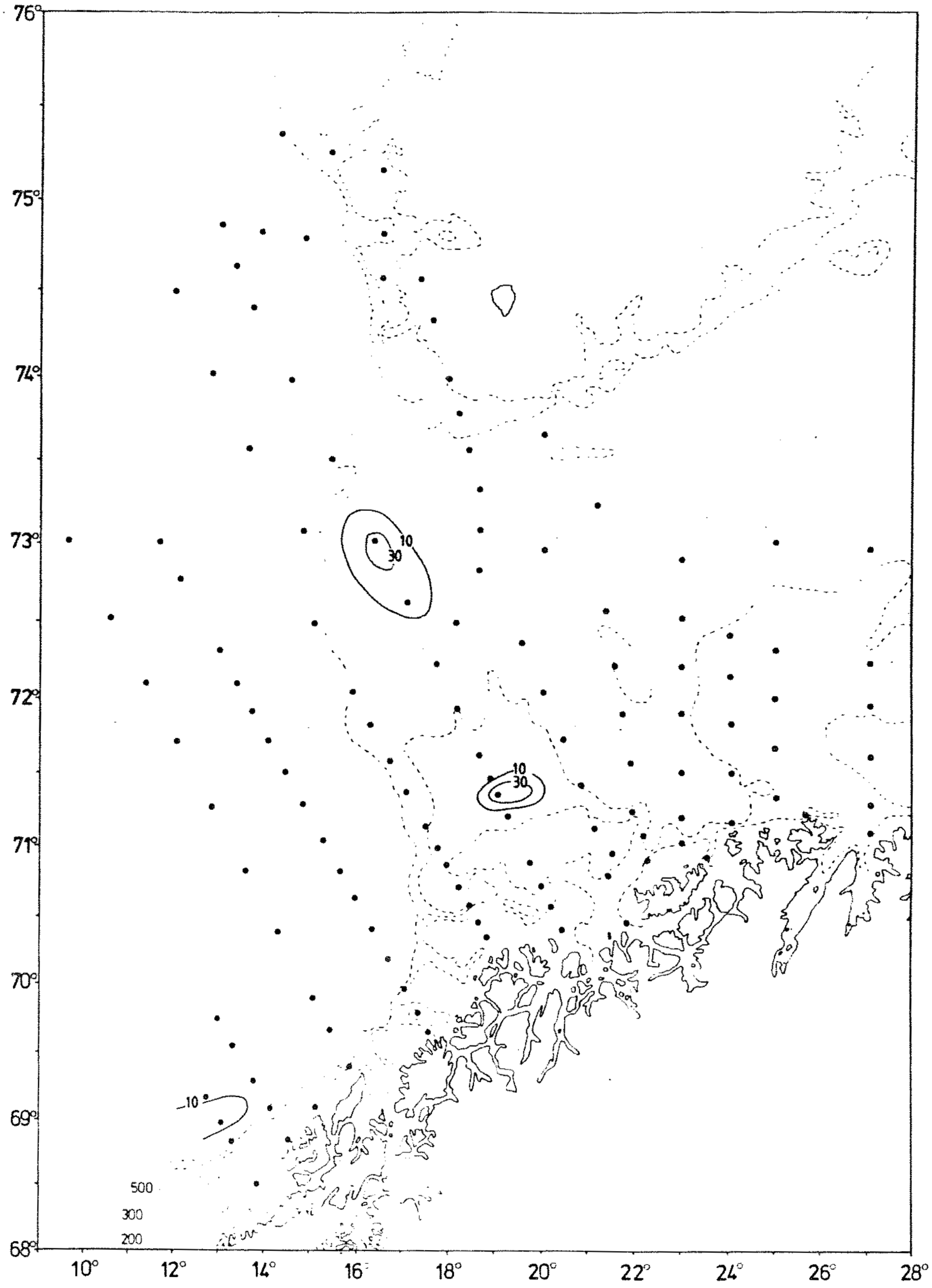

Fig.10. Utbredelsen av hyselarver. Antall/tråltime.

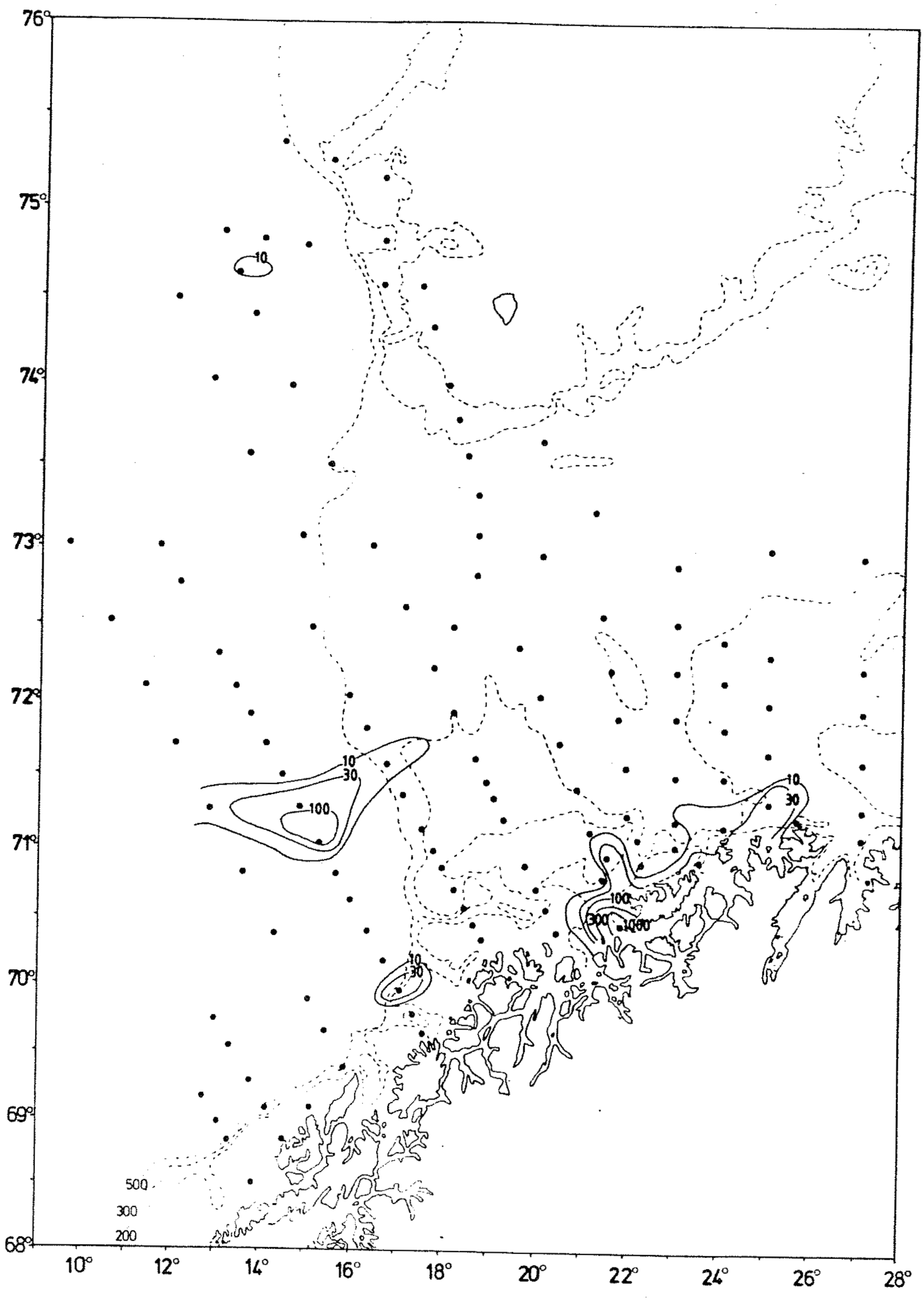

Fig.11. Utbredelse av tobislarver. Antall/tråltime.

Denne rapportserien har begrenset distribusjon. Opplysninger om programmet og rapportene kan rettes til

Programledelsen for HELP
Fiskeridirektoratets Havforskningsinstitutt
Postboks 1870
5024 Bergen

Oversikt over tidligere utkomne rapporter.

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