

This paper not to be cited without prior reference to the
author

International Council for the
Exploration of the Sea

C.M. 1974/H:23
Pelagic Fish (Northern)
Committee



Investigations on abundance and distribution
of herring larvae in the northern North Sea
and adjacent waters in 1973

by

Eka Hohlbeck

Institut für Hochseefischerei und Fischverarbeitung
Rostock, GDR

Investigations on abundance and distribution of herring larvae
in the northern North Sea and adjacent waters in 1973

1. Introduction

The investigations on the herring larvae abundance which have been performed since 1962 were continued in 1973 during a voyage of the fisheries research ship "Eisbär".

A research program agreed upon with the Peoples Republic of Poland and the Soviet Union for the investigation of the herring larvae abundance in the most important spawning areas along the east coasts of Scotland and England started in 1963 and has been continued with only a single interruption (we were unable to investigate the herring larvae abundance in 1972) until the present time.

The results of our work from 1962 to 1967 were published by Hyronimus in 1971, those for 1969 by Schultz and Hahlbeck in 1970 and those for 1970 and 1971 by Hahlbeck in 1973. The above publications and this paper deal exclusively with the results of our contribution to the joint program.

The investigations on the herring larvae abundance are intended to clarify the problem of recruitment and to contribute towards assessment of the coming year classes.

This paper deals with the abundance and distribution of herring larvae in 1973.

Material and Methods

During a voyage in the north-western North Sea and west of the Orkneys and Shetland Isles (ICES areas IVa and partly VIa), ichthyoplankton stations were sampled during the period from the 13th to the 24th of September using the "Hai" plankton sampler and, in order to compare the catches obtained by the "Hai" and a ring trawl, a ring trawl at 13 stations. Only the catches obtained with the "Hai" are shown in all tables and figures.

Table 1: Date of the investigations and number of stations

Date	Area	Number of stations	Mean number of herring larvae/m ² and station
18.9 - 20.9	eastern Orkneys (south of Fair Isle)	39	5
21.9 - 24.9	north-west Orkneys	34	53
15.9 - 17.9	Aberdeen Bank	24	0

The "Hsi" stations were sampled day and night (Gulf III plankton sampler from Messrs. Hydrobios, Kiel, mit Monodur net, mesh size: 315 My between filament centres; yarn thickness: 120 My; metal net used only on Aberdeen Bank, mesh size: 355 My; wire thickness: 224 My).

The herring larvae investigations were performed by the usual oblique hauls using the "Hsi".

The speed of the ship was 5 M.d. The "Hsi" was towed mainly by means of a wire rope with a diameter of 10 mm and the mean hauling and lowering speed was 0.66 m/s.

The depth of the "Hsi" was recorded at all stations. On the Aberdeen Bank, the sampler was equipped with a transducer from a net sounder which was connected to the ship by a net sounder cable in order to check the depth. The simultaneous use of a wire rope and a net sounder cable reduced the stability of the "Hsi". Steady sampling at all depths was not possible at all times owing to the different hauling speeds of the cable and trawl winches.

In the other working areas containing the majority of the stations sampled during the voyage, the Japanese cableless depth meter (FURUNO) was used. The speed of the ship and the duration of the haul were used as a basis for calculating the quantity of water fished.

The unknown filtration rate of the "Hsi" has, in the past, hindered sufficiently good quantitative analyses.

The installation of the flow meter (200 mm diameter) in the inlet opening of the "Hsi" in 1974 will introduce a new quality in the future evaluation of catches obtained by this sampler. The flow meter is calibrated by a fluid flow calibration device.

The area of the "Hai" opening, and thus the cross section of the water body fished, is 0.027 m^2 . On the condition that no pressure wave is formed before the net opening, 50.0 cbm of water are filtered while towing over one nautical mile.

The areas of the regions with abundancies of 1-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, ... larvae were measured by planimetry. The abundancies are shown in the figures in the categories 1-9, 10-49, 50-250 and above 250 for reasons of clarity. The total number of larvae was calculated by multiplying the measured area by the mean number of larvae in the region concerned.

The numbers of larvae were calculated and drawn separately for the three size groups $<10 \text{ mm}$, $10-15 \text{ mm}$ and $>15 \text{ mm}$ and were summed to obtain the total number of larvae caught.

Results

Figure 2 shows the positions of the stations in the whole of the investigated area together with the total number of larvae per square metre.

The highest larvae abundancies were found, as for the last several years, to the west and north-west of the Orkneys.

The larvae were concentrated mainly to the west of the Orkneys where they formed a single continuous area with a single concentration. They were found further to the west than in 1970 and 1971.

This was augmented in 1973 by a conspicuously dense distribution northwards of the Orkneys. The proportion of larvae $>15 \text{ mm}$ was conspicuously larger here than in the area to the west of the Orkneys.

Less herring larvae were found in the Moray Firth region than in 1971. The larvae here generally exceeded 15 mm in length. On the Aberdeen Bank, where numbers worth mentioning were found in 1971 for the first time, no herring larvae were caught in 1973.

Figure 1 gives an impression of the length distribution of the herring larvae. The mean lengthd differ in the subareas to the south of Fair Isle and to the north west of the Orkney Isles only insignificantly. Most larvae in the area with the highest

abundance (north west Orkneys) reached a length of 11 - 13 mm, this also applying to the area south of Fair Isle (mean length: 12.4 mm) where the abundance was not so high. Larvae of all size classes (figures 2b - 2d) were found in the West Orkneys/ Shetlands area.

Small larvae were found primarily in the northern part of the whole area investigated.

The majority of the larvae belonged to the medium sized group which formed the largest size group throughout the area investigated except in the Moray Firth region.

Small quantities of large larvae in noteworthy concentrations were found north of the Orkneys and in the Moray Firth.

More larvae were found south of Fair Isle than in 1971. The suspected drift can be seen in figures 2a - 2d.

Discussion

Table 2 shows the estimates of the herring larvae occurrence in the three size groups and subareas for 1973 together with the estimates from 1969 and 1971 for purposes of comparison.

Compared with 1971, a noteworthy improvement in the larvae abundance can be seen, particularly as a result of the additional areas with a high abundance north of the Orkneys. The numerical values for the abundance in the north west Orkneys area (see table 2) differ considerably from those for 1971. Our investigations in 1973 found the highest abundancies since 1969, although it should be noted that we were unable to investigate the larvae during 1972. Despite this improvement, the abundance should not be assessed as above average. It should also be remembered that, according to NELLEN and HEMPEL, the nylon net used in the "Hoi" for the first time in 1973 has better fishing properties than the metal net. Compared with the results of the ICES 1972 program (Saville and Mc Kay, 1973), the abundances in 1973 were lower than in 1972.

WOOD (1970) suggested that the larvae occurring in the ICES area VI a west of the Orkneys and Shetlands should be separated from the larvae in the north western North Sea (area IV a).

It has not been possible to solve this problem by means of our investigations which in 1971 and in the year discussed here went beyond 4°W.

In 1971, the distribution of the larvae west of the Orkneys covered an uninterrupted area with a pronounced concentration region. The small and medium sized larvae forming the larger part of the larvae were more numerous in the eastern part of this concentration area.

The concentration west of the Orkneys was also strongly pronounced in 1975, but it was located further to the west than in 1970 and 1971 and, at the boundary of the region, merged with the conspicuously dense occurrence north of the Orkneys. The proportion of larvae >15 mm is also conspicuously larger in this area than to the west of the Orkneys. The small and medium sized larvae forming the major part of the abundance indicate that a spawning ground exists in the western part of this area of concentration.

Table 2: Total number ($\times 10^9$) of herring larvae in the investigated area of the North Sea and adjacent waters

	Period	Number of stations	<10 mm	10-15 mm	>15 mm	Tot.
Total	14.9 - 5.10.69	105	34	365	149	548
East Orkneys	17.9 - 20.9.69	38	6	39	4	49
Aberdeen Bank	14.9 - 16.9.69	24	-	-	0.4	0.4
NW Orkneys	27.9 - 3.10.69	21	27	324	121	472
E. Shetlands/ E. Fair Isle	3.10 - 5.10.69	22	0.6	2	24	26.6
Total	16.9 - 28.9.71	102	163	521	92	776
East Orkneys	16.9 - 23.9.71	44	32	58	51	160
Aberdeen Bank	21.9 - 23.9.71	18	6	69	-	74
NW Orkneys	25.9 - 28.9.71	40	125	394	41	542
Total	13.9 - 24.9.73	97	193	1474	144	1734
East Orkneys (S. Fair Isle)	18.9 - 20.9.73	39	7	262	44	299
Aberdeen Bank	13.9 - 17.9.73	24	-	-	-	-
NW Orkneys	21.9 - 24.9.73	34	186	1212	100	1435

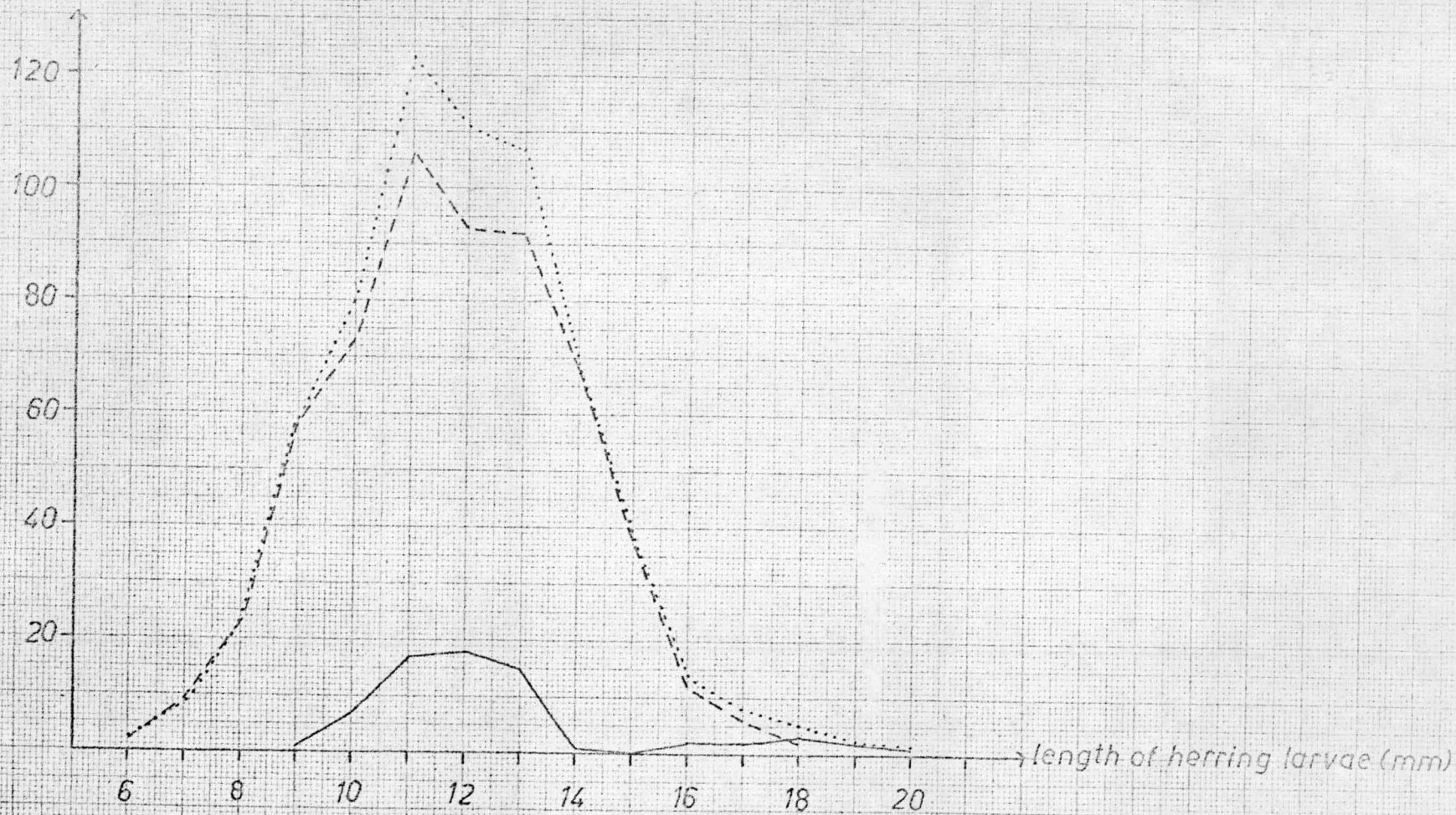
Summarising, it must be said that larvae populations of different origins can merge in the ICES area IV a in some years, but do not merge regularly. This problem will receive further attention in future investigations.

References

- Anon. 1971 Report of the North Sea Herring Assessment Working Group
Coop. Res. Rep. Ser. A. (1971), Nr. 26
- Hahlbeck, E. 1973 Untersuchungen über das Vorkommen von Heringslarven in der nördlichen Nordsee 1970 und 1971
Fischereiforschung, Rostock 11 (1973)
1. S. 53-60
- Hempel, G. 1960 Untersuchungen über die Verbreitung der Heringslarven im Englischen Kanal und der südlichen Nordsee im Januar 1959
Helgol. Wiss. Meeresunters. 7 (1960)
S. 72-79
- Hyroniatis, E. 1971 Abundance and distribution of herring larvae in the western North Sea in 1962-1967
Repp. Proc. Verb. Copenhagen 160 (1971), S. 83-86
- Nellen, W. und Hempel, G. 1969 Versuche zur Fängigkeit des "Hoi" und des modifizierten Gulf-V-Planktonzählers "Neckthai"
Ber. D.W.K. Meeresforsch. 20 (1969) 2,
S. 141-154
- Saville, A. and Mc. Kay, D.W. 1973 Report on the international surveys of herring larvae in the North Sea and adjacent waters in 1972/73
ICES C.M. 1973, H: 13 (Mimeo)
- Schultz, H. and Hahlbeck, E. 1970 Untersuchungen zum Heringslarvenaufkommen in der nordwestlichen Nordsee 1969
Fischereiforschung, Rostock 8 (1970), 2, S. 59-63
- Wood, R.J. 1970 Report on the international surveys of Herring Larvae in the North Sea and adjacent waters in 1969/70
ICES C.M. (1970) H: 4 (Mimeo)
- Zijlstra, J.J. 1972 Report on the international surveys of Herring Larvae in the North Sea and adjacent waters in 1970/71
Coop. Res. Rep., Ser. A. (1972) Nr. 23

herring larvae
numbers

Fig. 1: Length distribution of herring larvae, 19, 3



— south of Fair Isle
- - - northwest of Orkneys
..... total

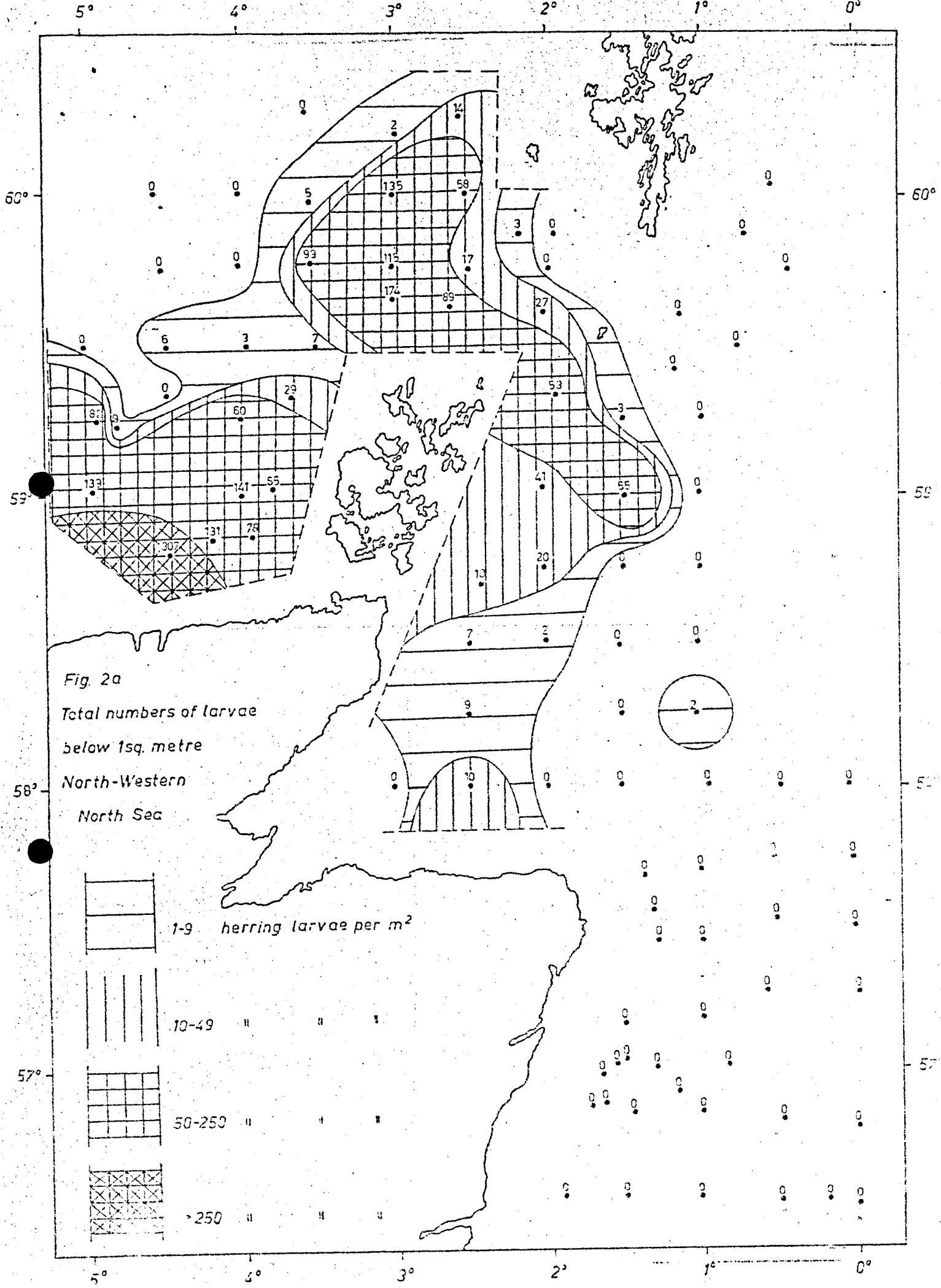
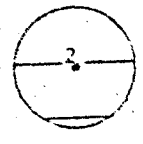
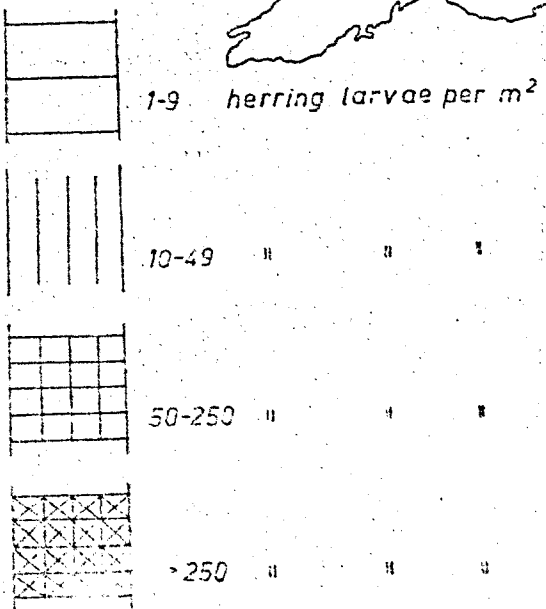


Fig. 2a
 Total numbers of larvae
 below 1sq. metre
 North-Western
 North Sea



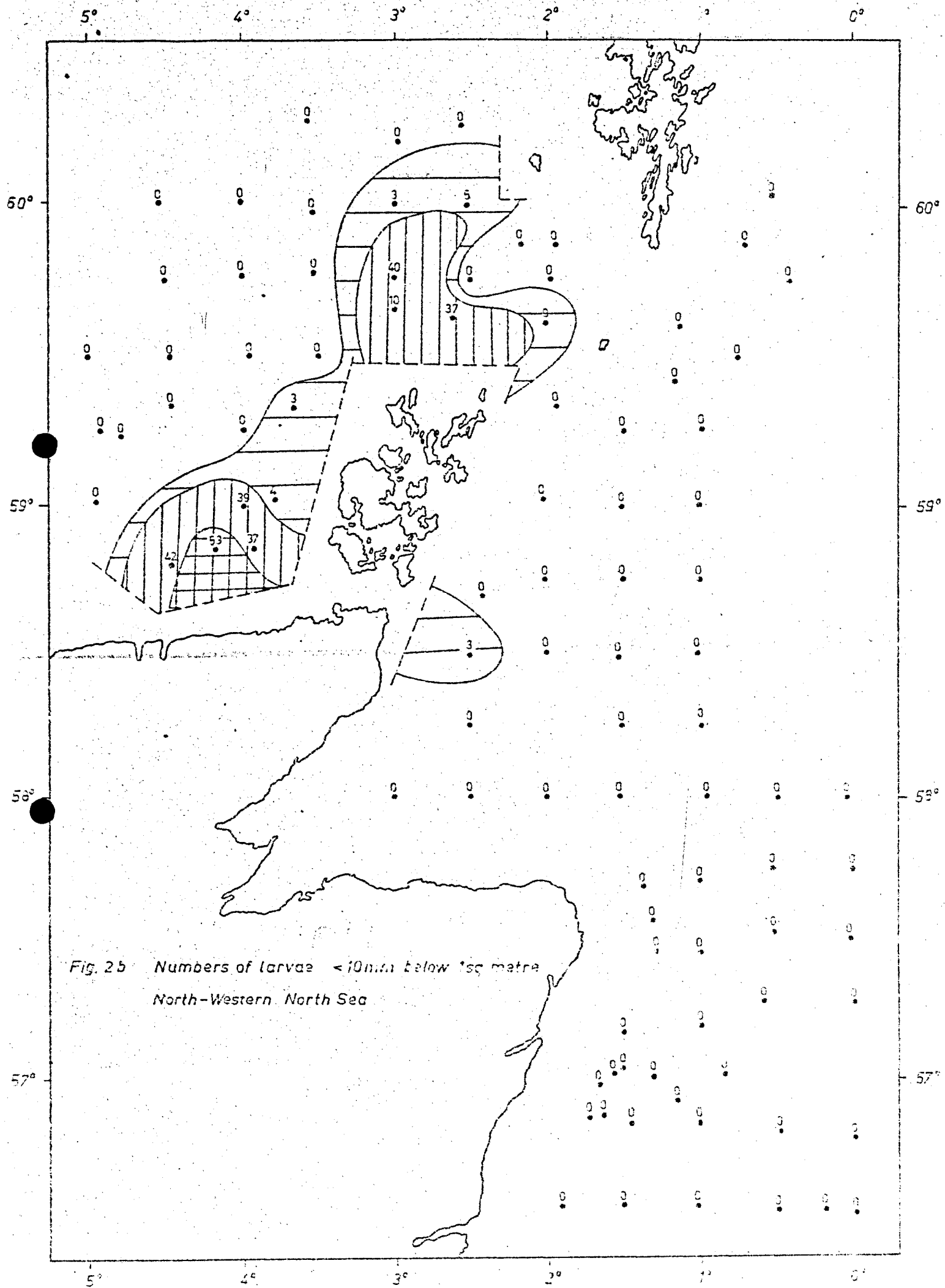


Fig. 2b Numbers of larvae <10mm below 1sq metre
North-Western North Sea

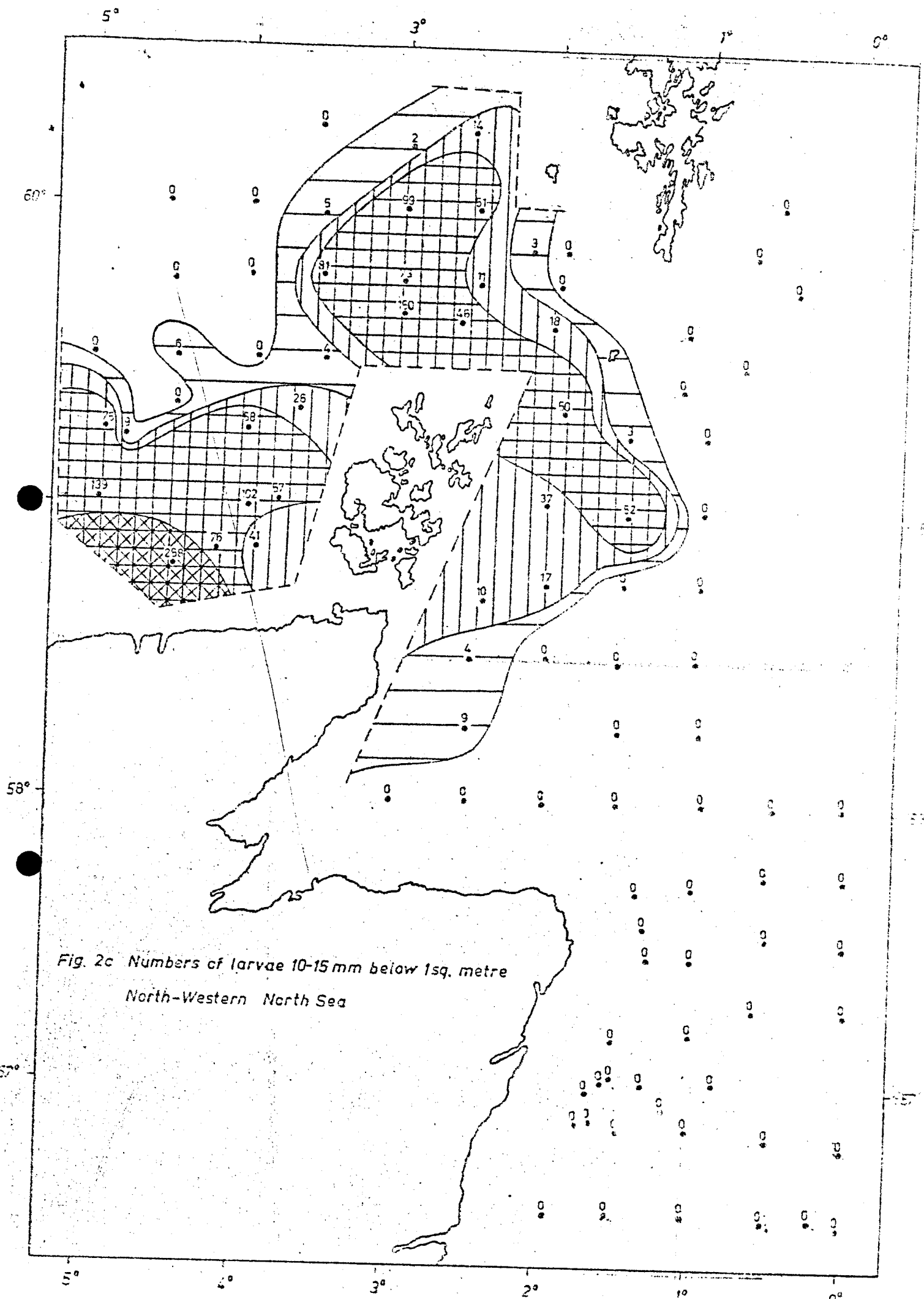


Fig. 2c Numbers of larvae 10-15 mm below 1sq. metre
North-Western North Sea

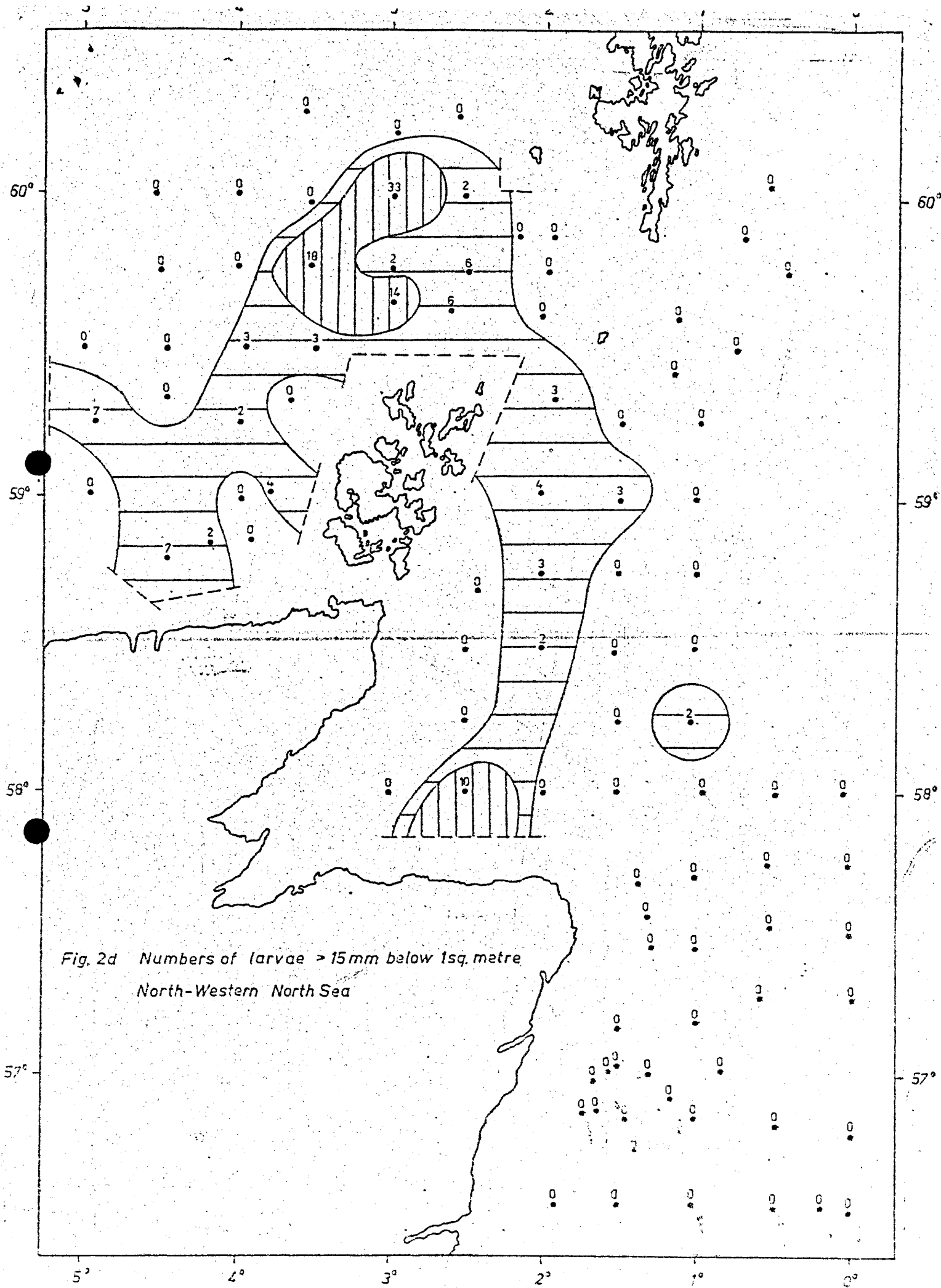


Fig. 2d Numbers of larvae > 15 mm below 1sq. metre
North-Western North Sea