C.I.P.S.

TECNICAL REPORT

1973/Biol./Synthese R.Z. 01

MATHEMATICAL MODEL OF THE
POLLUTION IN THE NORTH SEA

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A STUDY OF THE DISTRIBUTION OF FISH LARVAE ALONG THE BELGIAN COAST

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1. Introduction.

Fish plankton (fish eggs and larvae) constitutes in general an essential link in the foodchain and is especially very important in the life-cycle of fish, the density and distribution of fish plankton being determinant for the strength of the year-classes.

In addition these organisms are very sensitive to modifications of the quality of the environment.

In the frame of these considerations a fish plankton survey was carried out during the period 1972 - 1973.

This study had mainly the commercial fishes in view, however the larvae of non-commercial fishes were also determined.

2. Material and methods.

The densities of fish larvae along the Belgian coast were determined on a monthly basis by means of the Dutch type Gulf Sampler 43 Stations were chosen along the coast.

These include (fig. 1) :

- 12 coastal stations so as to observe the influence of domestic waste waters on the distribution of the fish larvae in time and space.

- 14 stations where the influence of industrial pollution, in some cases caused by dumping activities, on the fish plankton was studied.

- 17 stations which were chosen in order to have a general idea of the distributions and densities of fish larvae along the coast ; these stations are complementary to the above mentioned stations and were only sampled on a six-monthly basis.

At the same time certain physical parameters such as temperature (fig. 2) and salinity were determined. These parameters are very important because they have an influence on the occurrence of fish larvae (De Veen, 1967).

The data mentioned in figures 3, 4, 5 and 6 refer only to the six-monthly sampling of 1972 and 1973 and involve only the quantitatively most important commercial species namely Clupea sp. and Solea vulgaris L.

During 1972 only 28 stations were sampled and during 1973 43. In 1973 the sampling frequency was also higher.

No sampling took place during July 1973.

3. Results and discussion.

The Belgian coast is characterized by a rather homogeneous temperature and salinity pattern. Figure 2 shows the average temperature for the period 1/1/1973 till 30/9/1973.

Salinities were found to be less than 34 $\%_o$. This is one of the reasons why spawning of plaice does not take place in this area in spite of the occurrence of stocks of mature plaice (Lubbert, Ehrenbaum & Willer, 1951).

Special attention is given to Clupea sp. and Solea vulgaris L.

Clupea sp.

Within this genus the identifications has not yet been completed, however as great quantities of eggs of Clupea sprattus L. were found, it is most likely that these larvae are Clupea sprattus L.(Van de Velde, 1973).

Figures 3 and 4 show a rather homogeneous distribution of the larvae of Clupea sp., the highest densities however occur near the coast and in the vicinity of Nieuwpoort.

The spawning takes mainly place in the first half of the year with a maximum in May (fig. 7)(Ehrenbaum, 1964, Wheeler, 1969). The high densities found in 1972 (2822 larvae/1000 m^2) were never reached in 1973 (967 larvae/1000 m^2).

Solea vulgaris L.

The Belgian coast is very important as spawning area and as nursery ground for soles (De Veen, 1967).

From figures 5 and 6 it is clear that the sole larvae are mostly located near the shore and especially in the vicinity of the Belgian-French border (De Clerck and Van de Velde, 1973).

A maximum density of 112 sole larvae/1000 m^2 was obtained in April 1973 near Nieuwpoort.

The evolution in time of the sole larvae densities for the period 17/1/1973 - 24/9/1973 is given in figure 7. From this figure it is obvious that the spawning starts in March with a maximum in April and May (De Clerck and Van de Velde, 1973 ; De Veen, 1967 ; Ehrenbaum, 1964 ; Van de Velde, 1973 ; Wheeler, 1969 ; Zijlstra, 1968).

The beginning of the spawning coincides with temperatures higher than 6° C (fig. 2) (Arbault & Boutin, 1967).

Other species.

The large quantities of larvae of Pomatoschistus minutus (Pallas) found along the coast are in agreement with the presence of important stocks of young and adult gobies (Redant, 1973).

The maximum frequencies of larvae were found in June 1973 (379 larvae/1000 m^2) near the Belgian-French border.

The other species, commercial as well as non-commercial fishes, appear very temporarily in our coastal waters (fig. 8). Their distribution area is also very small.

4. Conclusions.

The Belgian coast is mainly characterised by the presence of the larvae of two important commercial fishes namely Clupea sp. and Solea vulgaris L.

The larvae of the non-commercial fish Pomatoschistus minutus (Pallas) occur also in very great numbers along the coast. In addition a few other species : Caranxtrachurus (L), Ammodytes lancea Cuv., Platicthys flesus (L), Callionymus lyra L., Syngnathus sp., Limanda limanda (L), Belone bellone (L), Liparis liparis L., Gadus luscus L., Onos sp. and Gasterosteus aculeatus L. appear only sporadically.

Considering that the Belgian coast is a spawning area and a nursery ground for some commercial fishes and being aware of the fact that fish plankton is very sensitive to modifications of environmental quality special care has to be taken to avoid pollution in this area.

5. References.

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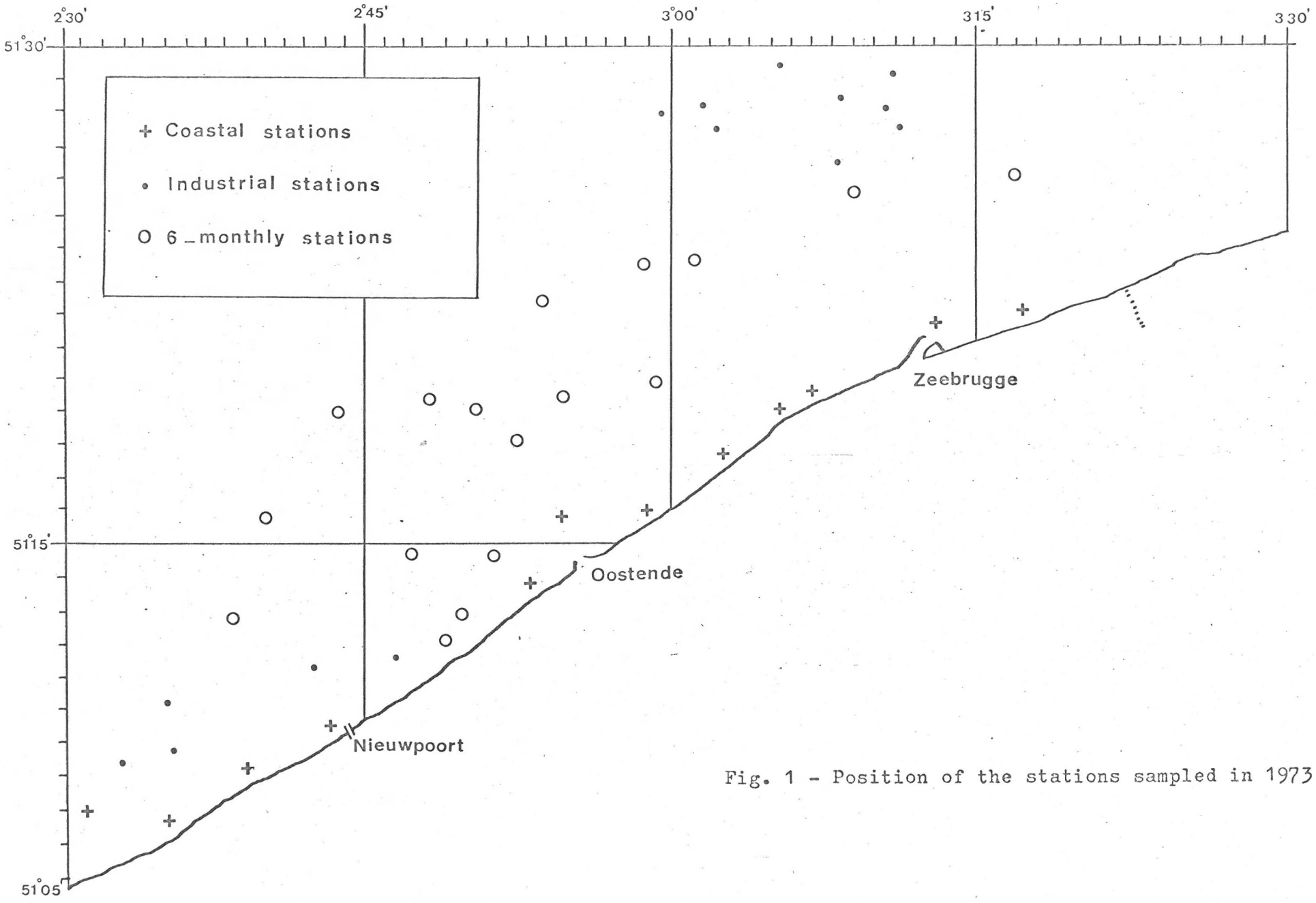

Fig. 1 - Position of the stations sampled in 1973

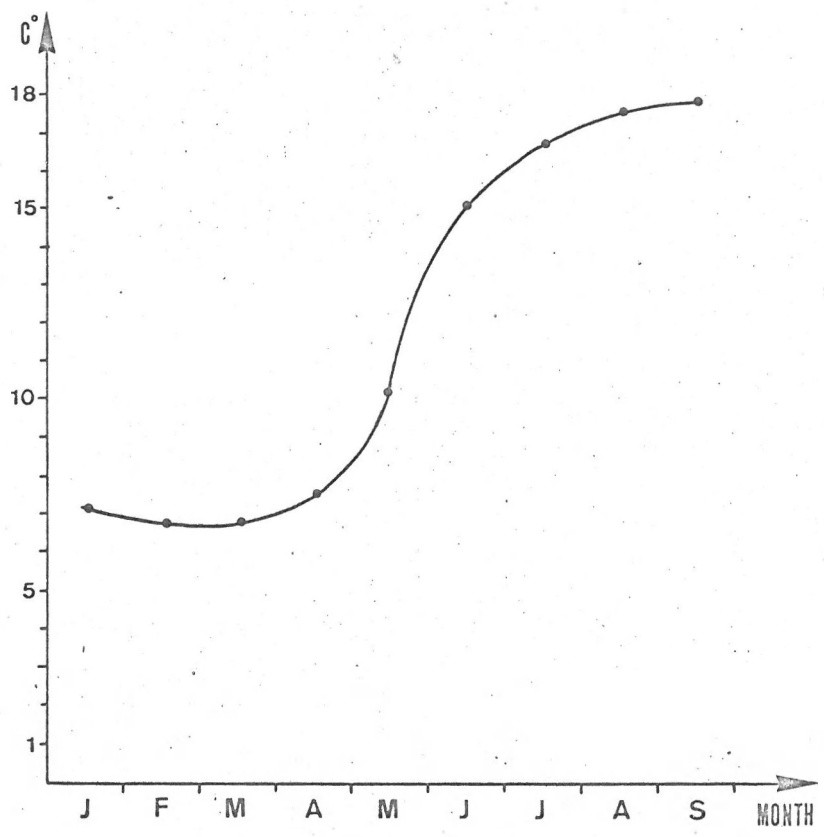

Fig. 2 - Average temperature curve (West-Hinder)

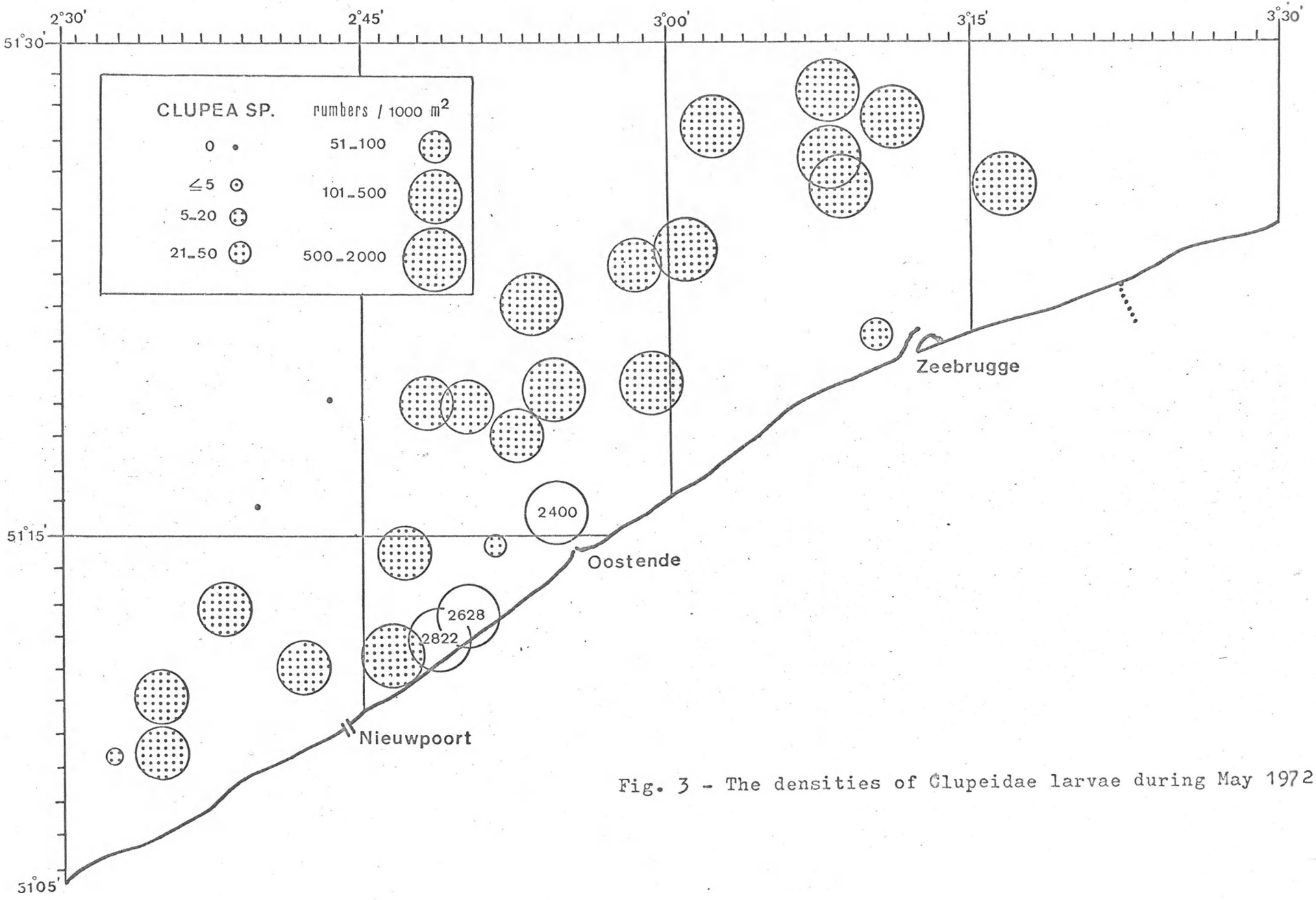

Fig. 3 - The densities of Clupeidae larvae during May 1972

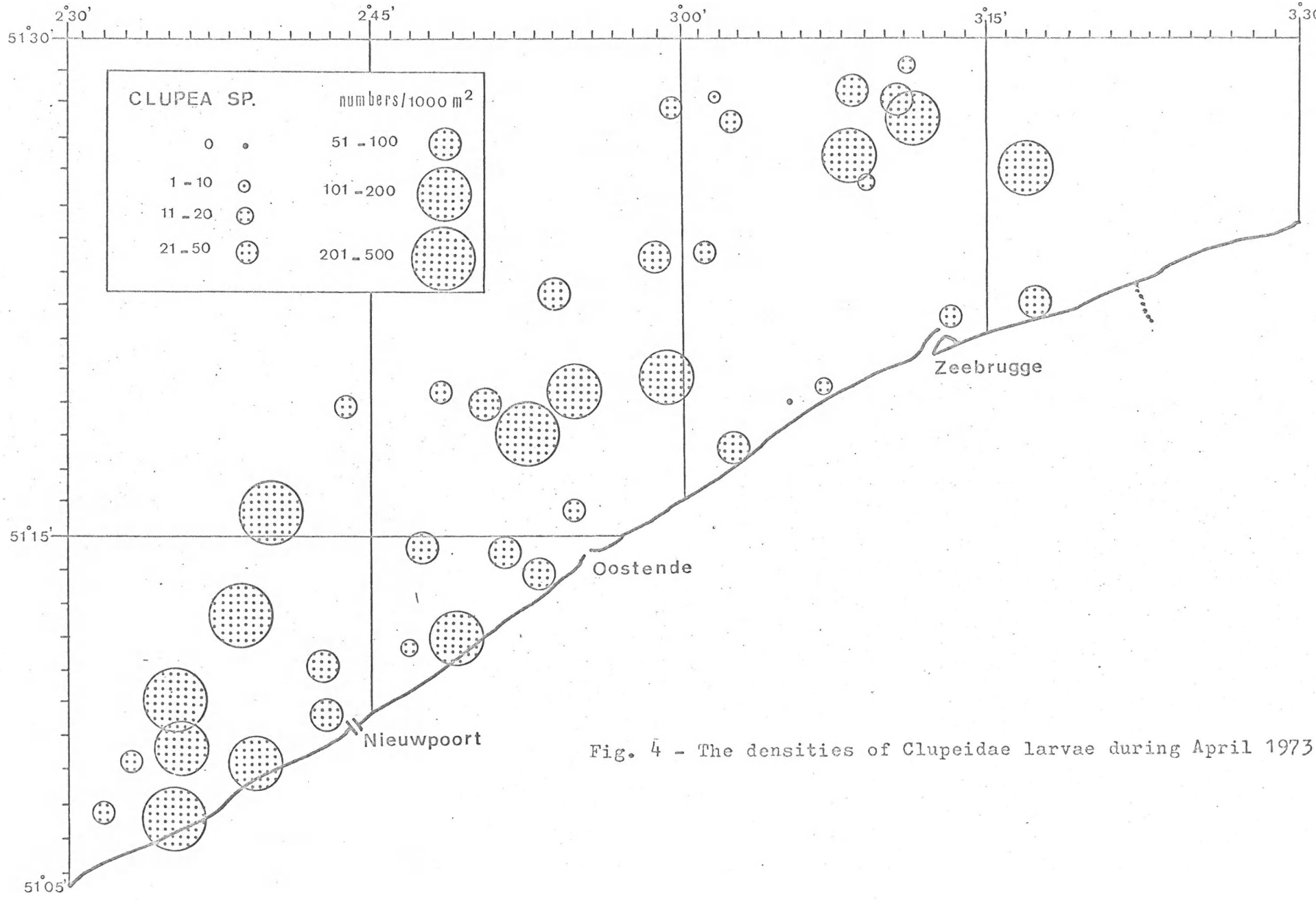

Fig. 4 - The densities of Clupeidae larvae during April 1973

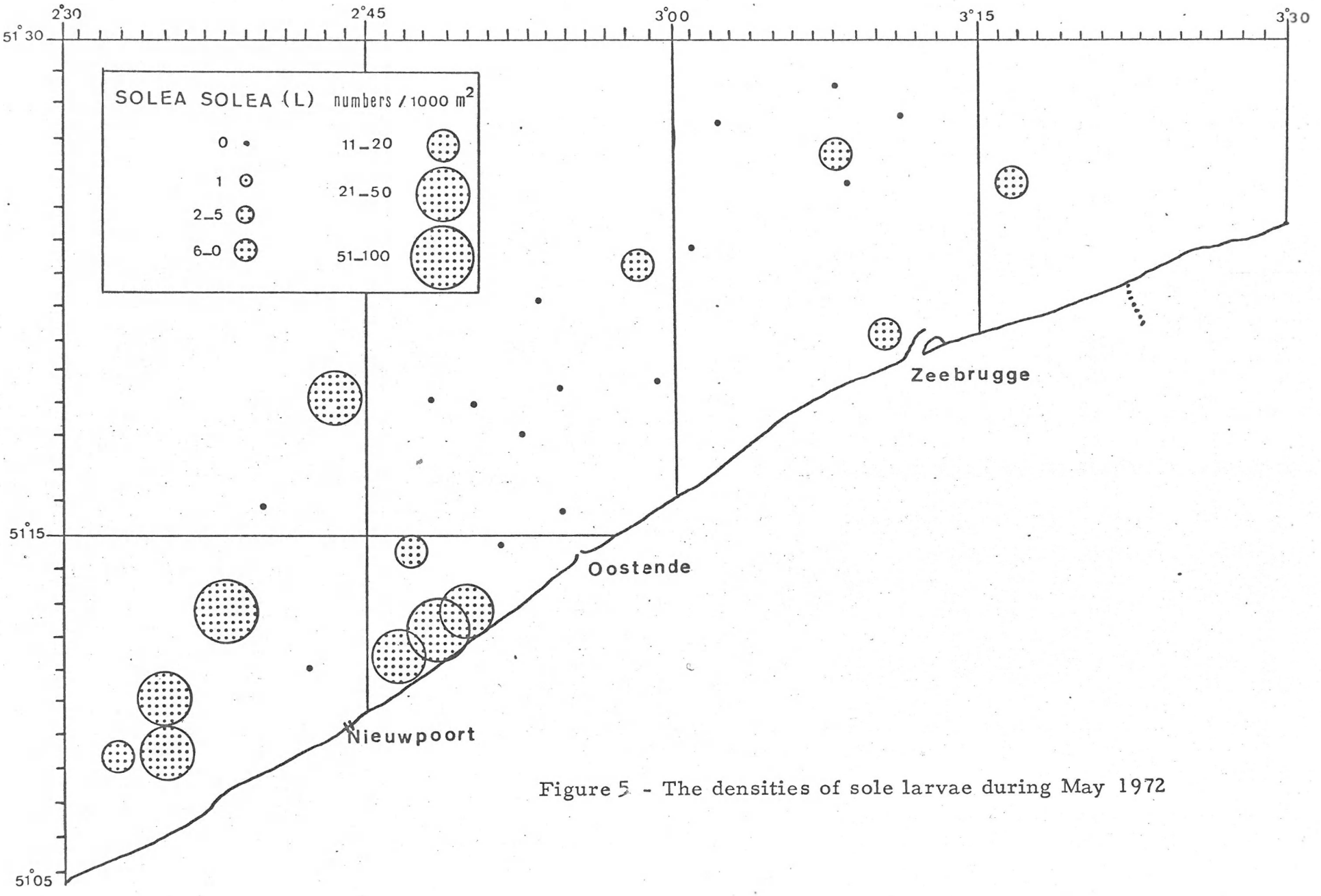

Figure 5 - The densities of sole larvae during May 1972

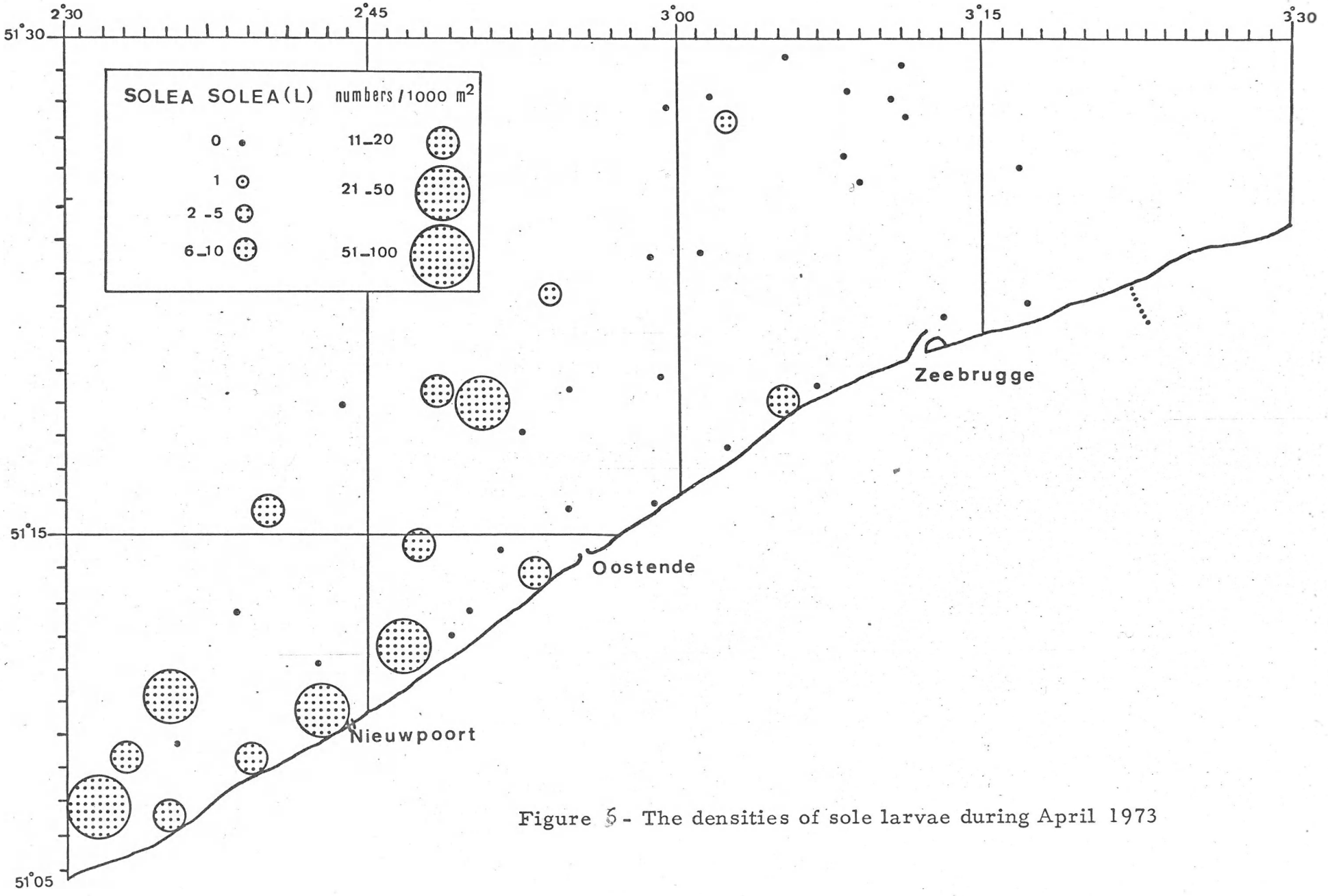

Figure 5 - The densities of sole larvae during April 1973

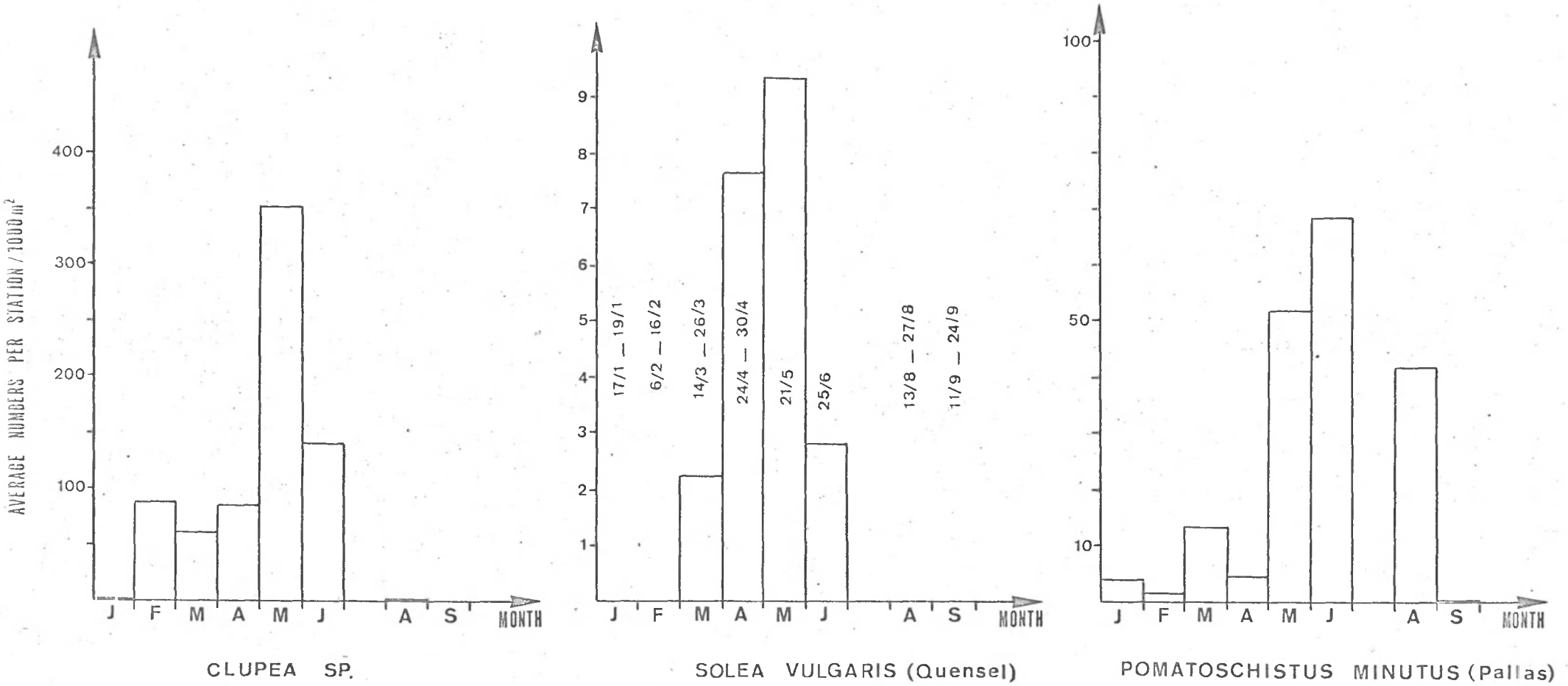

Fig. 7 - Distribution of the main fish larvae during the period 17.1.1973 - 24.9.1973

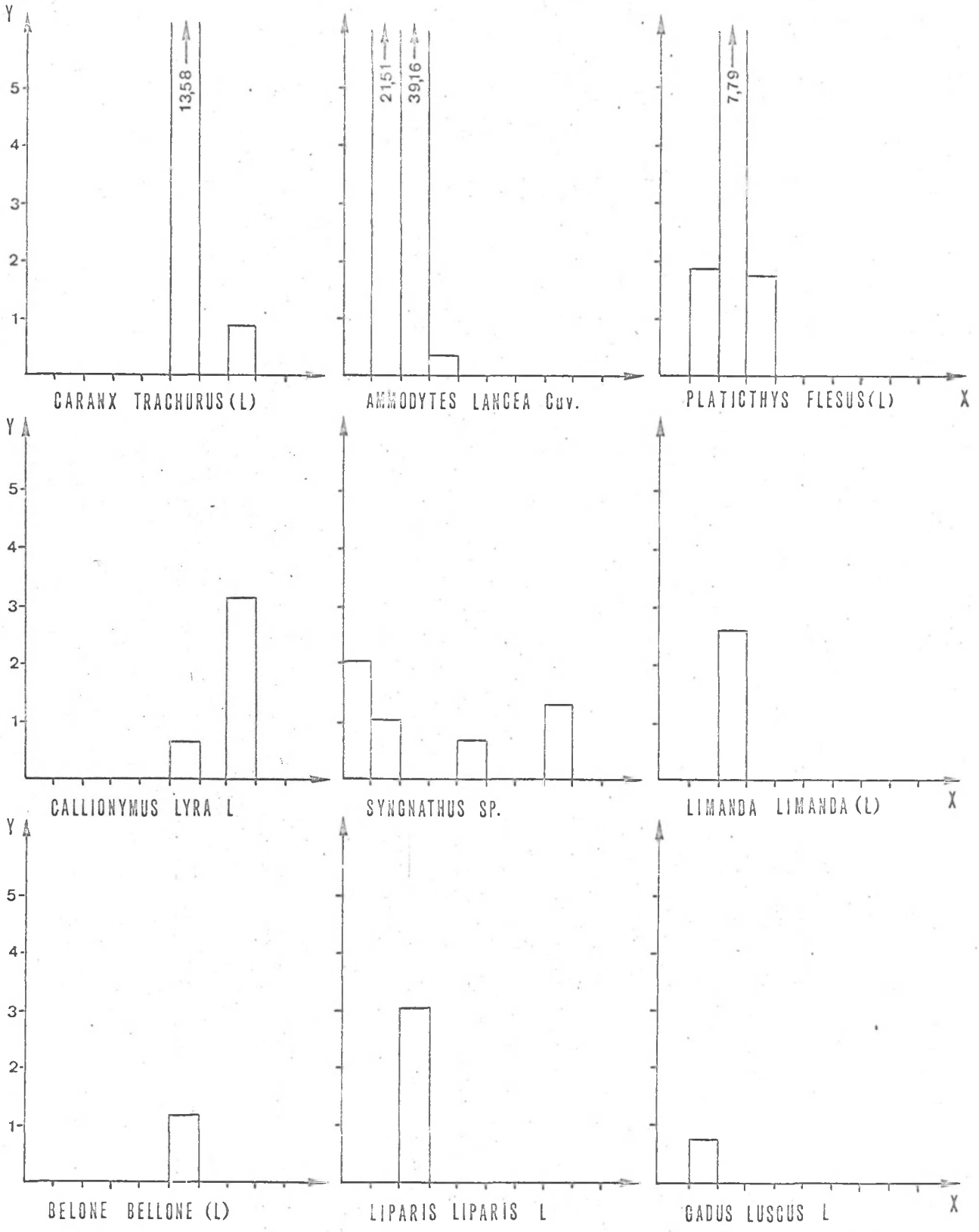

Fig. 8 - (continued)

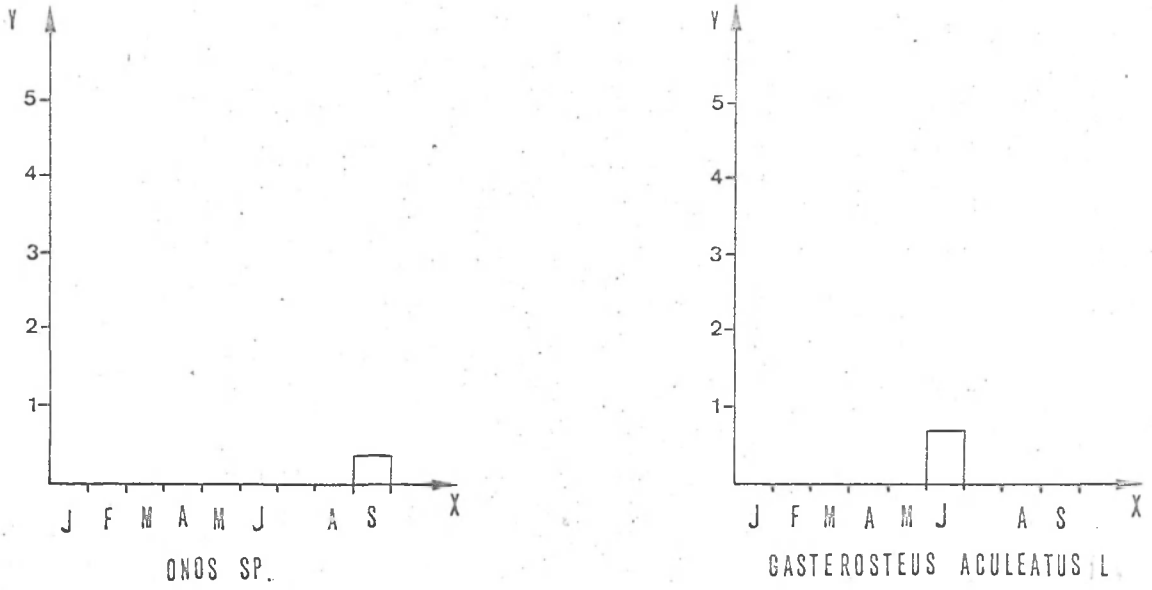

Fig. 8 - Distribution of the quantitatively less important fish larvae during the period 17.1.1973 - 24.9.1973
X : months
Y : average numbers per station/1000 m^2