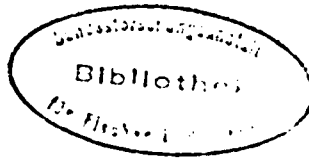


International Council for  
the Exploration of the Sea



C. M. 1996/S:43  
Theme Session S "Shelf Current  
and Its Effects on Fish Stocks  
(including results from EC-SEFOS)

## DISTRIBUTION AND ABUNDANCE OF THE ICHTHYOPLANKTON FROM THE WESTERN COAST OF THE IBERIAN PENINSULA

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### ABSTRACT

This study presents the results obtained from two surveys, carried out in March and March/April 1995, along the western coast of the Iberian Peninsula. Analysis of the plankton collections were used to determine the distribution and abundance of horse mackerel, hake, mackerel, blue whiting and sardine eggs and larvae. The surface temperature in the areas where fish eggs and larvae occurred, ranged between 13.5 and 17.0°C from 14th to 24th March and between 16.0 and 18.3°C from 28th March to 10th April. Nineteen (in the first sampling) and eighteen (in the second sampling) fish families were identified in the samples. In the first sampling (A) the three most abundant families were Clupeidae (23.9%), Gadidae (22.3%) and Myctophidae (9.4%) and in the second sampling (B) were Clupeidae (35.3%), Myctophidae (20.7%) and Gonostomatidae (11.1%). Clupeidae was represented by sardine (*S. pilchardus*, Walbaum) and the dominant species of Gadidae was blue whiting (*Micromesistius poutassou*, Risso). The most important commercial fishery in the area are sardine, hake and horse mackerel. Sardine eggs and larvae were the dominant in the surveyed area and this is an important spawning period for this species. The pattern of distribution and abundance of fish eggs and larvae of the target species, horse mackerel and mackerel are similar to the results obtained during last years in the Portuguese coast. Correlation was found between larval abundance and zooplankton biomass in the first survey and was significant at the level of 98%.

## INTRODUCTION

During last years many surveys were carried out to study the early life history stages of the commercial species along the Portuguese continental coast. In the beginning especially *Sardina pilchardus* eggs and larvae were investigated but, later on, other targets species, *Trachurus trachurus*, *Merluccius merluccius* and *Scomber scombrus* were studied. In 1995, although *Micomesistius poutassou* was not a commercial important species for Portugal, studies on blue whiting eggs and larvae were started.

Since 1994, the ichthyoplankton surveys carried out along the Portuguese continental coast are included in the Project "Shelf Edge Fisheries and Oceanography Study" (SEFOS), task 2 - Distribution and Dispersal of Early History Stages (Phases 2 and 3).

The objective of this paper is to study the abundance and distribution of fish eggs and larvae and related some environmental parameters. Analysis of zooplankton biomass related with fish larvae were also investigated.

## MATERIAL AND METHODS

During March and April 1995, two plankton surveys were carried out, on board of R/V "Noruega", along the Portuguese continental coast (Fig 1). The first sampling was undertaken from 14th to 24th March (A), with a grid of 69 stations covering all the Portuguese coast and the second one, was covered by a grid of 60 stations from 28th March to 10th April (B) and the surveyed areas were the southwest and south Portuguese coast (B).

At each station, double oblique tows were taken with WP2 net (200 $\mu$ m mesh size) at a constant speed of 3 knots, from the surface to 200m maximum depth. A digital "Hydro-Bios" flowmeter was used for the calculations of the filtered water volume (Smith and Richardson, 1977). The plankton samples were preserved in 4% formalin, neutralized with sodium bicarbonate. Plankton volumes were measured by displacement and all fish eggs and larvae were sorted

## RESULTS

Only data on the temperature at surface are available to relate with fish eggs and larvae and these values ranged from 13.5 to 17.0°C between 14th and 24th March and from 16.0 to 18.3°C between 28th March and 10th April.

Fish eggs data showed that they are distributed along the surveyed area in both plankton sampling (Fig.2). The maximum abundances, 2058.3 eggs/m<sup>2</sup> and 947.6 eggs/m<sup>2</sup>, were registered, respectively, in A and B, in south coast. In these stations the values of the surface temperature

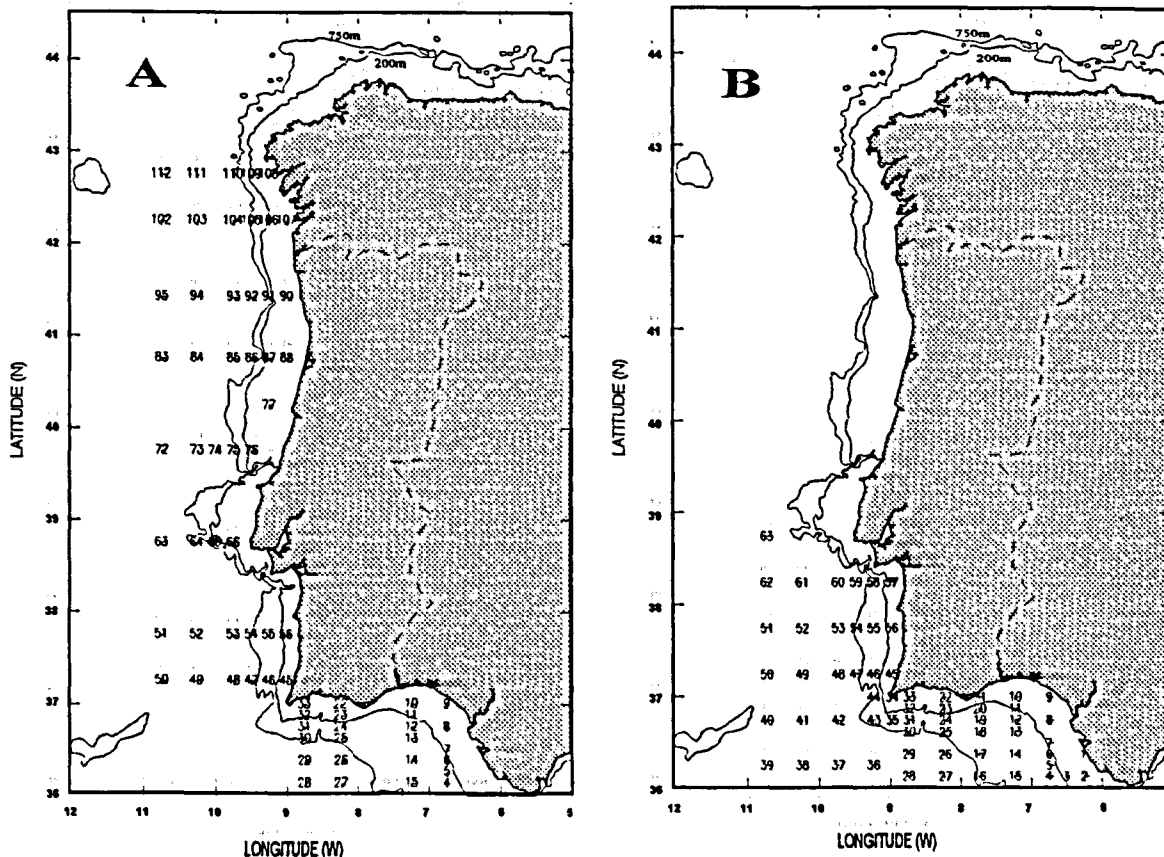


Figure 1 - Grid of plankton stations: A (14 to 24 March 1995) and B (28 March to 10 April)

were 15.5 and 17.0°C, respectively. From the plankton samples eggs from sardine, horse mackerel, mackerel and anchovy were identified. A total of twenty three (A) and seventy three (B) eggs of anchovy (*Engraulis engraulis*) were collected in three stations of the south coast, between the bathymetrics of 20 and 200m and the surface mean temperature in the area was 15.3°C.

Fish larvae occurred over the whole surveyed area (Fig.2), between the bathymetrics of 20 and 3000m. Maximum abundances, 109.3 larvae/m<sup>2</sup> (A) and 307.6 larvae/m<sup>2</sup> (B) were registered in stations with the bathymetrics of 180 and 95m and the values of the surface temperature in these areas were 14.0 and 16.0°C, respectively.

Nineteen (A) and eighteen (B) fish families were identified in the samples. In the first sampling the three most abundant fish families were Clupeidae (23.9%), Gadidae (22.3%) and Myctophidae (9.4%) and in the second sampling Clupeidae (35.3%), Myctophidae (20.7%) and Gonostomatidae (11.4%) (Fig.3). Clupeidae is represented by sardine (*S. pilchardus*) and the dominant species of Gadidae was blue whiting (*Micromesistius pouassou*). The other fish families common in both sampling were Callionymidae (4.8 and 3.0%), Sparidae (4.1 and 6.0%), Gobiidae (8.5 and 2.7%), Soleidae (1.1 and 1.6%) Blenniidae (2.6 and 0.2%), Paralepididae (3.3 and 1.8%), Macrorhamphosidae (2.9 and 9.8%), Anguillidae (0.4 and 0.2%) and Bothidae (0.7 and 0.2%). Gobiesocidae (0.4%), Ammodytidae (6.8%), Carangidae (0.9%), Pleuronectidae (0.7%), Soleidae (0.7%) and Trachinidae (1.3%) were recorded in the first sampling and in the

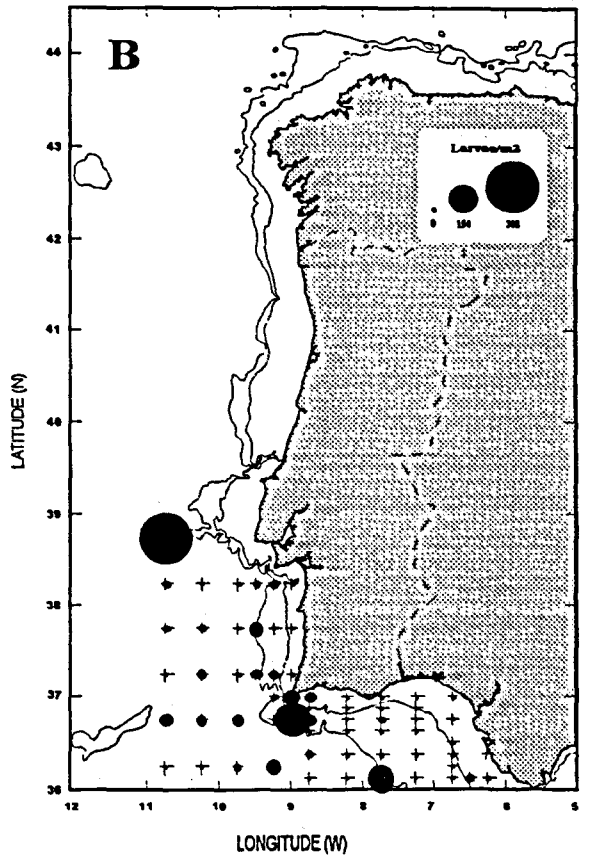
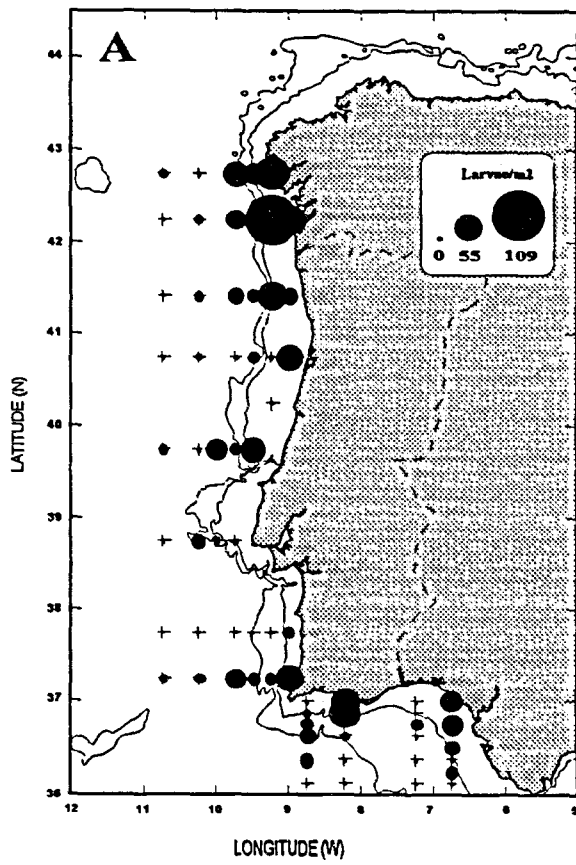
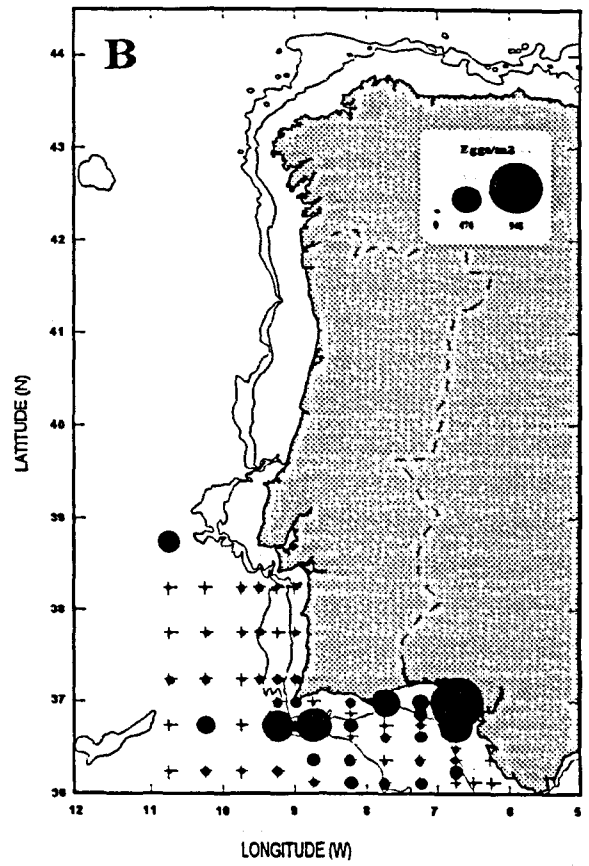
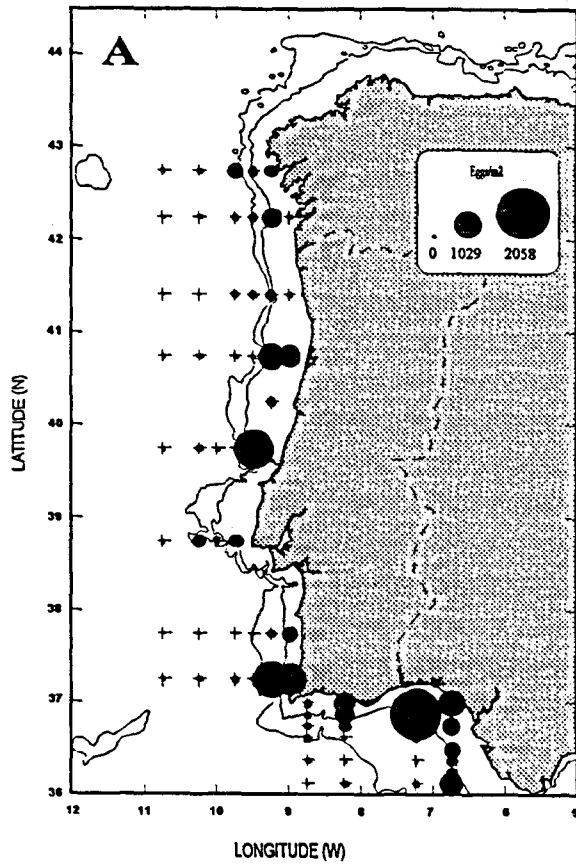


Figure 2 - Geographical distribution and abundance of fish eggs and larvae.

second sampling Labridae (0.6%), Scombridae (0.4%), Astronesthidae (0.6%), Sternophychidae (0.3%) and Hemirhamphidae (0.2%). In figure 3 "Others" included fish families with percentages less than 5 and not identified families.

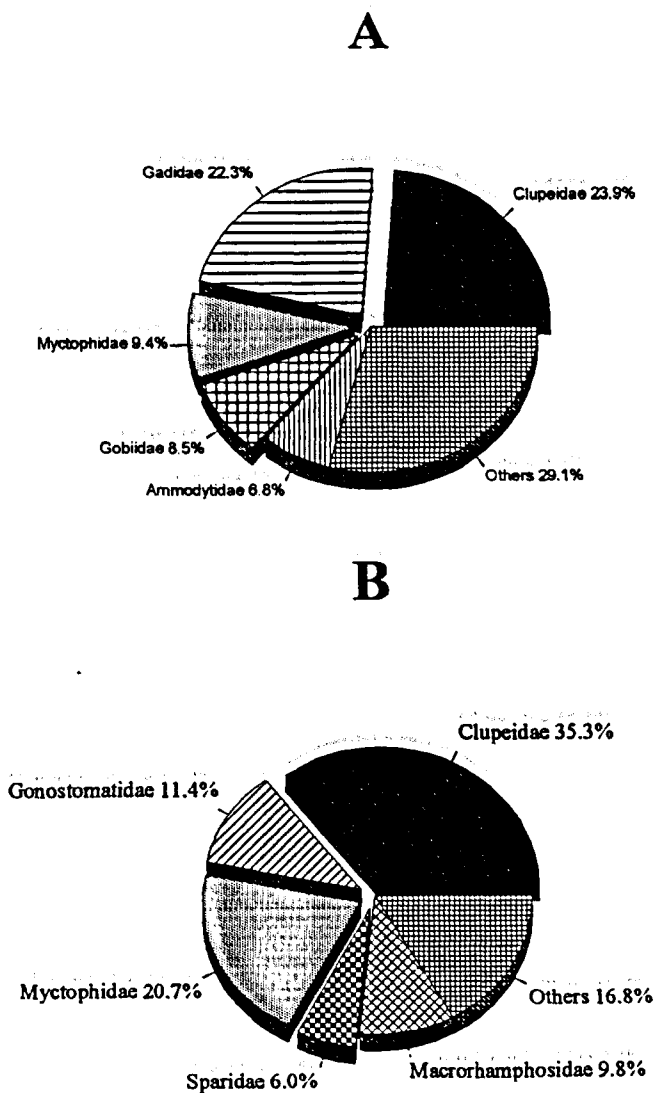


Figure 3. Percentual abundance of fish larvae, in both surveys (A and B), n° of individuals = 9637 in A and n° of individuals = 4155 in B.

*Sardina pilchardus*

In the stations where sardine eggs and larvae were recorded the surface temperature ranged from 13.8 to 17.4°C and occurred between the bathymetrics of 20 and 2000m. Sardine eggs were the

most abundant with percentages of 54.6 (A) and 37.9 (B) of the total number of fish eggs and were collected mostly in south coast (Fig.4). In the first sampling, highest abundance (2031.8 eggs/m<sup>2</sup>) occurred in the bathymetric of 225m, while in the second sampling the greatest concentration was 7.8 eggs/m<sup>2</sup>, recorded in the bathymetric of 100m and the values of the surface temperature in these stations were 17.4 and 15.5°C, respectively. During these two surveys, A and B, sardine larvae were distributed, respectively, from the bathymetrics of 20 to 590m and 95 to 155m and the values of surface temperature in the stations where sardine larvae were collected ranged between 13.8 and 16.8°C.

#### *Trachurus trachurus*

Figure 5 presents the geographical distribution of horse mackerel eggs and larvae. In the areas where *T. trachurus* eggs and larvae occurred the surface temperature ranged from 13.5 to 17.5°C. Eggs of this species were collected between the bathymetrics of 30 and 4000m. Highest concentrations were registered in the first sampling, and the maximum abundance, 762.3 eggs/m<sup>2</sup>, occurred in the bathymetric of 405m and the value of the surface temperature was 14.6°C. Horse mackerel larvae were collected only in the first sampling in two stations (Fig. 5) with concentrations of 0.5 and 3.7 larvae/m<sup>2</sup>, in the bathymetrics of 87 and 120m and the values of the surface temperature were 14.9 and 13.5°C, respectively.

#### *Micromesistius poutassou*

Blue whiting is one of target species of the SEFOS project but is not commercially important in Portugal. Larvae of this species were collected in the first sampling (Fig. 6) and were distributed along the west coast, between the bathymetrics of 100 and 3000m. In the areas where blue whiting larvae were registered the values of the surface temperature ranged from 13.5 to 15.1°C. Maximum concentration, 30.6 larvae/m<sup>2</sup>, occurred in the bathymetric of 920m and in this station the surface temperature was 14.0°C.

#### *Scomber scombrus*

Mackerel eggs were collected in both surveys and distributed between the bathymetrics of 30 and 405m. In the first sampling was observed the highest concentration, 16.6 eggs/m<sup>2</sup>, in the bathymetric of 150m and the value of the surface temperature was 14.0°C. In the second sampling mackerel larvae were registered in one station, with the concentration of 7.3 larvae/m<sup>2</sup>, in the bathymetric of 95m (Fig. 6) and the value of the surface temperature was 16.0°C. The surface temperature values where mackerel eggs and larvae were registered ranged from 13.8 and 17.4°C.

Other target species hake (*Merluccius merluccius*) was not recorded in the surveyed area and in Portuguese waters hake larvae is almost rare.

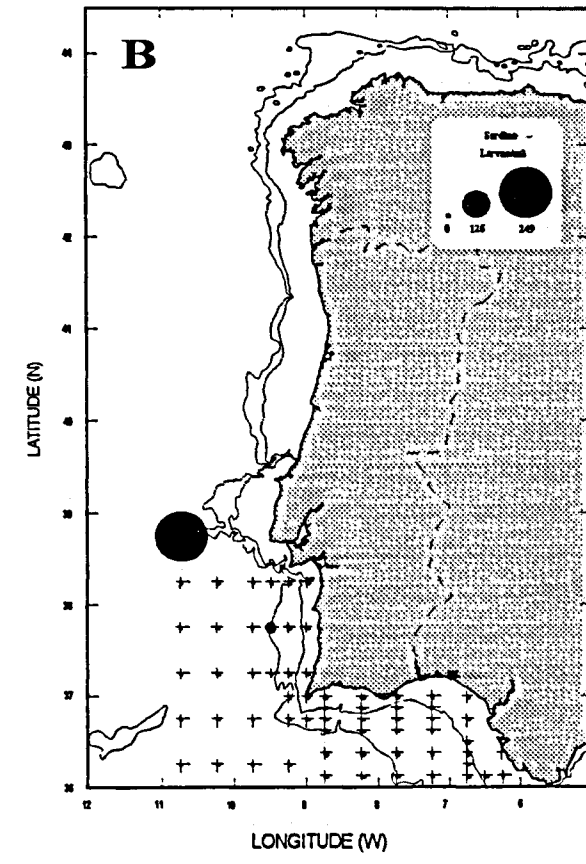
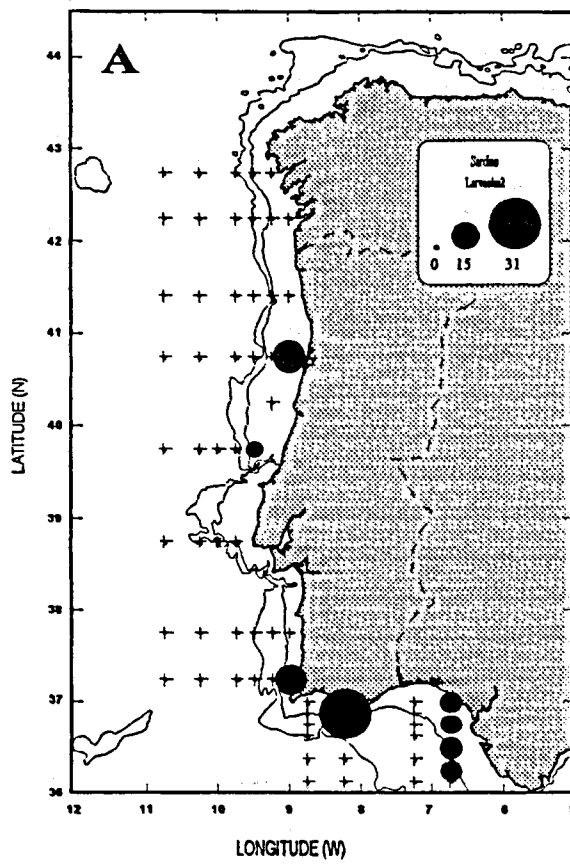
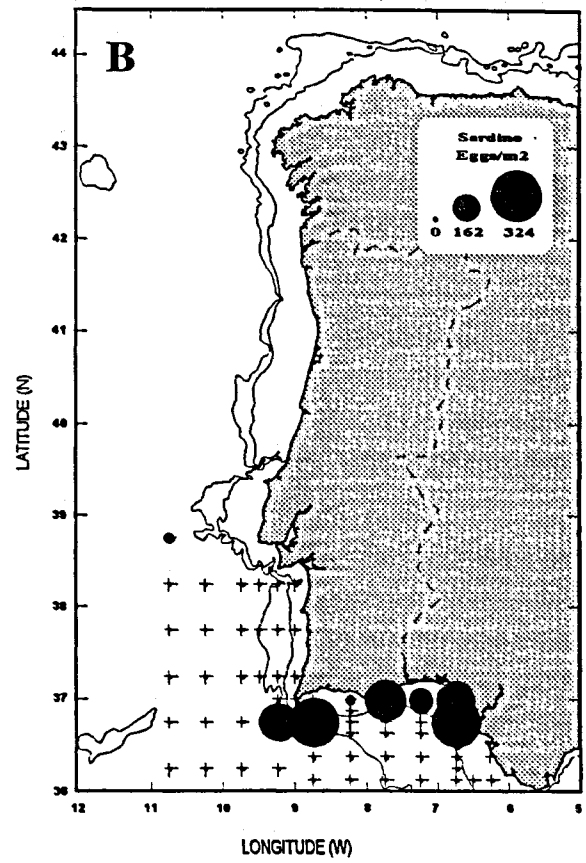
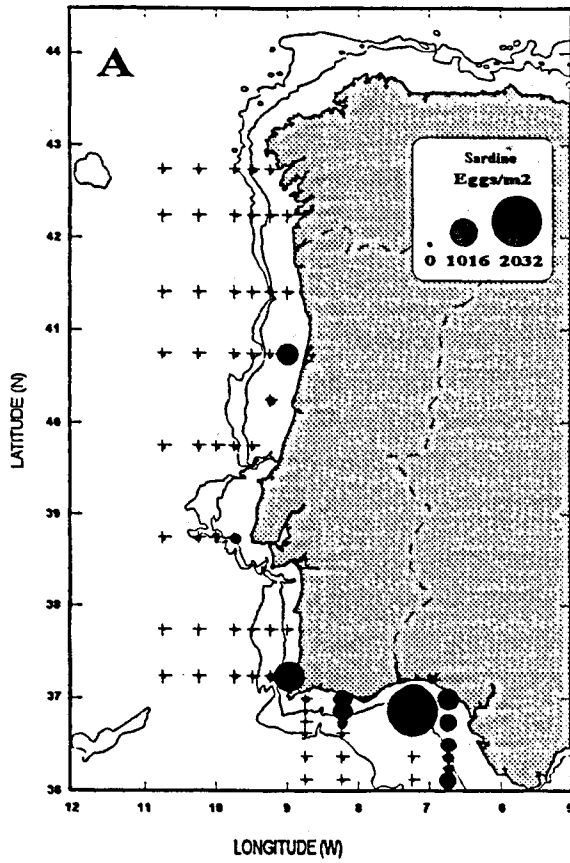


Figure 4 - Geographical distribution and abundance of sardine eggs and larvae.

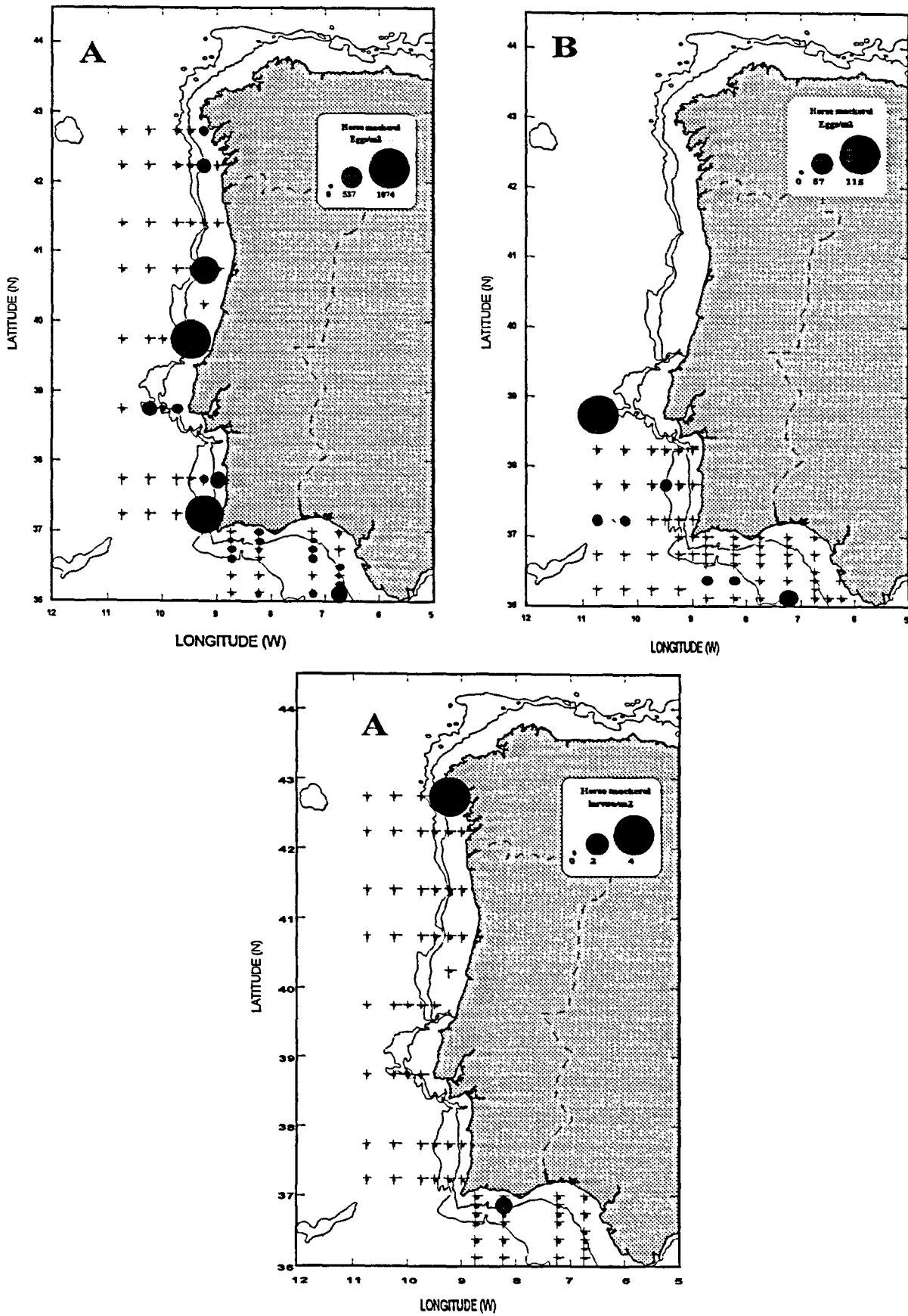


Figure 5 - Geographical distribution and abundance of horse mackerel eggs and larvae.



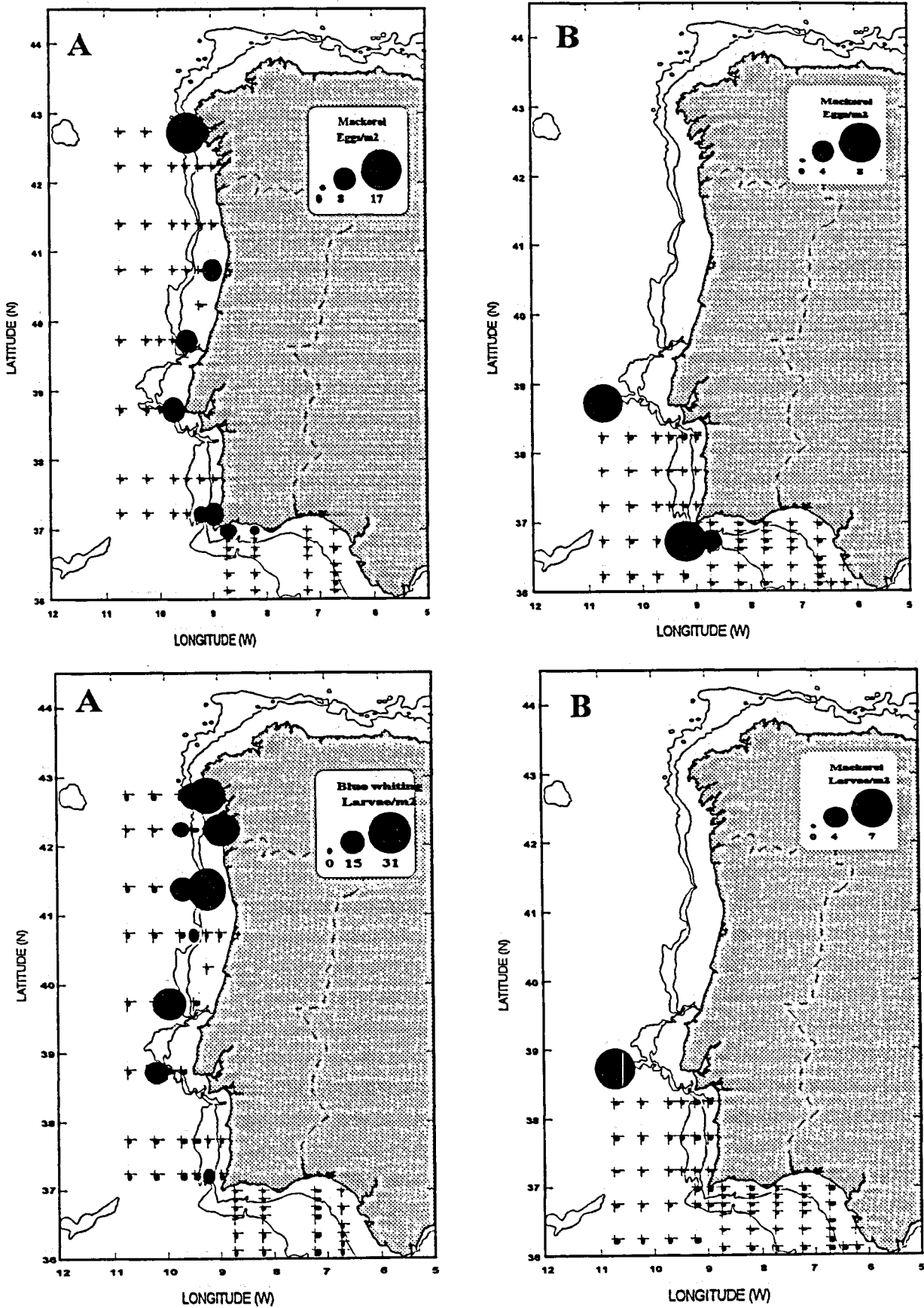


Figure 6 - Geographical distribution and abundance of mackerel eggs and larvae and blue whiting larvae.

### Zooplankton biomass/fish larvae abundance relation

In the first sampling, zooplankton biomass varied from 3.33 to 1137.02 ml/m<sup>2</sup> and fish larvae abundance ranged from 0.78 to 109.26 larvae/m<sup>2</sup>. However, in the second sampling, those parameters varied from 7.53 to 122.38 ml/m<sup>2</sup> for zooplankton biomass and 1.37 to 307.56 larvae/m<sup>2</sup> for fish larvae abundance. Most concentrations points are coincident with small zooplankton biomass and low number of larvae (Fig. 7). Nevertheless, in the first sampling two cases were registered, corresponding greatest zooplankton biomass (1137.00 and 524.50 ml/m<sup>2</sup>) to the low values of fish larvae (3.57 and 109.26 larvae/m<sup>2</sup>). In the second sampling, was observed one case with highest number of fish larvae (307.56 larvae/m<sup>2</sup>) corresponding to 90.99 ml/m<sup>2</sup> of zooplankton biomass. In the first sampling was found correlation between these two parameters, significant at 98%, with  $r=0.254$  (nr of observations = 69) and no correlation was found in the second sampling, with  $r=0.305$  (nr of observations = 60).

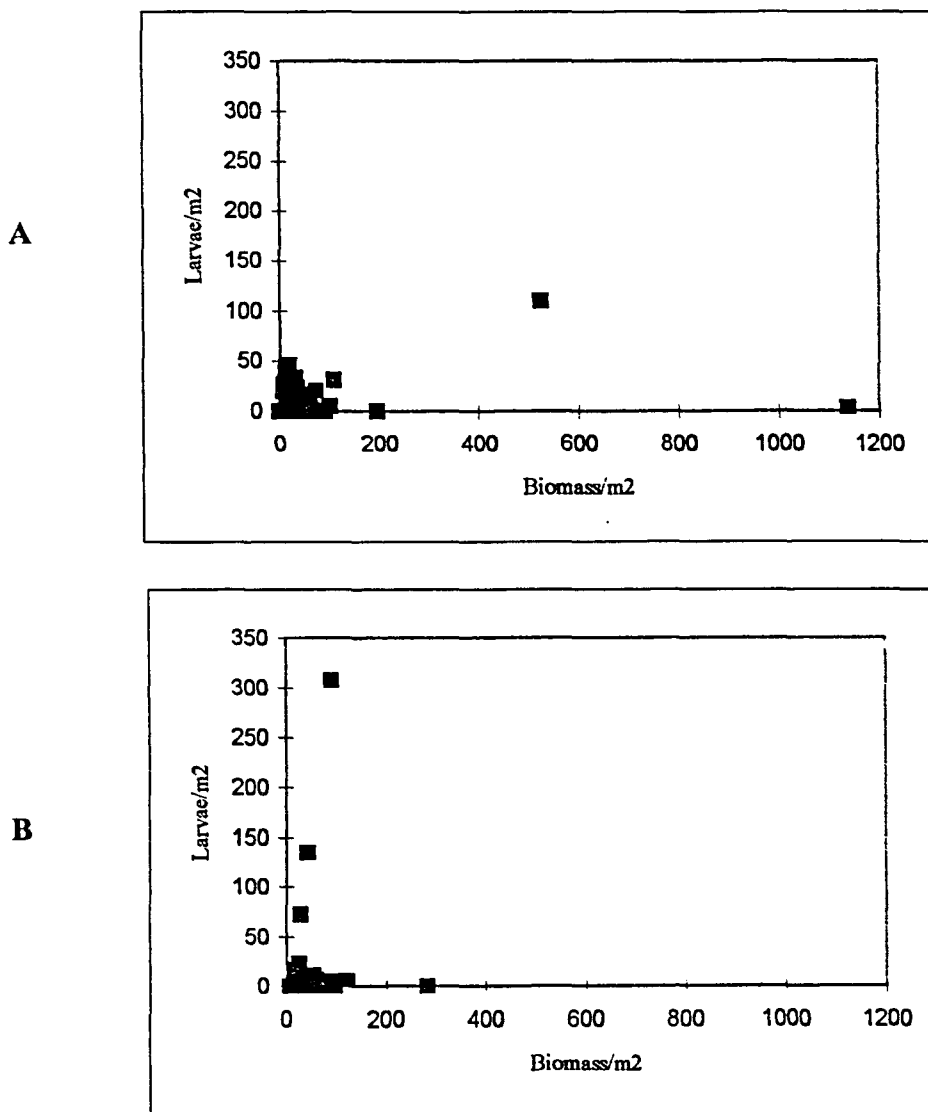


Figure 7. Number of fish larvae versus zooplankton biomass volumes, in both surveys (A and B).

## DISCUSSION

Concerning fish eggs, the dominant species in Portuguese waters is *Sardina pilchardus* and is very important commercially in Portugal. In our samples sardine eggs and larvae were the most abundant and these results are in accordance with previous works on ichthyoplankton, off Portuguese coast (Sobral, 1975, Ré, 1981, 1986, Ré *et al.*, 1982, Ré *et al.*, 1990, Afonso, 1991, Cunha *et al.*, 1992, Afonso and Lopes, 1994, Farinha and Borges, 1994 and Lopes and Afonso, 1995).

Considering geographical distribution and abundance of sardine eggs, they were recorded inshore the bathymetric of 2000m and the highest concentration was registered in south coast. Similar pattern of eggs distribution are already described by some authors that studied the planktonic stages of sardine in this area.

Horse mackerel is also an important fishery in Portuguese waters and is second in economic interest in Portugal. In 1992, *T. trachurus* eggs were studied for daily egg production (Farinha and Borges, 1994). Regarding our data, concentrations of more than 100eggs/m<sup>2</sup> were recorded between the bathymetric of 135 and 405m. Some horse mackerel larvae occurred in first sampling, inshore the bathymetric of 120m. Data from 1990 (Afonso and Lopes, 1994) indicated concentrations of *T. trachurus* between the bathymetrics of 20 and 1000m.

According to the geographical distribution of blue whiting larvae, they were recorded near the slope of the continental shelf, offshore the bathymetric of 100m and mostly in northwest coast. The mean value of surface temperature where *M. poutassou* larvae occurred was 14.3°C.

There is a decrease in the number of mackerel eggs from the first to the second sampling and it seems that the peak of spawning is earlier. Similar results were obtained in March/April 1994 from the samples collected in the northwest Portuguese coast (Solá *et al.*, 1996). Highest concentrations were observed offshore the bathymetric of 100m and recorded in waters with mean surface temperature of 15.1°C. A very scarce mackerel larvae distribution was obtained in the first sampling occurred in the bathymetric of 95m.

*M. merluccius* larvae are rare in the plankton samples, off Portuguese coast. Hake is an important commercial species in Portugal with a high market value although annual catches is low. A total of six hake larvae were registered in December, March and July 1979/80 (Ré *et al.*, 1982) and in summer 1990, only a single larva was collected in the bathymetric of 104m (Afonso and Lopes, 1994), in the northwest coast.

According to the results obtained in both surveys for the relationship zooplankton biomass/fish larvae abundance, correlation was found in the first survey, significant at the level of 98% ( $p < 0.02$ ). No correlation was found for these two parameters in the second survey and similar result was obtained in autumn 1991 (Lopes and Afonso, 1995). However, Afonso, (1995) found correlation with those two parameters in some months from 1981/83, from the samples collected at surface, in south west coast.

## ACKNOWLEDGMENTS

The authors are grateful to the staff of IPIMAR for collecting and sorting the samples and the crew of R/V "Noruega".

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