VERTICAL DISTRIBUTION AND MIGRATION OF FISH LARVAE DURING THE NIGHT IN THE N.W. AEGEAN SEA

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Abstract

The variability of fish larvae composition and abundance, caught with a 60-cm Bongo net, was determined after analysing data from ten hauls carried out at a station, during night and early morning, at two different depths (22 and 70 meters). The greatest aggregation of larvae was found at 09:30h-09:50h in both depths and the lowest at 03:00h in the 22-meter hauls and at 21:00h in the 70-meter hauls. From the 33 taxa, which have been identified, the six most numerous species *(Sardina pilchardus, Gymnammodytes cicerelus, Benthosema glaciale, Lampanyctus crocodilus, Myctophum punctatum* and *Maurolicus muelleri)* presented different temporal variability of larval abundance, while depth was also an important factor influencing such variation.

Keywords: ichthyoplankton, larvae, vertical profil, migration, Aegean Sea

Introduction

Very few icthyoplankton surveys have been conducted in Greek waters since the beginning of our century, when the Danish *Dana* and *Thor* expedition in the Mediterranean took place. (1, 2, 3). Till now, there have been very few attempts to study the abundance and distribution of many fish eggs and larvae and juveniles in the Aegean Sea. (4). The objective of the present work was to study the variability of fish larvae composition and abundance at a station, during night and early morning, at two different depths (22 and 70 meters), using a 60-cm Bongo net.

Materials and methods

At the 9th of February 1991 a station in N.W. Aegean Sea was selected for night and early morning sampling, on a three-hour basis. The depth of the station was 232 meters. Plankton hauls were made using a paired Bongo net with a mouth diameter of 60 cm and a mesh size of 0.500 mm. Every 3 hours, from 21:00h. to 09:50h, two different horizontal tows, one at depth of 22-m and the other at 70-m respectively, took place. Continuous recording and adjusting the haulling depth was made using a depth sensor of SCANMAR system S-400. A variety of opening and closing towed nets have been used recently to investigate the vertical distribution of icthyoplankton (5). The lack of opening and closing net has been compensated by increasing the hauling duration. The duration of each haul was 15 minutes, except the shooting and hauling time, which was rather short in relation to the total duration of the haul. Proportionally, the bulk of the organisms caught in each haul should have come from the selected depth with little contamination from layers above. Samples from each haul labeled, preserved in 4% neutralized formalin and stored in plastic vials for subsequent analysis in the laboratory. The time, the duration and the depth of each haul were recorded. The mean value of filtered water of all hauls was 602.24 m^3. Sunset on the 9th of February took place at 17:57h and sunrise at 07:22h, and the moon was two days old. From the ten hauls only the last two were made during daylight.

Results

A total of thirty-three taxa of fish larvae were identified. The numbers of larvae per 1000 m^3 filtered water of each taxon, as well as the times and the depths of the hauls are given in Table 1. More than 80% of the total abundance of larvae in each haul was composed of only 6-7 species. *Myctophidae* larvae made up the greatest part of the icthyoplankton community and were represented by eight species. The species *Benthosema glaciale, Lampanyctus crocodilus* and *Myctophum punctatum* were the most abundant species of this family. Another mesopelagic species, whose larvae exhibited great aggregation, was *Maurolicus muelleri*. Finally the species *Sardina pilchardus* and *Gymnammodytes cicerelus* displayed also high abundance.

The total abundance of all larval taxa collected during the night at two different depths is presented at Figure 1. At 22-m samples the maximum value was observed at 09:50h and the minimum value at 03:45h, while at 70-m samples the maximum value was observed at 09:30h and the minimum at 21:30h. At the samples of 22-m the greatest aggregation of sardine larvae (*Sardina pilchardus*) found at 21:00h and 09:50h (104,8 and 156,5 larvae per 1000 m^3 filtered water) and the lowest at 03:00h (19.8 larvae/1000 m^3 filtered water). In all 70-m samples the abundance of larvae did not show considerable variation (between 20 and 40 larvae/1000 m^3 filtered water).

The larvae of sand eel (*Gymnammodytes cicerelus*) were found at greater abundance at 22-m than at 70-m, from 21:00h to 21:30h. However between 03:00h and 03:50h the opposite occurred which probably indicates a night vertical migration from surface to deeper waters from 21:00 to -03:50h.

The larvae of *Benthosema glaciale* were found at significantly greater values at samples of 70-m than at samples of 22-m. Two peaks of high concentration of larvae were observed at 70-m samples, one at 00:50h (59.8 larvae/1000 m^3 filtered water) and another one at 09:00h (91 larvae/1000 m^3 filtered water).

The larvae of *Lampanyctus crocodilus* presented a simultaneous increment of abundance in both depths during the night and the greatest aggregation occurred early in the morning. It is possible that the larvae of this species, migrate from deeper to upper layers during the night.

The abundance of larvae of *Myctophum punctatum* exhibited the same temporal variation in the two different depths, except early in the morning, when at the 70-m sample we found a significant greater quantity of larvae than at the 27-m one.

Finally the larvae of *Maurolicus muelleri* presented a quite different abundant variation at two depths during the night. However, the greatest aggregation of larvae was found at 70-m samples.

The larvae of *Benthosema glaciale, Lampanyctus crocodilus, Myctophum punctatum* and *Maurolicus muelleri* were found in plankton in the Aegean Sea during the whole year. The larvae of *Sardina pilchardus* and *Gymnammodytes cicerelus* occurred in the plankton only in winter and spring (1).

The literature on the relationship between light intensity and vertical distributions of fish larvae seems confusing. Most species appear to migrate towards the surface at night (6, 7). According to Tanning (3) the great majority of the larvae of Myctophidae were found to the phaeplankton and the upper knephoplankton, and different vertical distributions of larvae were found between day/night hauls and also between winter/summer hauls. Russell (8) in his study of the vertical distribution of postlarvae in the Plymouth area, found that pilchard were much more numerous in the collections made at night when there might be more than thirty times as many as caught in the day-time.

A Kolmogorov-Smirnov Test (9) showed no significant differences in length frequency distributions for the six species by depth and time. Similarity of family compositions between hauls was determined by non-metric multi-dimensional scaling (MDS) (10) ordination, using logarithmic transformed pooled data from the replicates at each hauls, with Bray-Curtis similarity index (11). MDS separated haul B10 from

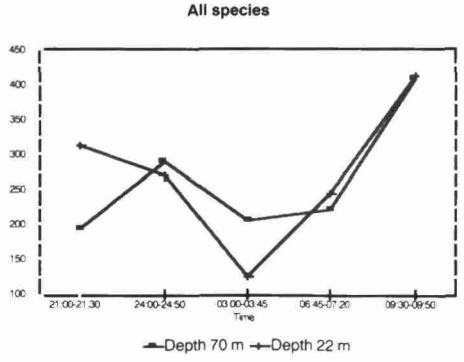

Fig. 1. Temporal variation of larval abundance at two depth.