DISTRIBUTION PATTERNS OF FISH DURING THE PLANKTONIC PERIOD OF THEIR LIFE HISTORY

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ABSTRACT

The static and dynamic distribution patterns of ichthyoplankton were investigated over a 4 year period (1981 - 1985) off the coast of Leigh, on the northeastern coast of New Zealand. Emphasis was given to horizontal and vertical distributions, and these were described on scales encompassing broad areas of the outer Hauraki Gulf and smaller areas of 1 - 100m. The ages of these small fish were also investigated by examining daily increments in the otoliths, and this allowed a more complete interpretation of distribution patterns.

Sampling that was carried out at different distances from the mainland identified major differences in the distribution patterns of individual species. For example, pilchards were caught in high densities right across the continental shelf, whereas morid cod were restricted to the outer edge of the shelf. The most intensive investigations were carried out over the Summer months and these revealed large differences in the abundances of species. For instance, few bothids and triglids were captured in December, while large numbers were caught in January. The spawning activity of adults and broad scale differences between water masses were probably responsible for these distance and time related patterns. Large differences in the densities of ichthyoplankton were found at different localities within each area of the continental shelf (e.g. close to the mainland). Furthermore, detailed investigations of abundances at a single locality over a three day period showed large changes. These changing distribution patterns were related to the dynamics of localized hydrological features (e.g. tidally induced gyres). The presence of islands over the continental shelf also influenced the distribution of small fish. Some species were only found near land, regardless of the distance from the mainland. From ichthyoplankton hauls and direct observations made using SCUBA, it is argued

that the behaviour of ichthyoplankton may have a strong influence on their distribution patterns. For example, tripterygiids and gobiesocids of a variety of ontogenetic forms were observed to aggregate and maintain their position in the shallow areas of rocky reefs.

Large differences were found in the vertical distributions of fish and this was true in water columns from 1 - 40m in depth. Ichthyoplankters of a number of species had different depth distributions. Some species were consistently found near the surface (e.g. hemiramphids & mugilids) or near the bottom (e.g. eleotrids). For species found throughout the water column during the day, it was suggested that biological and physical stratification (e.g. thermoclines) strongly influenced relative densities at each depth stratum. Some species (especially engraulids & scombrids) migrated toward the surface at night. Migration patterns varied for each species and among times. The latter patterns were related to ambient light levels which changed with the phase of the moon.

Small scale structure in the pelagic environment influenced the distribution of fish. Large numbers of fish were found around drift algae and when experimental algae were left to drift, small fish of several species (e.g. Monacanthids) were quickly attracted to it. A number of species were abundant in surface waters, but did not associate with drift algae (e.g. engraulids). For fish that were found around drift algae, the association may be important as a source of shelter and food. There was considerable seasonality in the occurrence of fish species around algae, and the abundance of total drift algae. Drift algae were most abundant over Spring and early Summer. The movements and accumulation of algae are discussed in relation to the potential influence it has on recruitment patterns of fish in nearshore environments.

The distribution patterns of small fish were strongly influenced by the

surface slicks of internal waves. Densities of small fish, drift algae, and zooplankton were higher in slicks than in rippled water adjacent to them. Slicks moved at 0.5 - 1.25 km per hour in the direction of shore. A consequence of aggregation in slicks, therefore, is that small fish may be transported onshore. It is suggested that the accumulation of zooplanktonic food in slicks may be important for the feeding of ichthyoplankters.

Many of the fish found in surface waters, be it in open water or around drift algae, had adult fin-ray counts and were not considered to be larvae, according to current definitions. From information on the age and size of these fish it is suggested that the capacity of fish to settle at a variety of ages and sizes has probably been underestimated. Furthermore, the occurrence of physical processes such as slicks may influence the duration of the planktonic phase and subsequent settlement rates of fish into nearshore environments. The major findings were used to provide an overall picture of what happens during the planktonic phase of some species (Chrysophrys auratus, Parika scaber & tripterygiids), and these case histories are discussed in relation to current hypotheses concerning the ecology of ichthyoplankton.

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