

5. COMMUNITY STRUCTURE.

Estuarine plankton, as mentioned earlier, form a class by themselves chiefly because they are adapted to the vagaries of this environment. The zooplankton element consists of both holoplankton and meroplankton. It is evident from the distribution and abundance (Chapter 4) that the holoplankton is dominated by a single group - Copepoda. The meroplankton may consist of larvae of many benthic invertebrates and fish. In the estuaries investigated in the present study, zoea larva of Brachyura was the dominant form. Other larvae of polychaetes, cirripedes, carideans and other decapods were also frequent.

The stenohaline marine forms and some fresh water organisms which enter accidentally, do not have any role in the ecosystem of the estuaries. Records of these species from estuarine mouths or heads are of academic interest only. It could be seen that many groups of zooplankton like euphausiids, ostracods, appendicularians, salps and doliolids which play an important role in the oceanic ecosystem are usually excluded in the

estuarine plankton. Curiously, almost all of them are filter feeders and the absence of these groups in the estuarine habitat is interesting. Cladocera, another filter feeding group, also had a peculiar distribution in the estuaries (Chapter 4.2.5). Many of the groups which are diverse in the oceanic environment like hydromedusae, ctenophora and chaetognaths (all carnivores) have only a few representatives (mostly allochthonous forms entering the estuaries from the adjoining neritic waters during the saline period) in the estuary.

The zooplankton is thus dominated by true estuarine forms which have evolved adaptations to the fluctuations mainly salinity. The salinity ranges for the common species that occur in the estuary (Fig. 25 A & B) are, however, not their salinity tolerances, but only the recorded ranges in the present observations. Experimental studies have shown that many low saline species can be acclimatised slowly to readapt to sea water indicating that their low salinity adaptation was physiological than a fixed genetic change (Grindley, 1980).

As discussed earlier (4.3), estuaries sustain enormous standing stock of zooplankton compared to the sea. But the role of the zooplankton in the food chain

is difficult to be pinpointed in the estuarine ecosystem as there is no shoaling fishery in the shelf waters. Even larger estuarine fishes like Mugil and Chanos are mainly herbivorous or detritivorous (Hiett, 1944). The coefficient of energy transfer from primary to secondary level was only 7.4% for Cochin backwaters and 6.6% for Mandovi-Zuari estuaries of Goa (Selvakumar et al., 1980) indicating excess phytoplankton production ~~is also~~ available for alternate pathways. Perhaps a large portion of phytoplankton and zooplankton production in estuaries contribute to the productivity of the coastal waters or forms a major source to the organic matter in bottom deposits. This could help the sustenance of a rich benthic life and in fact, high benthic biomass has been reported from several estuaries (Kurian, 1972; Ansari, 1974; Parulekar et al., 1980). The population of penaeid prawns which abound in the estuaries during the saline period may also be a major direct or indirect consumer.

Calanoid copepods play a pivotal role in the ecosystem of any aquatic environment. In the estuaries all over the world they are dominated by only a few genera or families. In the estuaries of India species of the families Acartiidae and Pseudodiaptomidae are dominant. A few species of the family Paracalanidae also occur in appreciable numbers. Species of the genera Eurytemora,

Acartia, Pseudodiaptomus and Tortanus characterise the estuaries of South Africa (Grindley, 1980). Australian estuaries include a few other genera also like Boeckella, Gladiferens and Sulcalanus (Taw and Ritz, 1978).

Heinrich (1962) recognises three 'types' of life cycles in the zooplankton in relation to feeding. Type 1 depends on the availability of food and breed only when food is plenty. Breeding in type 2 is independent of food supply and they usually store fat. These two types mainly occur in the higher latitudes and bathypelagic systems. Type 3 occurs mostly in the tropics where the species are more or less continuous feeders and breeders. The estuarine copepods probably fall under this category since the copepodites of true estuarine forms are present in the collection although the saline premonsoon season. Biochemical studies on zooplankton from Cochin backwaters (Madhupratap et al., 1979) indicate that most species have a very low lipid storage indicating that they feed continuously. In such cases protein may function as an important food reserve (Conover and Corner, 1968; Rayment et al., 1969) which may be mobilised to meet the metabolic requirements.

The common carnivorous copepods of the pelagic realm belonging to the families Euchaetidae, Pontellidae and Candacidae are not represented in these estuaries (but for the genus Labidocera). The few species of the family

Paracalanidae are probably herbivores whereas most of the species belonging to families Acartiidae and Pseudodiaptomidae are omnivores or detritivores. Only a few species like Acartiella graveleyi and A. keralensis appear to be carnivores (Tranter and Abraham, 1971).

The importance of detritus and associated bacterial load as a direct nutritional source to zooplankton especially copepods is now widely recognised (Heinle and Flemer, 1975; Heinle et al., 1977; Conover, 1979). Obviously there is no dearth of detrital material in the estuaries. Studies from Cochin backwaters reveal that phytoplankton production is in excess when compared to zooplankton grazing pressure (Qasim, 1970; Madhupratap et al., 1977). Hence availability of food is not the limiting factor for zooplankton survival in these estuaries.

In the higher latitudes there is usually a pulse of phytoplankton production in the spring. This is followed, after a lag, by an increase in zooplankton standing stock. In the tropics however, there is usually, no such sudden pulse and phyto-zoo-plankton production rates show a more or less an even curve. In contrast, in the coastal regions upwelling may cause sudden blooms of phytoplankton associated with large swarms of filter feeders like tunicates (Madhupratap et al., 1980).

The production trends of phytoplankton and zooplankton in the Cochin backwaters are not much varied, but the peak abundance attained by zooplankton in mid-summer (Fig. 29 A) is probably due to a relatively more stable environment (see Chapter 7) than the availability of food supply. Similarly salinity and currents must be affecting their survival in the monsoon period since phytoplankton production was fairly high during this period.

The carnivores of the zooplankton component (hydro-medusae, ctenophora and chaetognatha) also show a close relation to increase in abundance of other zooplankton (Fig. 29 B). Naturally, their numbers are much less compared to secondary producers as in any ecosystem (say, terrestrial). All of them are high saline forms and apart from a low availability of food, salinity must be a major factor causing the decline of their population during the monsoon.

These estuaries are thus left unexploited at secondary level during the monsoons. The pathways of energy (derived from primary production and detritus etc.) transfer during this period is yet to be worked out.

The food chain in the estuaries are apparently simple compared to the more complex oceanic ^{eco system} environ-ment. The shallowness restricts vertical compartmentalisation, unlike the sea where vertical migration and depth range of zooplankton species are critically associated with distribution of food. The excess phytoplankton production and bacteria along with zooplankton and their faecal pellets contribute to the richness of the bottom deposits. The benthic community flourish and many of these estuaries are rich in clam beds, polychaete and amphipod communities. The benthic community is in turn exploited by an abundant population of prawns and other predators which feed on them.

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