CHAPTER III
STUDY AREA AND ITS ENVIRONS

3.1 COCHIN BACKWATER

The Cochin backwater is a part of the largest lake in Kerala, the Vembanad lake (Lat 9°28' and 10°10' N and Long 76°13' and 76°30'E). It is a shallow tropical estuarine system of about 270 square kilometres located in the southwest coast of India. It has a narrow perennial connection with the Arabian Sea, and on the northern and southern sides it receives two major rivers, the Periyar and the Pampa respectively. Four small rivers, viz. the Achancoil, the Manimala, the Meenachil and the Muvattupuzha empty into the lake. Among these the Muvattupuzha river and the Meenachil river join it around the middle. The hydrographical conditions depend on the influence of the sea and rivers. The depth of the backwater varies from 1 to 5 m except in the dredged channels, namely the Cochin Approach Channel, the Ernakulam Channel and the Mattanchery channel for the passage of ships. The location of the study area in the Cochin backwater is shown in Fig.2.

Hydrographical structure is subjected to great changes depending on the seasons. Climatologically, the annual cycle consists of the pre-monsoon, monsoon and the post-monsoon seasons. It is influenced by the southwest monsoon from about the middle of May to August and by some precipitation from the northeast monsoon during October-December. The river discharge large quantities of freshwater into the estuary during these periods. Owing to these factors, the salinity of the water gets lowered during the peak periods of monsoon. The hydrography of Cochin backwater has been investigated

3.2 DETERMINATION OF SALINITY AND SEDIMENT TEXTURE

In an estuarine habitat, salinity of the water has been recognised as an important factor controlling the fauna and flora. It is well known that in tropics temperature does not show considerable fluctuations between the maxima and minima (Paul, 1942).

A thorough knowledge of the hydrographical conditions of an area is essential to understand the distribution, growth pattern, breeding and abundance of the fauna of a region during the different seasons of the year. Some attempts have been made to relate the distribution of the organisms with hydrology of Cochin backwaters. Desai and Kutty (1967) studied the distribution and abundance of benthic fauna. Madhupratap (1978) has made a study on the ecology of zooplankton resources.

Among the various physical factors of the environment, the study of sediment is a principal factor in understanding the complexity of ecological relationship with bottom fauna (Josanto, 1971a). Veerayya and Murthy (1974) have studied the distribution of sediments in the Vembanad Lake. Josanto (1971b) studied the grain size distribution of the Cochin backwater sediments. Similarly, Vizakat et al. (1991) gave an account of the community structure of benthos of Konkan, west coast of India, in relation to sediment texture, organic carbon content of sediment and bottom water salinity.
This section of the study deals with the description of the salinity and sediment texture of the mussel bed of *M. senhassia*.

### 3.3 MATERIALS AND METHODS

Collections of the specimens and sediment samples were made using an ordinary two jaw van Veen grab. Sediment samples taken along with the mussels during pre-monsoon period and monsoon period were removed and dried for grain size analysis. Bottom water was collected by means of bottom water sampler and salinity was estimated by titration against silver nitrate using potassium chromate as indicator.

A known quantity of sediment was dispersed overnight in 0.025 N solution of sodium hexa metaphosphate. The coarse fraction was separated using 230 mesh sieve, dried and weighed. The finer fractions like silt and clay were analysed by pipette analysis (Krumbein and Pettijohn, 1938). The sand, silt and clay percentage of the sediment sample were calculated and plotted in a triangular graph paper (Shepard, 1954).

### 3.4 RESULTS

Salinity variation in the mussel bed during the period from February 1987 to December 1988 are given in Table 1. Based on this observation, the year can be divided into pre-monsoon (January-May), monsoon (June-September) and post-monsoon (October-December) periods. During the pre-monsoon period gradual increase in salinity could be noticed. The highest salinity (30.9 ppt) observed was in May. From July onwards the salinity showed a decreasing trend with the advancement of southwest monsoon. During
Table 1. Salinity variation (in ppt) at the study area during the period 1987-88

<table>
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<tr>
<th>Month</th>
<th>1987</th>
<th>Year</th>
<th>1988</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>28.0</td>
</tr>
<tr>
<td>March</td>
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</tr>
<tr>
<td>April</td>
<td>30.2</td>
<td></td>
<td>28.9</td>
</tr>
<tr>
<td>May</td>
<td>30.9</td>
<td></td>
<td>29.2</td>
</tr>
<tr>
<td>June</td>
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<td></td>
<td>18.6</td>
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<tr>
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<td></td>
<td>6.7</td>
</tr>
<tr>
<td>August</td>
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<td></td>
<td>0.8</td>
</tr>
<tr>
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<td></td>
<td>4.2</td>
</tr>
<tr>
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<td></td>
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</tr>
<tr>
<td>December</td>
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<td>15.8</td>
</tr>
<tr>
<td>January</td>
<td>24.2</td>
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</table>
Sand - silt - clay diagram
(after Shepard, 1954)

Figure 3. Sand-silt-clay contents in the sediment of the study area during pre-monsoon (○) and monsoon (●) period.
this period the salinity marked a fall almost to a near-freshwater condition. Lowest salinity (1.4 & 0.8 ppt) could be noticed during August. Again in September a rise in salinity value was noticed. Salinity distribution showed only minor variation till November due to the small amount of precipitation during the northeast monsoon period. From December onwards again a steady increase in salinity was noticed.

The results of grain size analysis of the sediments obtained during the pre-monsoon and monsoon periods are shown in Figure 3. The average percentage of sediment fractions of the pre-monsoon period was 28.1% (sand), 48.4% (silt) and 23.5% (clay) and was of sand silt clay in nature. During the monsoon period sediment was of silty sand type with 69.68% of sand.

3.5 DISCUSSION

An understanding of the seasonal variation of important physico-chemical factors of estuaries is an essential pre-requisite for the interpretation of the distribution, abundance, settlement and various behavioural responses of an animal population. Temperature, salinity and the nature of the bottom deposit are the significant factors that may affect the distribution of bottom fauna (Jones, 1950). Among these factors, salinity is the major factor affecting the distribution and abundance of *Museulista senhausia* in the study area. A marked difference in salinity values between pre-monsoon and monsoon periods was observed. The river discharge during the period of southwest monsoon results in drastic decrease in the salinity. During the peak period of the southwest monsoon, it is almost close to freshwater condition. The quantity of freshwater discharged into the backwater through the rivers and
land run off is so much that the tidal influences become almost negligible. During this period remarkable change in the distribution of *M. senhausia* could be encountered. The population was totally absent in this area. The settlement of spat could also not be encountered during this season which may be due to the prevalence of very low saline condition in the backwater.

Those animals which are acclimated to changing salinities through several years of physiological adjustments survive wide fluctuations in salinity, while less tolerant forms are completely eliminated or they migrate to the adjacent suitable area and the area left bare by the organisms is subsequently recolonised by the larvae of these organisms brought in by tidal currents when optimum condition is reestablished (Batcha, 1984). Extremely low salinity of the ambient medium results in the reduction in the number of individuals. Thus diversity of species was low during the southwest monsoon period. Desai and Kutty (1967) observed that the salinity of the water governs the abundance of bottom fauna of the Cochin backwater. Parulekar et al. (1973) suggested that a decrease in the population of *Meretrix casta* in Benastrim clam bed in Mandovi-Cumberjua canal and Zuari estuarine system of Goa was associated with the unfavourable natural condition of high temperature and high salinity. Madhupratap (1978) found higher numerical counts and biomass of zooplankton in Cochin backwaters during high saline pre-monsoon period and a decrease with the onset of monsoon. Ajithakumar (1984) found difference in the distribution of *Perna indica* and *Perna viridis* according to salinity fluctuation.

Presence of *M. senhausia* again observed in November-December months as a result of the gradual rise in salinity of the backwater and its intensity
attains a peak during the pre-monsoon months of March-May when the salinity become high. During these periods the mussel is found to form thick beds in bottom sediment in varying densities. Besides, these are found to invade the inner part of the whole estuary with the salinity increase. Thus it is found aggregated in different regions of the estuary.

Nature of substratum can be another important factor restricting the occurrence of the mussel *M. senhausia*. Here the sediment of the mussel bed is a mixture of sand, silt and clay. This is found to be the suitable substratum for the vigorous growth of the species. During late-monsoon period the sediment is found to contain more sand and less silt with fragments of shells in it. In this sediment *M. senhausia* could not be encountered. Thus silty sand and thick clay are found to be not suitable for the existence of the species. Particle size of the sediment is a function of the mixing process and dilution of sea water with freshwater (Batcha, 1984). Desai and Kutty (1967) have stressed the importance of sediment texture in the distribution of benthic fauna. Vizakat et al. (1991) also obtained similar results in the study on the distribution of benthic community in the sub-tidal region of Konkan coast. Thus it can be suggested that sediment texture is also an important factor in controlling the formation of the mussel bed, even though the salinity is regarded as the major limiting factor in the occurrence and distribution of *M. senhausia*.

During pre-monsoon period the abundance and exploitation of this mussel are quite high. The mussel divers reach the location of bed by canoes and collect the mussel by hand. Using a net bag they separate the mussels
from mud. canoe is full collects about no mussel fish

Figure 4. Mussel divers collecting the mussels from bottom sediments

Figure 5. A load of mussels collected
from mud. The fishing is generally done at low tides for 3-4 hours till the canoe is full with mussels or the high tide begins. A canoe with two persons collects about 200-300 kg of mussels per day. The season for the mussel fishery in this zone starts from October/November to June. There will be no mussel fishery during monsoon months.