5. COMMUNITY STRUCTURE AND ORGANISATION

5.1 Introduction

Most of the marine ecosystems today are subjected to anthropogenic disturbances, which has considerable effects on habitat quality and associated biota. The current rapid rates of increase in urbanization, industrialization and over population lead to changes in biomass, species composition and diversity (Chapin III et al., 1997). The natural communities of zooplankton consist of a great variety of species. The number of species present is used to express the diversity of plankton community. The productive nature of any environment can be assessed by its species richness and population density. Prasad (2003) studied the Diversity and Richness of zooplankton in Coringa mangrove habitat, east coast of India. Seasonal variations and species association of meroplankton in the Palk Bay and Gulf of Manar along the east coast was studied by Krishnamoorthy and Subramanian in the year 2003.

Species diversity is an important parameter of an ecosystem (Mac Arthur, 1965; Margalef, 1968). Species diversity is a measure of finding the distribution of individuals in a natural community of different species. Systems with high diversity have more trophic pathways through which energy flows (Mac Arthur, 1955). According to Sanders (1968) has been asserted that the evolution of communities lies in the biological interactions and stability of the ecosystem. Devassay and Battathiri (1974) reported that the diversity index gives a measure of the way in which individuals in a community are distributed.

5.2 Materials and Methods

The collection and other procedures are given in chapter 2.

To assess the ecological diversity of the micro and macrozooplankton in the environment, the following parameters were calculated using Shannon-Weaver index (Pielou, 1975 and Shannon and Weaver 1963).

\[
H' = - \sum{pi \log_2 pi}
\]

Where \(H'\) = Diversity in bits/indivudal.

\(Pi = \frac{ni}{N}\)

\(ni=\) Number of individuals in the sample.

\(N=\) Total number of individuals in the sample.

Species Richness Index (SR) (Gleason, 1922) was calculated using the formula

\[
SR = \frac{S-1}{\ln N}
\]

Where \(S=\) Number of species.

\(N=\) Natural logarithm of the total number of individuals of all species in the sample.

Evenness or Equitability (‘J’) the distribution of individuals among various species was calculated using the formula of Pielou, (1966).

\[
J = \frac{H'}{\log_2 S}
\]

Where \(H'\) = The species diversity in bits/individual.

\(S=\) Number of species.
5.3 Results

5.3.1 Spatial and temporal variations of species diversity, richness and evenness of Microzooplankton in station I and II

In station I recorded the high index value of 3.24 bits/unit, during May and June 2006 and the low index value was recorded 2.03 in December 2005. At station II the diversity was ranged from 2.87 bits/unit (August 2005) to 3.16 bits/unit (April 2006). Species diversity (H’) of microzooplankton community ranged from 2.03 to 3.24 bits/unit, in station I and II. The species diversity reached its peak in summer months (May and June 2006) and fall during monsoon season (December 2005) in station I and in station II it was recorded the highest index value in summer (April 2006) and the lowest value during premonsoon season (August 2005) (Table7 & Figure 183).

In station I the highest species richness was recorded 45 species during April and May 2006 and in station II it was recorded 47 species during May 2006. In both stations the highest species richness was recorded during summer season (Table8 & Fig.184). In the present study the species richness is higher (47) in station II than in station I (45). The high evenness index value (0.87) of microzooplankton population were observed in station I during January 2006 and the lowest of evenness value (0.55) was observed during December 2005 in station II. At station II the lowest value of 0.79 evenness was noted in the month of September 2005 and the highest value 0.85 was observed in the month of January 2006. (Table 9 & Fig 185). The statistical analysis of variance showed that the results of annual variations in the indices of species diversity of microzooplankton during July 2005- June 2006 at station I and II was found significant (Table 13).

5.3.2 Spatial and temporal variations of species diversity, richness and evenness of Macrozooplankton in station I and II

In station I, the high index value of 3.89 was recorded during June 2006 and low index value of 3.06 was recorded in March 2006 and in station II the high index value of 3.79 was recorded in November 2005 and low index value of 3.22 was recorded in January 2006. Species diversity (H’) of macrozooplankton community was ranged from 3.06 to 3.89 bits/unit, in station I and II. The maximum species diversity
was recorded in summer and minimum was recorded in post monsoon season in station I and in station II the maximum was recorded in monsoon and minimum was recorded in post monsoon. (Table 10 & Fig186)

The species richness ranged from 71 – 81 at station I. The lowest value of 71 species were recorded during monsoon season (December 2005) and the highest value of 81 species were recorded during summer season (April 2006). At station II the highest species richness was recorded in the month of July 2005 and the lowest species richness was recorded in the month of January 2006. Species richness ranged from 67 species to 103 species in station II. It is showed in Table 11 & Fig 187.

The evenness index of macrozooplankton population were observed in station II and the highest value of evenness 0.85 was recorded in November 2005 and lowest of evenness value 0.68 was recorded during June 2006 at station I. At station I it was ranged from 0.68 (June 2006) to 0.82 (December 2005) and the minimum was observed during summer and the minimum was recorded in monsoon (Table 12 & Fig 188). At station II the evenness values varied between 0.75 and 0.85. The maximum was recorded during monsoon month (November 2005) and minimum was recorded during premonsoon (August 2005) and summer (April and May 2006) months. In the present study in both stations the highest evenness index of macrozooplankton population was observed during monsoon season and the lowest value was observed during summer season. The analysis of variance (Table 14) for annual variation in the indices of species diversity of macrozooplankton at station I and II was found significant.

5.4 Discussion

Species diversity is defined as the absolute number of species present in an environment (Pillai et al., 1973). Species diversity is used as a measure of maturity of an ecosystem (Margalef, 1958). In the present study the microzooplankton diversity values were ranged from 2.03 to 3.24 bits / unit. Margalef (1967) reported that the tintinnids showed higher diversity than copepods in West Mediterranean sea. Beers et al. (1980) reported the high species diversity index for tintinnids. In the present study the maximum diversity (3.24) was observed during summer (May 2006 and June2006)
season in station I and this may be due to more number of species observed during summer month. From this it could be inferred that the species diversity increased during active species succession. This similar observation has been made by Damodara Naidu (1980) in tintinnid community in Vellar estuary. The more number of macrozooplankton with high diversity was also noted in the present study. Generally species diversity increased with an increase in population density. In the present study high species diversity was observed during summer and pre monsoon seasons when the population density was high, whereas the low values were observed during the monsoon season due to low population density. Chandran (1982) reported that the maximum diversity was observed inter tidal zone of vellar estuary during pre monsoon and summer.

Less variation in micro and macrozooplankton species diversity values at station I and II reflects the stability of environmental conditions. The summer, late post monsoon and early pre monsoon seasons were too stable to develop high diversity. It was due to the physiological stress and physico-chemical characteristics imposed by the environment. Even though the high population density was associated with high species diversity, the lower diversity index for microzooplankton at station I corresponding with higher population density were observed in the present study. This may be due to dominant occurrence of copepods during the same period, other zooplankton species were found minimum. The low diversity index values noticed during monsoon could be attributed to heavy rainfall and turbidity. Similar observation has been made Sivakumar (1982), Thanagaraj (1984) and Jegadeesan (1986).

In general, species diversity coincides with the species richness i.e., with the increase in species richness will increase species diversity. In the present study the species richness value was 28 during August 2005 and the diversity index value was 2.52 during December 2005. In station I the species richness value was 40 and the species diversity index value of microzooplankton was very low throughout the study period all the months of study period. The higher species diversity was observed during summer months may due to favorable hydrographic parameters and rich nutrients. At station II the values of species richness do not always coincide with species diversity
index value for macrozooplankton. The highest species richness value was 103 in the month of July 2005 and the species diversity index value was 3.66 and this value was compared with low species richness value (67) and species diversity value (3.22). In the present study the difference in the diversity values were negligible.

In the present study the species richness were recorded during peak summer and this similar observations were observed from Arasalar, Kaveri and Coleroon estuarine waters (Saraswathy, 1993, Bragadeeswaran, 2002 and Thillai Rajaseker et al., 2005). Another approach of diversity is by determining the equitability which is defined as the extent to which the species occur in numbers. Thus the equitability is greatest when the specimens of different species composing a sample are in equal numbers and minimal when the specimens are most unequally divided among species.

In the present study the low diversity values coincided with low evenness values. In both stations high evenness value was observed during some months maybe due to indicated that the species were present in the particular months are equally distributed and not allowing a single species to dominate over others. Contrary to this low value of evenness during December 2005 (0.55) at station I of microzooplankton suggested that the unequal distribution of the species. This could be substantiated with the findings of Patrick (1971), reported that the evenness of distribution of specimens among the species may result the competition under optimum conditions or may be responsible of unfavorable conditions.

Goswami and Selvakumar (1977) found a significant correlation between salinity and copepod species. In the present study also observed the significant correlation between copepod species and salinity. The values of microzooplankton diversity have positive correlation with salinity (Wellershaus, 1974). In the present study a significant positive correlation was observed between salinity and species richness in both the stations. The variations occurred in diversity of zooplankton could be explained to some extent based on environmental fluctuations. In the present study, during the low salinity period the diversity value was low and the zooplankton abundance was quite steady with intermediate densities. The highest and lowest
densities of zooplankton were found to coincide respectively with the minimum and maximum suspended particulate matter concentration (Kelly et al., 2000).

Abundance and diversity of zooplankton at station I and II are reflected in the status of diversity and productivity of marine ecosystem of these two stations as a whole. The present baseline information on the zooplankton distribution and abundance are useful for further ecological assessment, monitoring of the coastal ecosystem and fishery production (the livelihood of the native people) of S.P. Pattinam and Manamelkudi.