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Comparative study of planktonic diversity in manakkudy (mangroves) estuary

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ABSTRACT

Nutrients are considered as one of the most important parameters in the estuarine environment influencing growth, reproduction and metabolic activities of living beings. The results of an investigation carried out during March 2010 to August 2010 on physico-chemical and diversity of phytoplankton and zooplankton at the Manakkudy estuary (Southwest coast of India) were reported. Presence of Mangrove forest gives a helping hand in the maintenance of biodiversity and increase in fauna and flora of Manakkudy estuary (Brackishwater). Presently, 66 phytoplankton species representing different classes, viz., Bacillariophyceae (25); Chlorophyceae (18); Cyanophyceae (10); Dinophyceae (8) and Euglenophyceae (5) were recorded. Totally 93 species of zooplankton viz., Rotifera (42); Protozoa (24); Arthropoda (12); Cnidaria (11) and Annelida (4) were identified.

Introduction

Life in aquatic environment is largely governed by physico-chemical characteristics and their stability. Estuaries are economically important ecosystem for fisheries in tropical regions (Kawabata *et al*., 1993) and they act as a transitional zone between land and sea (Bardarudeen *et al*., 1996). Planktonic communities are highly sensitive to environmental variations, as a result change in their abundance, species diversity or community composition can provide important indication of a particular environment. Biomass and productivity of phytoplankton in different size ranges are important factors regulating the productivity of higher tropic level organisms. Phytoplankton initiates the marine food chain, by serving as food to primary consumers like zooplankton, shellfish and finfish (Sridhar *et al*., 2006., Mathivanan *et al*., 2007). Tropical aquatic ecosystems are the most productive areas with rich zooplankton population (Robertson and Blabber, 1992). Studies on planktonic composition and physico-chemical characterization of water bodies are necessary to obtain basic knowledge on the biodiversity in a given region. Therefore, an attempt has been made to assess the comparative study of planktonic (phyto and zooplankton) diversity and certain physico- chemical characteristics in Manakkudy estuary.

Materials and methods

Monthly samples were collected from Manakkudy estuary (Kanyakumari District, Tamil Nadu) for some physico-chemical, phytoplankton and zooplankton analysis during the period of March 2010 to August 2010. The famous Manakkudy estuary (Latitudes 8° 05; Longitudes 77° 32') is located on the southwest coast of India. Manakkudy estuary formed by the confluence of river Pazhayar with Arabian Sea. Manakkudy estuary covers an area of 150 hectares which extends over a length of 2kms with a width of about 500m and 4.85m depth. The estuary is planked with retting pits on either side of the bend region of the estuary. On either side the banks of this estuary more than 200ha of salt pans are situated. Expect during the monsoon season the estuarine water is separated from the sea, by a sand bar. So this estuary is called as a "Bar built Estuary". Another attraction of Manakkudy is the mangrove ecosystemof the estuarine environment serves as a good nursing ground for several species of fish and shell fish and it is a store house of seed resources. Water and Atmospheric temperature were measured using an accurate mercury thermometer. PH was assessed using the digital Elico pH meter. Dissolved oxygen, salinity and alkalinity were analyzed by standared methods (APHA, 1985). Phosphate, nitrite, nitrate and ammonia were estimated the standared methods described by Strickland and Parsons (1972). Phytoplankton and zooplankton were identified using the standard works of Desikachary (1959 and 1987), Santhanam *et al*. (1987), and Davis (1955).

Results and discussion

Presently variations of Physico-chemical characteristics of Manakkudy estuary were represented in Table 1. Air and water temperature values (°C) varied from 28.6 and 30.1 and from 27.8 to 29.8 respectively. During the study period, there was a marked variation in different water quality characteristics. Hutchinson (1957) stated that temperature is important in controlling both the quality and quantity of plankton. The pH values recorded ranged between 7.6 to 8.2. The recorded high summer pH might be due to the influence of sea water penetration and high biological activity (Das *et al*., 1997) .The salinity values (ppt) varied from 10.8 and 19.1. The salinity acts as a limiting factor in the distribution of living organisms and its variation caused by dilution and evaporation is most likely to influence the fauna in the coastal ecosystem (Balasubramanian and Kannan, 2005). The alkalinity values (mg/l) ranged from 46.2 to 120 respectively. An increase in total alkalinity may be related with increase in pH as suggested by Wetzel (1983). Variation in dissolved oxygen content values (mg/l) from 3.22 and 4.39 respectively. The ammonia (µg.at-N/l) values observed from 2.18 to 3.75. The recorded higher concentration could be partially due to the death and subsequent decomposition of phytoplankton and also due to the excretion of ammonia by planktonic organisms (Segar and Hariharan, 1989). In this biotope, nitrite values (µg.at-N/l) observed from 0.28 to 0.96. The recorded low nitrite value may be due to less freshwater

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inflow and high salinity (Murugan and Ayyakkannu., 1991). The nitrate values (µg.at-N/l) ranged between 1.95 and 2.90 respectively. The increased nitrate level was due to freshwater inflow, mangrove leaves (litter fall) decomposition and terrestrial run-off during some season (Santhanam and Perumal, 2003). The recorded phosphate values (µg.at-P/l) observed from 0.48 to 0.90. Phosphorus is one of the important nutrients governing overall algal growth.

Out of 66 species of phytoplankton, 25 species belonged to Bacillariophyceae, 18 species to Chlorophyceae, 10 species to Cyanophyceae, 8 species to Dinophyceae and 5 species to Euglenophyceae were recorded. In this observation, among the various species *Amphora ovalis, A.angusta, Bacteriastrum varians, B.furcatum, Coscinodiscus subtilis, Cyclotella granii, Diploneis cuspiduta, D.iyra, Navicula indica, N.longa, Nitzschia marina,* were the most abundant forms. Ei-Gindy and Dorghan (1992) reported that phytoplankton and their growth depend on several environmental factors, which are variable in different seasons and regions. Meshram (2005) reported that overloading of nutrients and dissolved matter in water bodies affect the plankton diversity. The phytoplankton distribution and productivity depends on various physico-chemical factors such as salinity, pH, temperature and nutrients (Nedumaran *et al*., 2001).

A total of 93 species of zooplankton, the majority was formed by Rotifera (42), followed by 24 forms of Protozoa, 12 species of Arthropoda, 11 species of Cnidaria and 4 species of Annelida were identified. The most common species of zooplankton were *Acartia danae, A.spinicauda, A.southwelli, A.erythraea, Acrocalanus gracilis, A.gibber, Acanthometron sp, Brachionus calyciformis, B.plicatilis, B.angularis, Copepod nauplii, Euphausia diomediae, Tintinnopsis tubulosa, T.butschi, T.beroidea, T.cylindrica, T.mortensenii, T.bermudensis, Oithona rigida, and O.brevicomis.* The abundance and variations in zooplankton of estuaries are mainly related with salinity regime. The zooplankton in the mangrove areas mostly includes Rotifera, Protozoa, Copepods and Crustacean larvae. Studies on zooplankton communities, especially Copepods are very important in assessing the health of coastal ecosystems (Ramaiah and Nair, 1997). Further, among the calanoids, *Acartia spp*. dominated the other forms throughout study period (Madhupratap, 1987) and that of *Oithona spp*. among cyclopoid was noticed (Mckinnon and Klumpp, 1998). Similar findings were earlier reported in Parangipettai coastal waters by Santhanam and Perumal (2003) who have pointed out that the abundance of *Oithona sp*. (3) was mainly due to its high reproductive capacity. In the present investigation, when the planktonic diversity was subjected to comparative analysis, higher productivity could be registered in zooplankton than the phytoplankton species. The high level of zooplankton productivity may be due to the ample food availability as well as due to their continuous breeding nature, high reproductive capacity and the suitable environmental conditions of this biotope. The low level of phytoplankton production may be due to grazing by zooplankton and fishes. And also phytoplankton production is dependent on physico-chemical conditions such as temperature, salinity, pH and certain nutrients.

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Table 1. Physico-chemical characteristics of Manakkudy estuary during March 2010-August 2010

Parameters	March	April	May	June	July	August
At temp.(°C)	30.1	30.0	28.7	28.9	28.6	29.2
Water temp.(°C)	29.8	29.0	28.1	28.1	27.8	29.0
pH	8.0	8.1	7.9	7.6	8.2	7.8
Salinity (ppt)	19.0	14.6	16.5	12.7	19.1	10.8
Alkalinity (mg/l)	78.0	120	68.7	79.1	79.1	46.2
DO (mg/l)	4.16	4.38	3.49	4.39	3.22	3.71
Nitrite (µg.at-N/l)	0.28	0.96	0.34	0.34	0.29	0.29
Nitrate (µg.at-N/l)	2.10	1.95	2.90	2.90	2.10	2.80
Ammonia (µg.at-N/l)	2.78	3.75	3.14	3.11	3.15	3.14
Phosphate (µg.at-P/l)	0.90	0.48	0.64	0.52	0.62	0.52

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