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STUDIES ON PLANKTON DIVERSITY OF TUTICORIN MANGROVE ECOSYSTEM

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S.R.T. SHERLY CROSS
St.Mary's College, Thoothukudi, Tamil Nadu, India

T. JEBARANI RAJATHY & T. MOHANRAJ
Aditanar College of Arts and Science, Tiruchendur, Tamil Nadu, India

Abstract

Investigation on phytoplankton and zooplankton diversity of the mangrove environs of the Gulf of Mannar biosphere reserve, in specific to Karapad Bay and Korampallam Creek of Tuticorin was carried out from March 2010 to February 2011. Regular monthly samples were collected from the study area and were subjected to plankton identification and biomass estimation. From this one year study, a total of 14 phytoplankton and 12 zooplankton species were evidenced.Thallasiothrix sp., Rhizosolenia sp. and Cossinodiscus sp. were the dominant forms of phytoplanktons from the study area. The maximum number of phytoplanktons wasrecordedas242.36 cells /l at Korampallam creek during April 2010
***Keywords**: Gulf of Mannar, mangroves, biomass, plankton*

Introduction

Ecologically, mangroves are defined as an assemblage of tropical trees and shrubs that inhabit thecoastal intertidal zone. The area under mangrove ecosystem in Tamil Nadu is about 225 $km^{2.}$ Mangrove forests are rich in biodiversity providing a habitat for wide varieties of animal and plant species.They also act as nurseries for fin fish, shell fish, crustaceans and molluscs. In addition, mangrove forests play a vital role in trapping sediments, thereby stabilizing coastlines and protectingcoral reefsand sea grass meadows. Fertility and healthiness of mangrove environment is reflected through productivity of the phytoplankton and zooplankton as primary and secondary producers. Organic materials derived from decaying mangrove leaves are also used as primary food source, which sustain larval and juvenile stocks.

Both phytoplankton and zooplankton communities have been successfully used in coastal water quality monitoring and as bio indicators of pollution (Wang *et al.*, 1999; Brooks *et al.*, 1999; Dunbar and Webber, 2003; Webber *et al.*, 2005). They are the initial biological components from which energy is transferred to higher organisms through food chain (Ananthan*et al.*, 2004; Tiwari *et al.*, 2006). Data on abundance, distribution and species composition of phytoplankton are essential to know the status of an estuarine ecosystem. They form the vital source of energy in the marine environment. They initiate the marine food chain, by serving as food to primary consumers, which include zooplankton, shellfish, finfish and others (Ananthan*et al.*, 2004; Tas and Gonulol, 2007).Robertson and Blabber (1992) suggested that the plankton in mangrove habitats contribute about 20 to 50% of total fish productivity.

Influence of physical and chemical variables on planktonic communities in mangrove waters are more pronounced than the near shore coastal environment, resulting in seasonal changes of planktonic species composition and densities (Kannan and Vasantha, 1992). Thus, planktonic communities and their periodic shift in abundance and composition is an important biotic factor in the mangrove ecosystem. Information on species diversity, richness, evenness and dominance evaluation on the biological components of the ecosystem is essential to understand detrimental changes in environs (Krishnamoorthy and Subramanian, 1999). Some studies on the annual distribution patterns of phytoplankton have been made earlier in the Pichavaram mangroves (Krishnamurthy and Jeyaseelan, 1983; Mani, 1992; Kathiresan, 2000).

Most studies have been focused in bays and not enough is known about the potential of planktonic communities as descriptors in mangrove lagoons. Hence the present study has been undertaken with a prospect to understand the diversity and biomass of plankton species found in the Tuticorin mangrove ecosystem.

Materials and Methods

Study Area

The present investigation was carried out to study the phytoplankton, zooplankton diversity for a period of one year from March 2010 to February 2011 at 4 stations of Karapad Bay and 3 stations of Korampallam Creek.

Phytoplankton

Surface water samples were collected at different stations. Hundred litres of seawater was concentrated to 250ml by filtering through 20µ mesh-sized plankton net. The cells were quantitatively estimated using a Sedgewick Rafter. The Phytoplanktons were identified using binocular microscope and were classified up to species level following standard monographs (Hustedt, 1930; Peragallo, 1965; Newell and Newell, 1966).

Zooplankton

Water samples were collected from surface haul by using Heron-Tranter plankton net with a mesh size of 300 µ for 10 minutes at 1 nautical mile per hour boat speed. The planktons were counted using a Sedgewick Rafter. The Zooplanktons were then identified by referring standard manuals (Wickstead, 1965).

Results and Discussion

The phytoplankton and zooplankton species were recorded the maximum at Korampallam Creek as compared to the Karapad Bay. A total of 14 phytoplankton species were recorded from the Karapad Bay and Korampallam Creek mangrove region throughout the study period (Table 1). There was a slight variation in the species distribution and biomass between the different stations. However Thallasiothrix, Rhizosolenia and Cossinodiscus were the dominant forms. Phytoplankton biomass was observed between 181.89 and 242.36 cells / l in the study stations (Fig 3).

During the study period, 12 zooplankton species belonging to 10 genera were identified (Table 2). The zooplankton collections were dominated by copepods and eggs and larvae of fish, crabs and prawn. The dominant presence of larvae in the region denotes that the area is highly productive and acts as a breeding and feeding ground for juvenile fishes, shrimps, crabs and other crustaceans.The distribution was almost even throughout the different stations and at different seasons, except during the months of April and May. The zooplankton biomass was between 136542 and 192640 cells/m^3 (Fig 4).

The biomass of phyto and zooplankton was more in the mangrove zones, gradually increasing from March 2010 to May 2010.The maximum numbers of planktons were evidencedin the month of May, after whichthere was a declining trend in the density of phyto and zooplanktons. The results are shown in Figures 3 & 4.

The surface temperature of any aquatic ecosystem is an important factor for the distribution and relative biomass of plankton species. Thus increasing temperature enhances the metabolic rates of algal cells and growth rate of phytoplankton species. The growth rate is faster at higher temperature but drops considerably beyond an optimal temperature (Eppley*et al.*, 1979; Schoemann*et al.*, 2005). At Karapad Bay, the lowestnumbers of phytoplanktons were recorded during the month of Juneand zooplanktons during the months of September to December, which may be due to coupled effect of warm coolant water from nearby Tuticorin Thermal Power

Station aided by the atmospheric temperature. All zooplankton are poikilothermic and thus physiological rate processes and rates of overall growth are highly sensitive to temperature (Huntley and Lopez, 1992).

Among the zooplanktons Copepods and lucifer constituted the major standing crops followed by fish eggs. Stray dominance of mysisand amphipods in March, prawn larvae in November, decapods in February were also observed. At the Korampallam Creek, there was a rise in zooplankton volume from April, which attained a maximum value of 192640cells/m^3 during May, associated with monsoon. Except during March, April and June, the copepods constituted the most dominated group followed by fish eggs, lucifer, mysis, decapods and prawn larvae. The two peaks in zooplankton volume observed at both the stations, during April – May (high magnitude) and October - December (low magnitude) agreed with the findings of Marichamy*et al.* (1985) and Sreenivasan*et al.* (1995) that also have indicated the same trend in Gulf of Mannar area in their studies. The increased occurrence of fish eggs during May – July indicated the possible spawning season of various fin-fishes in this area.

Thus, the present observations indicated not much change in the relative fertility of Tuticorin waters especially the inshore waters from past studies (Asha and Diwakar, 2007). While the importance of mangroves as a nursery area for fish and prawn species has become a focus for research. The zooplanktons of mangroves are a major component of the trophic structure and should be equally valued within the research (Beck *et al.*, 2001). However, the role of zooplankton in mangroves is virtually unknown despite their pivotal trophic role as intermediaries between alternative carbon sources (detritus) and higher consumers such as fish (McKinnon and Klumpp, 1998). Zooplanktons in Indian mangroves were found to comprise mainly of copepods, in some seasons up to 95% (Kathiresan, 2000). Thisaccessible information through the studyonphyto and zooplankton distribution and biomass could form a useful tool for further ecological assessment and monitoring of these mangrove ecosystems of Tuticorin.

Conclusion

Lack of knowledge on mangrove ecosystems, their extent, status and linkages to other ecosystems hampers efforts to conserve and manage mangroves, leading to the unsustainable exploitation of these productive coastal resources. According to Macintosh and Ashton (2002)a comprehensive information database of mangrove biodiversity in each country is necessary to monitor the status of mangrove biological diversity, realise its economic potential and areas of application. This is critical in planning an effective management of mangroves. Mangroves serve as a critical nursery for young marine life and therefore play an important role in the health of fisheries and the economic well-being of fishermen.

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Table 1 Shows list of Phytoplankton collected from the study area (+Present; -Absent)

Name of the Phytoplankton	Karapad Bay	Korampallam Creek
Cyclotellastriata	+	+
Skeletonemacostatum	-	+
Coscinodiscus centralize	+	+
Coscinodiscusgigas	+	+
Coscinodiscusradiatus	+	+
Rhizosoleniastyliformis	+	+

Rhizosoleniaalata	-	+
Triceratiumfavus	+	+
Odontellamobiliensis	+	+
Thalassionemanitzschioides	+	-
Thalassionemalineatum	-	+
Thalassiothrixfrauenfeldii	-	+
Pleurosigmaelongatum	-	+
Noctilucascintillans	+	-
Nitzschiaclosterium	+	-
Ceratiumtripos	+	+
Calothrixsp	+	+

Table 2 Shows list of Zooplankton collected from the study area (+ Present; - Absent)

Name of the Zooplankton	Karapad Bay	Korampallam Creek
Copepods	+	+
Acrocalanussp.	+	+
Corycaeusdanae	+	+
Oithonasp.	+	-
Acartiasp.	+	-
Paracalanussp.	+	-
Centropagessp.	+	-
Macrosetellasp.	-	+
Cheatognaths	-	+
Sagittasp.	-	+
Cladocera	+	+
Evadnesp.	+	-
Aurelia sp.	+	-
Gastropod larvae	+	+
Fish egg	+	-
Brachyuran megalopa	-	+
*Pontellid*nauplii	-	+
*Penaeid*nauplii	+	+
Copepod nauplii	+	+
Zoea larvae	+	+
Lucifer henseni	+	+
Mysis stage	-	+
Polychaete larvae	-	+

Fig 3 Biomass of Phytoplankton recorded during March 2010 to February 2011 (Cells / Litre)

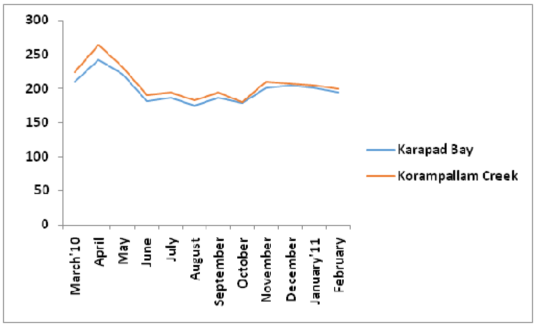

Fig 4 Biomass of Zooplankton recorded during March 2010 to February 2011 (Cells / m^3)