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# Assemblages of phytoplankton diversity in different zonation of Muthupet mangroves

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## HIGHLIGHTS

- Map-out the diversity pattern in different zonation of Muthupet mangroves.
- The limiting factor for phytoplankton growth was identified.
- In PCA, the hydrological parameters were enhancing the growth of phytoplankton.

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## ABSTRACT

The aim of this paper is to determine the seasonal successions, diversity and assemblages of phytoplankton population in different zones of Muthupet mangroves. The phytoplankton characteristics were studied at four different mangroves zones during 12 months of sampling period with monthly intervals. Species diversity, richness and evenness were calculated. Altogether, 72 species of phytoplankton were identified. The species belonging to four groups namely diatoms, dinoflagellates, blue greens and greens were recorded. Among these groups, diatom showed the highest contribution of the total abundance (Up to 70% in the different zone of Muthupet mangroves) and found to be more dominant in marine and Avicennia zone whereas blue greens and greens were found to be meagre in all the zones.



## 1. Introduction

Phytoplankton plays a vital role in the transfer of energy from primary to secondary level; hence, it acts as an integral part of marine and estuarine ecosystem (Tiwari and Nair, 1998). Phytoplankton is a predominant type of plants found in aquatic system and its community and relative abundance undergoes continuous changes at varying scales, and also used as good indicator of water quality (Muhammad, 2005). Mangroves ecosystems contribute to organic carbon and other nutrients in larger quantity to the adjacent coastal ecosystems through various mechanisms (Purvaja and Ramesh, 2000; Dittmar and Lara, 2001). Likewise, mangroves provide nutrients for phytoplankton growth, thus enhancing the secondary production and promotion of commercial fisheries (Alongi, 2002). Phytoplankton species are predominantly autotrophic or holophytic organisms. They are the most important producer of organic substances, and the rate of energy is stored in the tiny organisms determines the basic primary productivity of the ecosystem.

The assessment of plankton diversity may help to understanding the conservation ratio at various trophic levels. Some notable studies on phytoplankton and zooplankton diversity have been made by Rao and Choubey (1990); Ariyadej et al. (2004) and Mishra et al. (2010). According to Pawar et al. (2006) the phytoplankton study is a very useful tool for the assessment of biotic potential and contributes to overall estimation of basic nature and economic potential of water body. The use of a variety of agrochemicals in the catchment and human pressure is causing depletion of aquatic biota in the estuarine and coastal ecosystem. During monsoon season, turbidity caused by agricultural and surface runoff, diatoms and dinoflagellates have contrasting preferences as groups for ambient water turbulence; diatoms are generally found in high-turbulence habitats, whereas dinoflagellates are sensitive to turbulence (Margalef, 1978).

Several studies have shown marked differences in phytoplankton composition and distribution of mangrove waters; to our knowledge no study was undertaken regarding different zonation.

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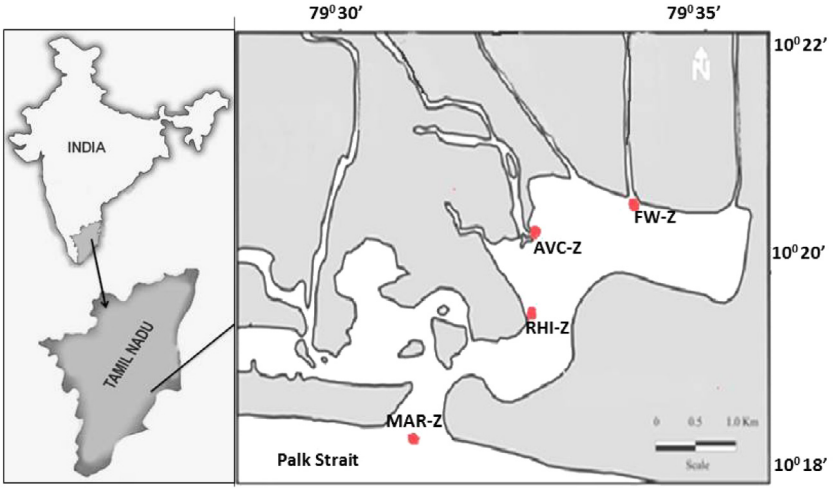


**Fig. 1.** Map showing the study area.

Therefore, in order to fill the lacunae that exist in this line; the present work has been made to study the assemblages of phytoplankton diversity in different zonations of Muthupet mangroves ecosystem.

## 2. Material and methods

Water samples were collected for season wise from the selected zones of Muthupet mangroves during January 2012–December 2012. For the present study, four different zones were selected taking into account factors such as fresh water zone, *Rhizophora* zone (core mangroves), *Avicennia* zone (core mangroves) and marine zone.

### 2.1. Study area

The Muthupet mangrove wetland of Vedaranyam area is located (Lat.10° 46′N Long.79° 51′E) in the southernmost tip of the Cauvery delta. It is a part of a large coastal wetland complex "Vedaranyam Swamp". This area has a gentle slope towards the Palk Strait of the Bay of Bengal. The distributaries of the Cauvery viz., Paminiyar, Koriyar, Kandaparichanar, Kilaithangiyar and Marakkakoraiyar discharge their waters into the wetlands and form a large lagoon before reaching the sea (see Fig. 1).

### 2.2. Physico-chemical parameters

For physico-chemical parameters, surface water sample was collected using plastic containers (1-L capacity) in all the zones. The plastic containers were rinsed thoroughly with sampling water (before use). After filling the containers, they were sealed and transferred to the laboratory for the physico-chemical analysis. The conventional parameters like water temperature were measured using sensitive thermometer (0.05 °C); water pH using Elico pH metre (model LI-120); water salinity using Hand portable Refractometer (ATAGO, Japan) and Dissolved oxygen were determined by using the modified standard method prescribed by Strickland and Parsons (1972). The Total Suspended Solids (TSS) and water nutrients ($NO_2$, $NO_3$, $NH_3$, $Po_4$ and $Sio_3$) were determined by standard methods as described by Grasshoff (1976) and Strickland and Parsons (1972).

### 2.3. Biological parameters

Phytoplankton samples were collected from the surface waters by towing a plankton net (mouth diameter 0.35 m) made of bolting silk (No.25 mesh size 48 μm) for half an hour. Subsequently, samples were preserved in 5% neutralized formalin and used for qualitative analysis. For the quantitative analysis of phytoplankton, the settling method described by Sukhanova (1978) was adopted. Numerical plankton analysis was carried out using Utermohl's sedimentation technique. Samples were allowed to settle in the counting chamber for 3–5 min prior to enumeration. Counting of plankton was done with the help of "Sedgwick-Rafter counting cell" as per the procedure given by Wetzel and Likens (2000). The plankton species were identified using standard works of Smith (1950) and Desikachary (1959). Further, the data were subjected to various univariate and multivariate methods available in PRIMER (Ver. 6). The Pearson correlation analysis was done using SPSS (Ver. 16) (Chicago, IL, USA). Principal component analysis was done with the help of PAST (Ver. 1.89).

## 3. Results

### 3.1. Environmental conditions

In the present investigation, the surface water temperature fluctuating between 21.5 and 34.4 °C with minimum during monsoon season and maximum during summer (Fig. 2(a)). The surface water salinity ranged from 28 to 34.2 psu with minimum in monsoon and maximum in summer season (Fig. 2(b)). Salinity varied significantly between the monsoon and summer seasons in the Muthupet mangroves waters, variations are probably influenced by fresh water discharge from rivers into the marine zone. The monthly fluctuations in the pH varied from 7.3 to 8.2 with minimum during monsoon and maximum during summer season respectively (Fig. 2(c)). The dissolved oxygen values were high (5.7 mg/l) during the monsoon and low (3.8 mg/l) during summer (Fig. 2(d)). TSS ranged from 15.5 to 76.5 ppm with minimum during summer and maximum during monsoon season (Fig. 2(e)).

Nutrients are considered as one of the most important parameters in the mangroves environment influencing growth, reproduction and metabolic activities of living organism. Distribution of nutrients is mainly based on the season, tidal conditions and freshwater flow from land source. Nutrients such as ammonia varied between 0.02 and 0.5 μmol/l minimum during summer and maximum value during premonsoon (Fig. 2(f)). Nitrite varied from 0.2 to 2 μmol/l with minimum during summer and maximum during premonsoon (Fig. 2(g)). Nitrate ranged between 2.42 and 4.94 μmol/l with minimum during summer and maximum during monsoon (Fig. 2(h)). Inorganic phosphate ranged between 0.9