Journal of Phytology 2009, 1(3): 158–163
© Journal of Phytology, 2009
ISSN: 2075-6240
Available Online: www.journal-phytology.com

REGULAR ARTICLE

STUDIES ON ECOLOGY OF PHYTOPLANKTON FROM PICHAVARAM MANGROVES, SOUTH EAST COAST OF INDIA

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SUMMARY

The spatial and seasonal distribution of phytoplankton species and their abundance to hydrographical parameters were studied during April 2000 and March 2001 from two stations of Pichavaram mangroves located in south east coast of India, (Lat. 11°27'N: Long 79°47E). During the study 91 species of phytoplankton were recorded which belongs to different groups viz. Diatoms (73), Dinoflagellates (17) and Slicoflagellates (1). Species such as *Coscinodiscus centralis, Pleurosigma elongatum, Thalassionema nitzschioides, Skeletonema costatum Triceratium favus, Odentella sinensis, Navicula longa* and *Ceratium furca* Constituted bulk of the population density. More number of species was recorded at station 1 and the production of phytoplankton was very high during summer season. The temperature, salinity, pH and dissolved oxygen examined fairly stable during the study period except monsoon. During the summer season nutrients level was low as well as the phytoplankton density was very high.

Keywords: Hydrographical Parameter. Mangroves. Phytoplankton.

T. Nedumaran and V.A. Prabu. Studies on Ecology of Phytoplankton from Pichavaram mangroves, South East Coast of India. J Phytol 1 (2009) 158-163
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1. Introduction

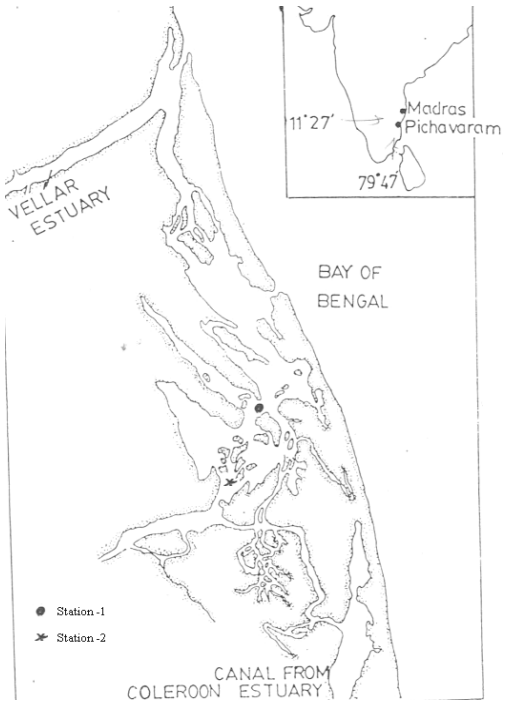
The phytoplankton is responsible for the process of primary production in water bodies and responsible for one quarter of the world's plant photosynthesis as the "Pastures of sea" [1]. Phytoplankton production contributes about 95% of the marine environment [2]. They serve as bio-indicators with reference to water quality and thus serve as a tool for assessing the health of the aquatic eco-systems. Phytoplankton may also be used to trace climatic changes in different geological periods and currently they are used as live-feed for zooplankton and the larvae of aquatic invertebrates and vertebrates in hatcheries. In recent years it was increasingly felt to explore and exploit all possible aquatic food resources to meet the nutritional requirements of the ever-increasing human population, the phytoplankton distribution and productivity depend on various physical-chemical factors such as temperature, salinity, DO, pH and nutrients like nitrite, nitrate, phosphate and silicate.

The mangrove ecosystem is a complex and dynamic one. The sense as a nursery ground for many commercially important fishes, shrimps and crabs, phytoplankton can be used as bio-indicators. Since they reflect even the subtle changes taking place in their immediate environment by changing, their species composition biomass and community structures. Productivity of the mangrove ecosystem is largely determined by their phytoplankton production. Hence the present attempt was made to study the hydrobiological characteristics of the mangrove area of Pichavaram, one of the ecologically interesting biotops.

2. Materials and Methods

The present investigation was made for a period of one year from April 2000 to March 2001 at two stations namely Periakadavu (Station-1) and Karithurai (Station- 2) located in the Pichavaram mangroves (Lat.11°27′N: Long.79°47′E) (Fig.1).

Fig. 1. Map sowing the study area



To estimate the physical and chemical characteristics, monthly surface water samplings were done. Temperature (air and surface water) was measured using a standard centigrade thermometer. Salinity, pH, dissolved oxygen and nutrients such as nitrate, nitrite, phosphate and silicate were estimated by adopting standard procedures [3]. For the qualitative analysis of phytoplankton, haulings were made using a plankton net (0.35 m mouth diameter) fabricated with bolting silk (Cloth No.25. 48 μm) for 15 minutes and the samples were preserved in 5% neutralized formalin. For the quantitative analysis of phytoplankton, the settling method described by Sukhanova [4] was adopted. Numerical plankton analysis was carried out using a Utermohl's inverted microscope. The species of phytoplankton were identified by using the standard works of in South Indian Diatoms [5], in West Coast of North American plankton diatoms [6], diatoms in Madras Coast, India [7], some fresh water algae [8], some Cyanophyta [9] and blue green algae in certain marine environment [10].

3. Results

Monthly rainfall varied from the minimum value of 10.0 mm (pre-monsoon season - July) to the maximum value of 297.5 mm (monsoon season - November) and no rainfall was recorded during February and March. The atmospheric temperature ranged between 28°C to 38°C at station -1 and from 26.5°C and 35°C at station -2 (Fig. 2). The surface water temperature varied from 27.5°C to 36°C at station 1 and from 26.5°C 35°C at station 2 (Fig. 3). Salinity showed wide variations and fluctuated from 8 to 33%o at station - 1 and 4 to 25%o at station - 2 (Fig. 4). The pH ranged between 7.2 and 8 at station - 1 and from 7.1 to 8.2 at station - 2 (Fig. 5). Low pH values were recorded during the monsoon season and higher values during the pre-

monsoon season. Dissolved oxygen concentration varied from 2.0 to 6.7 ml/l at station - 1 and from 3.2 to 6.8 ml/l at station-2 (Fig. 6) with the maximum during the monsoon season in November and the minimum during the post monsoon season in March at both the stations. The concentration ranges (µm) of nitrate, nitrite, phosphate and silicate at station 1 and 2 were 9.5 - 28.5 and 9.5-30.1, 1.2-5.7 and 1.2-5.7, 0.7-2.0 and 0.7-2.3 and 22.1-83.4 and 22.7-88.5 respectively (Figs. 7-10). All the nutrients were found to be high during monsoon season in November at both the stations.

Fig. 2. Seasonal Variation in Atmospheric temperature during April 2000 to March 2001 at Stations 1 and 2

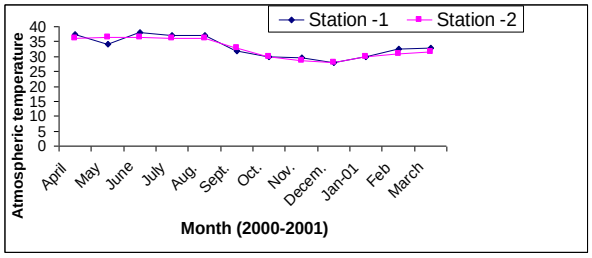


Fig. 3. Seasonal changes in Surface Water temperature during April 2000 to March 2001at Stations 1 and 2

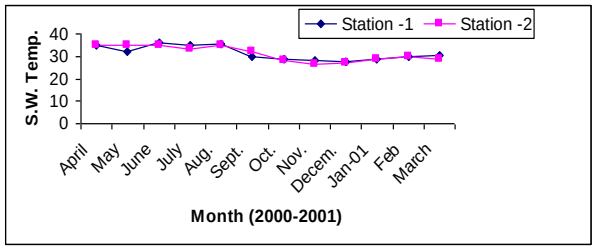


Fig. 4. Seasonal changes in Salinity during April 2000 to March 2001at Stations 1 and 2

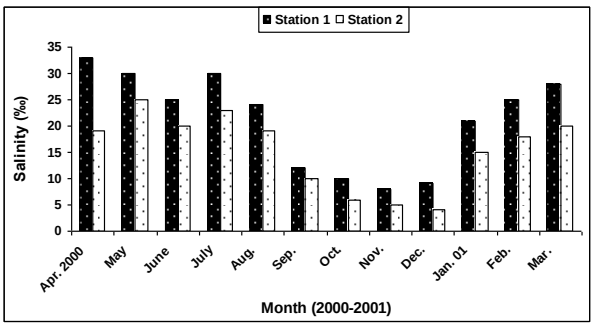


Fig. 5. Seasonal changes in pH during April 2000 to March 2001at Stations 1 and 2

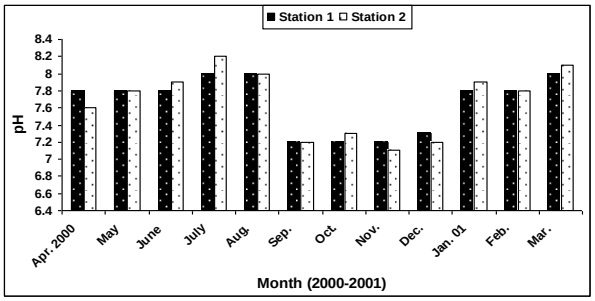


Fig. 6. Seasonal changes in dissolved oxygen during April 2000 to March 2001at Stations 1 and 2

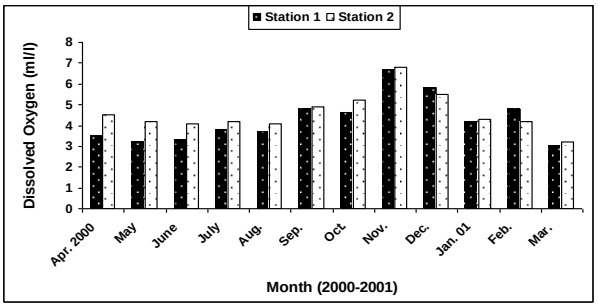


Fig. 7. Seasonal changes in Nitrate during April 2000 to March 2001at Stations 1 and 2

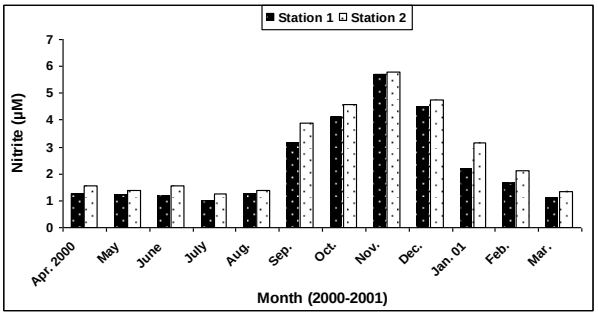


Fig. 8. Seasonal changes in Nitrite during April 2000 to March 2001at Stations 1 and 2

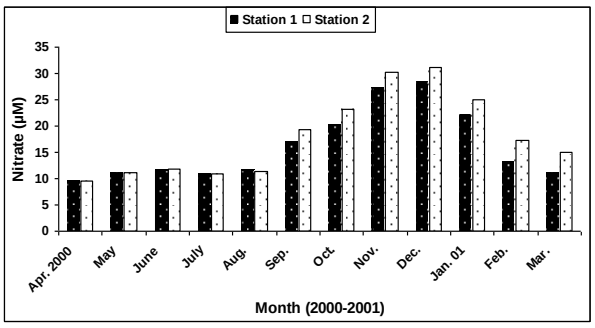


Fig. 9. Seasonal changes in phosphate during April 2000 to March 2001at Stations 1 and 2

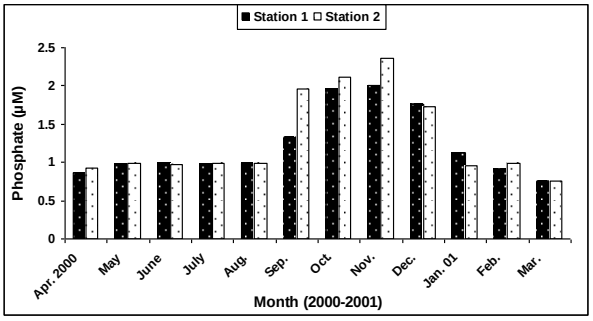
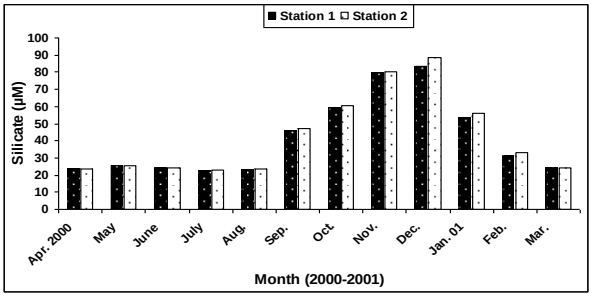


Fig. 10 Seasonal changes in Silicate during April 2000 to March 2001at Stations 1 and 2



A total of 91 species of phytoplankton were recorded and they belonged to different groups viz., (73) species of Diatoms, (17) species of Dinoflagellates, and (1) species of Silicoflagellates (Table 1). Phytoplankton occurred at two stations of the Pichavaram mangroves population density during the summer season (Table-1). The phytoplankton was dominated by diatoms, *Coscinodiscus centralis, C. excentricus, Skeletonema costatum, Ditylum brightwelli, Triceratium favus, Bacteriastrum comosum, Bellerochea malleus, Odentella sinensis, Eucambia zoodiocus, Rhizosolenia alata, Pleurosigma elongatum*, and *Thalassionema nitzschioides*.

Higher number of dinoflagellatus was observed during the summer season and the dominant species were Ceratium furca, C. tripos, *C. macroceros*, *Dinophysis caudata, Prorocentrum micans,* and *Protoperidinium oceanicum*.

4. Discussion

The northeast monsoon is very active during October to December and the maximum rainfall occurs in the study areas during this season. The monsoon rainfall exerts profound effects on the physico-chemical conditions such as the water, temperature, salinity, dissolved oxygen and nutrients. The maximum air and surface water temperatures during summer were due to the high atmospheric temperature and more radiant of solar energy falling on the surface water and high penetration in to the water column. The minimum air and surface water temperature observed during monsoon season in November were more humidity, cloudy sky and monsoonal rainfall. Salinity is an important hydrographical factor and it showed wide spatial and temporal variations. The maximum salinity value recorded during summer and pre-monsoon could be attributed to high solar radiation and salt-water dominance in summer. The minimum salinity registered in this study may be attributed to the monsoon rain and river run off. These observations were also well evidenced by the similar findings of seasonal and diurnal variation of hydrobiological characters of coastal waters of Chennai [11] and phytoplankton diversity in the Coleroon Estuary, south east coast of India [12].

The recorded minimum values of dissolved oxygen in post-monsoon season and maximum values in monsoon season are in agreement with the earlier observations [13, 14]. The pH is the reflection of many biological and chemical processes occurring in the natural waters [12]. The inorganic nutrient concentration was always higher during monsoon season due to heavy rain fall, land drainage and the input of fertilizers from the catchments areas and the lower values in the other seasons could be due to utilization by the phytoplankton [15].

Table 1. Check list of Phytoplankton Pichavaram Mangroves from Apr.2000 to Mar.2001.

Bacillariophyceae (DIATOMS)	St-1	St-2
Achnanthes brevipes Ag.	+	+
Amphora coffeaeformis (A.g.)kutz	+	+
A. marina (W.Son) V.H.	+	-
Asterionella japonica (Cl & Moller	+	-
Bacillaria paradoxa Gmel.	+	+
Bacteriastrum cosmosum Pavill	+	+
B. hyalinum Lauder	+	-
B. delicatulum Cleve	+	-
Bellerochea malleus (Btw.) V.H.	+	-
Biddulphia heteroceros Grun	+	-
Odentella mobilensis (Bail.) Grun	+	+
Odentella sinensis (Grev.) Grun	+	+
Chaetoceros affinis Lauder	+	+
C. diversus Cl.	+	-
C. lorenzianus Grun	+	-
C. peruvianum Brightwell	+	+
C. indicus Nov.	+	-
C.curvisetus Cleve	+	-
C. robusta Cleve.	+	-
Climacodium fraunfeldianum Grun	+	-
Cocconeis disculoidus Cl.	-	+
Coscinodiscus centralis Ehr.	+	+
C. gigas Her.	+	+
C. lineatus Ehr	-	+
C. radiatus Ehr.	+	+
C. excentricus Ehr	+	+
Cyclotella sp.	+	+
Ditylum brightwellii (West) Grun	+	+
Eucambia zoodiacus Ehr.	+	-
Fragilaria oceanica Cl	+	-
F. intermedia (Grev.) Grun.	+	+
Guinardia flaccida (Castra) Perag.	+	-
Gyrosigma balticum (Ehr.) C1	+	-
G. scalprides (Rabenh.) Cl.	+	+
Hemiaulus hauckil Grun	+	-
Hemidiscus hardmanianus (Grev.)	+	-
Leptocylindrus danicus Cl	+	+
Lithodesmium undulatum Ehr.	+	+
Lauderia annulata (Grev.) Cl.	+	+
Melosira sulcata (Ehr.) Kutz.	+	+
M. granulata Berb. & Ehr.	+	-
Navicula salinarum Grun.	+	+
N. longa (Greg.) Ralfs.	+	+
Nitzschia acuta Cl.	+	-
N. closterium Ehr.	+	+
N. longissima (Breb.) Ralfs	-	+
N. obtusa W. Sm.	+	+
N. sigmoidea W. Sm.	+	-
N.seriata Cl.	+	+
Planktoniella sol (Wallich) Shütt.	-	+
Pleurosigma angulatum (Kuetz.)	+	+
P. elongatum W. Sm.	+	-
P. narmanii Ralfs	+	-
P. aestuarii Berb. w.sm	-	+
Raphidonema Sp.	-	+
Rhizosolenia alata Brightwell	+	+
R. cylindrus Cl.	+	-
R. hebetata Bail	-	+
R. imbricata Brightw.	+	+
R. setigera Brightw.	+	-
R. stolterfothi H. Perag.	-	+
R. styliformis Brightw.	+	+
R. robusta Norman	+	-
Schroederella delicatula (Perag.)	-	+
Skeletonema costatum (Grev.) Ralfts	+	+
Stephanopyxis palmariana (Grev.)	+	-
Streptotheca tamensis Shrub.	+	-
Thalassionema nitzschioides Grun	+	+
Thalassiosira subtilis (Ehr.) Cl.	+	-
Thalassiothrix frauenfeldii (Grun.)	+	+
Triceratium favus (Ehr.) Clap.	+	+
T. reticulatum Ehr.	+	+
T. robertsianum Greville.	+	+
DINOPHYCEAE (DINOFLAGELLATES)		
Ceratium breve (Ost. schm.) Sch.	+	+
Amphisolenia bidentata Sch	+	-
C. furca (Ehr.) Clap & Lachm.	+	-
C. fusus (Ehr.) Dujard.	+	+
C. extensum (Paul.) Balech.	+	+
C. macroceros (Ehr.) Cl.	+	-
C. tripos (O.F.Mull.) Nitzsch.	+	+
Dinophysis caudata Kent	+	-
*Gymnodinium b*reve Davis	+	-
Noctiluca scintillans Sch. (Mac.)	+	-
Ornithocercus steinii Sch.	+	-
Prorocentrum micans Her.	+	+
Protoperidinium excentricum	-	+
P. oceanicum (Van.) Balech	+	-
P. pentagonum (Gran) Belech	+	-
P. spiniferum (Schiller) Belech	-	+
Pyrophacus horlogium Steinii	+	+
CHRYSOPHYCEAE (SILICOFLAGELLATES)		
Dictyocha fibula Ehr.	+	+

+ Present, - Absent; St- Station

The abundance showed major peaks, during summer however, coupled with decreased nutrient level and increased salinity. The domination of phytoplankton during low nutrient condition (summer) phytoplankton population reached its minimum in peak monsoon period because of many unfavourable conditions such as, heavy terrestrial runoff, high turbidity and suspended silt, low salinity and seaward flushing. Similar observation was recorded on earlier studies of Managem mangroves [16], Pichavaram mangroves [17] and Nethravathi estuary [18].

It can be concluded that phytoplankton biomass was maximum during summer season and minimum during monsoon season in the mangrove environment. The phytoplankton species composition and dominance are closely associated with the prevailing hydrographic parameters and nutrients.

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