

## A study on bio-documentation of phytoplankton diversity of Pamaniyar river, Mannargudi, Thiruvarur district

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### Abstract

In aquatic ecosystems, planktons act as a bio-indicator and one of the crucial signal of environmental disturbances. Planktonic quantification from four sites of Pamaniyar river, Thiruvarur District, were assessed for seasonal variations. Phytoplankton as Cyanophyta, Chlorophyta, Bacillariophyta and Euglenophyta were found major groups. Comparative data related to abundance of species showed that, members of Bacillariophyta were dominated.

**Keywords:** Phytoplanktons, biodocumentation, contamination

### Introduction

The composition, distribution and abundance of phytoplankton was found depend upon the chemical and physical qualities of water. Phytoplankton in the aquatic community serves as a food for development and growth of zooplankton. Apart from primary production, phytoplankton plays an vital role in food web of herbivorous animals and measured as biodocumentary indicators for water quality. The distribution of plankton depends on several factors as such as climatic changes, physical and chemical parameters. Most of the species of planktonic organisms were cosmopolitan in distribution (Mukharjee, 1997) [15]. Phytoplankton, being the primary producer, forms the lowest trophic level in the food chain of fresh water ecosystem, moreover, number and species of phytoplankton determined the quality of aquatic ecosystem (Bahura 2001) [2]. Distributions of phytoplankton with variation at different zones are influenced by physiochemical parameters of water. Phytoplankton study provides a relevant and convenient point in research and in mechanism of eutrophication with its impact on an aquatic eco-system (Meshram and Dhande, 2000).

Biological documentation provides the basis for life on the earth. Therefore applications of species richness indices are very essential to evaluate the distribution of species abundance. In the present study highlights planktonic richness, diversity and its relationship in terms of taxonomic richness and density which would help to understand diversity indices of biological community. Obtained data was discussed in relation to pollution status of Pamaniyar river and its impact over bioresource in the ecosystem.

### Materials and Methods



**Fig 1:** Map of study area

**a. Study Area:** Mannargudi is located at 10.67°N 79.43°E. It has an average elevation of 6 m (20 ft). Mannargudi is situated on the banks of Pamaniyar River, a tributary of the Vettar and is covered with fertile soil conducive for rice cultivation. The topography is completely flat and the town is a part of the fertile Cauvery Delta. Mannargudi is situated at a distance of 300 km (190 mi) from the state capital Chennai and 28 km (17 mi) from Tiruvarur, the district headquarters. The period from November to February in Mannargudi has a climate full of warm days and cool nights. The onset of summer is from March to the end of June. The average temperature range from 37 °C (99 °F) in January to 22.5 °C (72.5 °F) in May and June. Summer rains are sparse and the first monsoon, the South-West monsoon, usually sets in June and continues until September. North-East monsoon usually sets in October and continues until January. The rainfall during North-East monsoon is relatively higher and is beneficial to the district at large because of the heavy rainfall and the Western ghats feeding the river Cauvery. The average rainfall is 37 inches (940 mm), most of which is contributed by the North-East monsoon.

**b. Collection of Samples:** The plankton samples were collected by filtering 50 liters of water through standard planktonic net (75µm mesh) concentrated samples were stalked in 5% formalin. After settlement, the samples were diluted up to desirable concentration. Planktonic assessment of aquatic bodies was carried out by standard methods.

**c. Phytoplankton Assessment:** The systematic identification of phytoplankton was made by using standard keys of Sarode P.T. Kamat H.P. (1984) [19]. IAAB (1998) [16], Adoni A, Joshi, Gosh K, Chourasia S.K, Vaishya A.K., Yadav M and Verma H.G. (1985), Michael R G and Sharma B K (1988) and Dhanapathi (2000). [5] Sedge Wick – Rafter counting cell at 100 x magnifications was used for quantitative analysis of phytoplankton and zooplankton (Sedgwick, 1988) [20]. Routine analyses of physicochemical parameters were carried out. Data was compiled and graphically presented. Results were interpreted for the documentation of planktonic diversity and contamination status among four aquatic bodies.

## Results

### I. Phytoplankton Analysis

Phytoplankton as green algae, blue green algae, diatoms, desmids etc. were important among aquatic flora and proved ecologically significant as they forms the primary link in food chain for all aquatic animals (Misra *et al.*, 2001). The present study showed three groups of phytoplanktonic population as *Cyanophyta*, *Chlorophyta*, and *Bacillariophyta* (Table No. 1). Comparatively *Bacillariophyta*, was dominating with sixteen species in it. Next to *Bacillariophyta*, *Chlorophyta*, included nine species whereas, *Cyanophyta* showed four diversified species in study area.

- Cyanophyta:** Cyanophyta showed four species *Anabaena*, *Anacystis*, *Gomphosphaeria aponina*, *Cylindrospemum minimum*.
- Chlorophyta:** Chlorophyta showed nine species *Actinastrum gracillimum*, *Actinastrum hantzschii*, *Ankistrodesmus fulcatus*, *Chlorella*, *Eunotia faba*, *Microspora*, *Botricoccus*, *Pinnularia interrupta*,

*Spirogyra*.

- Bacillariophyta:** Comparative data related to abundance of species showed that, members of *Bacillariophyta* were found dominated, among these *Diatoma*, *Cyclotella meneghiniana*, *Gomphonema olivaceum*, *Gomphonema sphaerophorum*, *Gomphonema spiculoides*, *Navicula mutica*, *Navicula rodisa*, *Cymbella ventricosa*, *Fragilaria pinnata*. From August onwards the *Diatoma*'s started increasing and showed peak in December.

Phytoplanktonic population in the study area showed order of dominancy among the species with regards to number as follows: *Bacillariophyta* > *Chlorophyta* > *Cyanophyta*. The total numbers of phytoplankton species are 29. Maximum species richness in terms of Margalef's index ( $R_1=23.322$ ) recorded at site IV while minimum at site I ( $R_1=21.548$ ). Similarly maximum species diversity in terms of Shannon index ( $H' =1.531$ ) at site I while minimum ( $H' = 1.415$ ) at site IV. Maximum Mackintosh diversity ( $D= 1.226$ ) at site IV while minimum ( $D = 1.201$ ) at site I. Maximum species evenness was recorded at Mackintosh Evenness ( $E= 1.198$ ) at site II while minimum at site IV ( $E= 1.19$ ) respectively (Table No. 2).

**Table 1:** Enumeration of phytoplankton occurring at the study site throughout the year under summer, rainy and winter seasons

Phytoplankton Orders	Summer	Rainy	Winter
I. Cyanophyta			
<i>Anabaena</i>	+++	++++	++
<i>Anacystis</i>	+++	+++	+++
<i>Gomphosphaeria aponina</i>	+++	+++	+++
<i>Cylindrospemum minimum</i>	+++	++++	++
II. Chlorophyta			
<i>Actinastrum gracillimum</i>	+++	++++	++++
<i>Actinastrum hantzschii</i>	+++	+++	+++
<i>Ankistrodesmus fulcatus</i>	+++	ND	+++
<i>Chlorella</i>	+++	++++	+++
<i>Eunotia faba</i>	+++	++++	+++
<i>Microspora</i>	+++	++	+++
<i>Botricoccus</i>	+++	++++	+++
<i>Pinnularia interrupta</i>	+++	+++	++
<i>Spirogyra</i>	+++	+++	++
III. Bacillariophyta			
<i>Diatoma</i>	+++	+++	+++
<i>Cyclotella meneghiniana</i>	+++	+++	+++
<i>Gomphonema olivaceum</i>	+++	++	++++
<i>Gomphonema sphaerophorum</i>	+++	+++	ND
<i>Gomphonema spiculoides</i>	+++	+++	+++
<i>Gomphonema subapicatum</i>	+++	++	+++
<i>Navicula cryptocephala</i>	+++	+++	++++
<i>Navicula mutica</i>	+++	+++	++++
<i>Navicula protracta</i>	+++	ND	++
<i>Navicula pupala</i>	+++	+++	++
<i>Navicula rodisa</i>	+++	+++	++
<i>Cymbella turgidula</i>	+++	+++	+++
<i>Cymbella ventricosa</i>	+++	+++	+++
<i>Fragilaria constrains</i>	+++	+++	+++
<i>Fragilaria pinnata</i>	+++	+++	+++
<i>Stauroneis phoenicenteron</i>	+++	+++	+++

**Table 2:** Annual variation of phytoplanktons and biodiversity indices

Indices	Index	I	II	III	IV
Species richness	(NO) (R <sub>1</sub> )	34 21.548	34 21.925	34 22.566	23.322
Species diversity	(H*) (D)	1.531 1.201	1.505 1.205	1.462 1.215	1.415 1.226
Species evenness	(E)	1.201	1.198	1.194	1.19

(NO)=No of all species, (R<sub>1</sub>) =Margalef's index, (H\*) = Shannon index, (D) = Mackintosh diversity, (E) = Mackintosh Evenness

### Discussion

Now a day's aquatic biodiversity is threatened primarily by human misuse and mismanagement of both living resources and the ecosystems that support them. Most of the ponds are getting polluted due to domestic waste, sewage, industrial and agricultural effluents. The requirement of water from micro-organisms to man became serious problem because of unplanned urbanization and industrialization in a restricted zones. Water quality assessment generally involves analysis of physico-chemical, biological and microbiological parameters and reflects on abiotic and biotic status of the ecosystem (IAAB, 1998) [16].

In the present study, seasonal changes showed variation in planktonic population, most of the species were least documented in the period of rainy season our results were coincides with planktonic analysis of (Singh *et al.*, 2002) [23]. We found that, Phytoplankton population was maximum in summer due to favourable conditions of high level of nutrients with increased photo period of day with high intensity of light. Hunchinson, (1967) [7] found that, growth of phytoplanktons were more in pre-monsoon because of favourable environmental conditions as light, temperature etc.

### Conclusion

This study concluded that, high value of species richness at site I showed longer food chain indicating stable habitat as compared to other sites. Site II, III and IV polluted by contamination of sewage and other industrial effluents. Therefore, the water body has to be preserved for their future use, a sustainable and holistic management planning is necessary for conservation of Pamaniyar river.

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