

Influence of Spatial and Temporal Variations on Phytoplankton Community Structure in Pachiparai Reservoir, Kanyakumari District, TN, India

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ABSTRACT

Pachiparai Reservoir in Kanyakumari District TN, India is influenced by seasonally reversing monsoon and the characteristics of the water body influenced by riverine inflow. An effort to elucidate the spatial and temporal variation in the phytoplankton community was carried out. The observations were primarily made by during Jan 2004 – Dec 2004. Average phytoplankton abundance and primary production varied marginally during the period of study. Surface phytoplankton population showed seasonal variations and the abundance peaked during the beginning of North East monsoon (November). The inflow of water during the monsoon into the reservoir was the prime factor that influenced input of the nutrients and appeared to enhance the primary production. This study provides the details of the spatial and temporal variation and explores the implication and causative factors responsible for the dynamics of the phytoplankton populations.

KEYWORDS: Pachiparai Reservoir; Primary Production; Phytoplankton Diversity; Shannon – Weiner diversity index; Simpson index.

INTRODUCTION

A number of factors have been attributed to influence the diversity of fauna and flora in any aquatic ecosystem. An assessment of biological productivity of any aquatic ecosystem is essential to ascertain whether the productivity is sufficient enough to support the standing stock of commercially important fishes. Topical reservoirs are generally characterized by rich population of Phytoplankton (Srinivasan, 1964). Among the various factors that influence the diversity of fauna and flora of a reservoir ecosystem, phytoplankton play a pivotal role in the production of organic matter, which in turn is decided by the various environmental factors. Studies on the primary productivity in Indian lentic systems are meager (Srinivasan, 1964; Joshi et al., 1995; Sukumaran and Dhas 2001; Shrivastava, 2005). In the present investigation the primary productivity and phytoplankton diversity in Pachiparai Reservoir in Kanyakumari District TN, India was assessed to provide the present status of primary productivity and phytoplankton diversity of reservoirs in South India.

MATERIALS AND METHODS

The investigation was carried out over a period of twelve months Jan 2004 to Dec 2004. Phytoplankton samples were collected by filtering the water through bolting silk cloth (No. 25) and preserved in 4% formalin. The systematic identification of the phytoplankton was done adopting the standard keys of Desikachary (1959) and Cramer (1984). The enumeration of phytoplankton count was carried out with the help of a haemocytometer. The species diversity indices, viz., Shannon – Weiner diversity index (H^1), Simpson index (SI) and evenness index (D) were computed. Assessment of primary productivity was done as per the procedures of Apha (1992).

RESULTS AND DISCUSSION

In the present study, from the Pachiparai reservoir at least 13 species of phytoplankton were recorded. Of these 8 species belong to the division Chlorophyta, 3 Chrysophyta and 2 Cyanophyta (Fig. 1). The division Chlorophyta was comprised of *Staurastum longipes* and *S. fremantii* which were recorded almost through the course of investigation. *Staurodesms* sp. did not occur during Apr and May and *Ulothrix* sp. from Dec to Apr. The division Chrysophyta, was mostly represented by *Melosira* sp. during Jan - Apr, *Naviculata* sp. Jun - Mar and *Botryococcus* sp. Feb - Nov. In the case of Cyanophyta, *Oscillatoria* sp. occurred in abundance from Feb - May and *Microcystis* sp. from Jan – Jul (Fig. 2). In the study period maximum phytoplankton density (1021 Nos⁻¹) was recorded in the month of Nov. *Staurastum* sp. where recorded through the year, where as *Zygnema* sp. was the most abundant species (602 No⁻¹) recorded in the month of Mar (Table1).

The species diversity H^1 ranged from 1.242 (Sep) to 1.897 (Jan), SI from 0.614 (May) 0.898 (Jul) and J^1 from 0.646 (Apr) to 956 (Aug) (Fig. 3). The primary productivity in the planktonic algae is maximum in the upper photic zone of the water body. Therefore, assessments of the standing crop and rate of production are important factors that determine the fishery potential (Salakar and Yearagi, 2004). In the present study, primary production varied between 1412 mg C m⁻³d⁻¹ (Sep) to 3902 mg C m⁻³d⁻¹ (Jan). The high values of net primary production (NPP) gross primary production (GPP) could be recorded during the months of Jan, Feb, Jul, Aug and Dec all these months being the post monsoon period (Fig. 4).

The seasonal abundance of phytoplankton in Pachiparai reservoir was very high during post secondary monsoon season (Jan to Mar) than the post primary monsoon season (Aug and Sep). The phytoplankton population was considerably low during period of high precipitation; this could be due to the high turbid nature of the water in the reservoir which in turn brings about the decline in the intensity of light that enters through the water

on the upper region (Sugunan, 1980). A direct relationship between monsoon flow and plankton density has been reported in Richand reservoir (Nataraj, 1976).

The Shennon – Weiner diversity index (H¹) and Simpson index (SI) of the reservoir increased due to varied proliferation of phytoplankton during the two post monsoon seasons. This observation is in agreement with the previous report of Sugunam (1991) for net plankton in Nagarjunasargar reservoir. Sukumaran and Karthikeyan (1999) recorded similar observations in the species diversity of peri-phyton in Markonahalli reservoir. Decline in the values of diversity indices in the southwest monsoon and northeast monsoon coincide with the decline of species index of the phytoplankton community. This observation is in accordance with that of Margalef (1963). The establishment of some species during certain months during certain months could be attributed to the prevalence of favorable environmental conditions. Evenness index j was higher in certain months apparently due to comparable distribution of various genera and the species in the habitat as affirmed Whilm and Dorris (1968).

Phytoplankton synthesis new organic carbon by the process of photosynthesis in the present study the values of gross primary productivity and net primary productivity were higher in the post monsoon seasons. Subbamma (1993) observed that the population of the phytoplankton was much higher in the summer than in other seasons. This could be due to the prolonged day length and high intensity of light during this period. Srinivasan (1964) observed similar results in the Ammaravathi reservoir. In the present study the maximum value of NPP was recorded in the post monsoon period. This could be due to the prolonged availability of light and inflow of nutrients during the monsoon.

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Table 1. Phytoplankton Diversity in the Pachiparai Reservoir.

Phytoplankton Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Staurostrum longipes</i>	11	26	12	04	03	29	32	42	84	64	55	23
<i>S. fremantii</i>	41	46	32	11	03	14	29	39	06	16	21	32
<i>Staurodems</i> sp.	08	02	00	00	00	09	24	16	09	12	35	20
<i>Odegonium</i> sp.	00	10	14	08	02	00	00	00	00	00	00	00
<i>Desmidium</i> sp.	00	11	14	02	03	00	00	00	00	00	00	00
<i>Zygnema</i> sp.	36	306	602	262	120	12	00	00	00	00	00	18

<i>Spirogyra</i> sp.	16	26	30	07	02	00	00	00	00	00	00	06
<i>Ulothrix</i> sp.	06	08	06	15	00	00	00	00	00	00	00	03
<i>Melosira</i> sp.	18	28	48	21	00	00	00	00	00	00	00	00
<i>Navicula</i> sp.	04	10	14	00	00	10	20	24	26	18	19	16
<i>Botryococcus</i> sp.	00	230	126	110	118	70	46	50	75	32	03	00
<i>Oscillatoria</i> sp.	00	26	37	18	03	00	00	00	00	00	00	00
<i>Microcystis</i> sp.	04	62	86	73	18	03	04	00	00	00	00	00

Fig. 1. Divisions of Phytoplanktons in Pechiparai Reservoir.

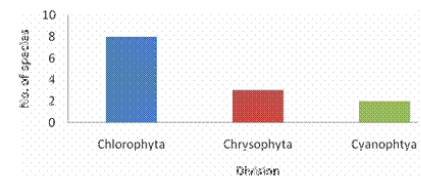


Fig. 2. Diversity of Phytoplanktons in Pechiparai Reservoir.

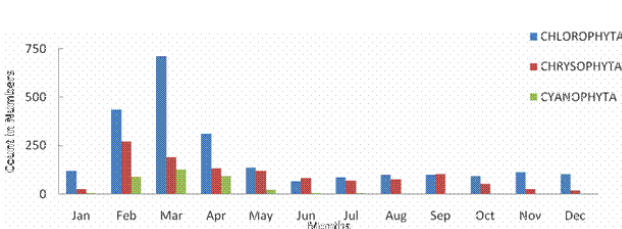


Fig. 3. Diversity index of the Phytoplanktons in Pechiparai Reservoir.

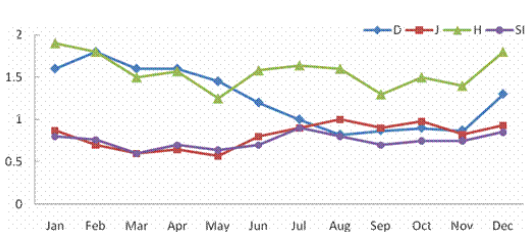


Fig. 4. NPP and GPP of the Phytoplanktons in Pechiparai Reservoir.

