

# Diversity of Plankton in a Village Pond at Dhanuvachapuram, Trivandrum

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**ABSTRACT:** Ponds, Lakes and Reservoir are most important water resources with multiple human utilization and ecological relevance. The old village pond at Dhanuvachapuram is such a pond which is almost oval in shape with an extent of 23 m<sup>2</sup>sq area. There is a seasonal variation in the depth of the pond. There is a continuous flow of water through the inlet and outlet. The pond also receives water from the neighboring Neyyar dam. In the present study an attempt has been made to study the seasonal variations in the plankton community, its diversity and hydrological parameters of this water body. In the present study, a total of 30 species of Phytoplankton and 32 species of Zooplankton were indentified from different classes during August 2014 to March 2015. Among the identified species, phytoplankton showed the complete dominance, especially, Chlorophyceae (48%) formed the dominant group, followed by Bacillariophyceae (35%), Cyanophyceae (13%) and Euglenophyceae(4%), while amid the zooplankton, Rotifers constituted (31%) followed by Copepoda (26%), Cladocera (19%), Crustacean (15%) and the least Protozoans (9%). The seasonal abundance of planktonic communities and its diversity were studied and fluctuations in the hydrological variables like DO, pH, Free CO<sub>2</sub>, TSS and temperature were also been recorded. The result provides a primary documentation of the plankton community and its diversity and basic understanding of the trophic status of the pond ecosystem.

**KEYWORDS:** Pond diversity, Physicochemical parameters, Seasonal variations

## I. INTRODUCTION

Ponds are generally small, shallow, confined bodies of standing water, habitats of great importance providing water for domestic, industrial and agricultural uses. Knowledge regarding the ecology of pond water is important tool for their systematic study. The planktonic study is a very useful tool for the assessment of water quality and productivity of any type of water body and also contributes to understanding of lentic water bodies (Pawar et.al 2006). The maintenance of healthy aquatic ecosystem is dependent on the biological diversity of the ecosystem and the abiotic properties of water (Harikrishnan,et.al,1999). Distribution of plankton and their variation at different zones of a water body is known to be influenced by physico-chemical parameters of water. Plankton are free floating microscopic organism that swim on the upper surfaces of water or are suspended in the water column. In aquatic system phytoplankton are an important biological characteristic which includes blue-green algae, green algae, diatoms, euglenoids etc. Similarly, zooplankton occupies the secondary level in the food chain and plays a significant role in the transformation of food energy synthesized by the phytoplankton to the higher trophic level. These freshwater communities are extremely sensitive to environmental variations. The phytoplankton community shows high diversity with the seasonal fluctuation, which indicates the diversity in ecological niches. The phytoplankton population of the Dhanuvachapuram pond includes Chlorophyceae, Bacillariophyceae, Cyanophyceae, and Euglenophyceae while zooplankton comprises of Rotifers, Cladocerans and Copepods. In the present study an attempt has been made to assess the diversity of phytoplankton and zooplankton and their distribution in the village pond.

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## II. RELATED WORK

Plankton species composition and abundance are functions of interactions with environmental conditions including, temperature, dissolved oxygen, pH and turbidity, in addition to grazing, competition and disease. Hutchinson and Bowen (1947) stated that it is well known fact that the total quantity of plankton present in the water of any water body may undergo marked and rapid variation, so that in the course of a year a number of pulses may succeed each other. The planktonic community at the Dhanuvachapuram pond shows a wide displacement from those occurring in natural unpolluted water bodies. Reports of annual planktonic community distribution and their peak concentration for Indian freshwater have been given by Ganpathi and Chacko and Krsihnamurthy (1954), Das and Srivastava (1956), Das (1957, 1959) and Michael(1968). In general a bimodal peak (postmonsoon and monsoon peak) occurring in July – September and Oct - Nov respectively is the usual pattern in India. In the present study, however, there was increase in plankton diversity during the monsoon followed by postmonsoon. Nevertheless, some small scale variations also occurs due to specific changes. Michael (1968) reported a single but prolonged peak lasting from January to April. Similarly, Mukerjee et.al (1993, 1995) in their studies of a polluted pond reported a single peak of phytoplankton in October-November. In the present study, though, zooplankton diversity does not coincide with peaks in phytoplankton community, similar observation was reported by Cotelloe et al (2005) rather 'it occurs with the time lag. This may be due to the grazing intensities of both zooplankton and fishes and the time the most of the zooplankters require time to develop, as reported.

## III. MATERIAL AND METHOD

The study was carried out from August 2014 to March 2015. Samples were collected on the basis of seasonal wise i.e Monsoon (August- September), post-monsoon (October – November), December-January (winter) and February – March (pre-monsoon) etc. Samples were preserved in 4% formalin. Four different sampling sites of pond were selected for the biological parameters study. The phytoplankton species have been identified following (Trivedi and Goel,1986; Gupta,1999 and Edmondson,1959). The zooplankton species have been identified with the help of standard keys of (Sarode and Kamat, 1984) and also analyzed few physico-chemical parameters as per standard procedures (Sigeo and Edward,2010; Roy and Datta Munshi,2010).

## IV. RESULTS

The annual mean value and standard deviation of the physico-chemical parameters of water recorded from four different sites and monthly variation in physico-chemical of village pond were presented in (Table 3). The water was found to light green in color. Air temperature and surface water temperature ranged from 29-32 °C to 26-30 °C respectively. The pH of water, the highest value was observed during Aug (7.8) and that of lower value during December (7.0). The transparency values found to be in the range between 17 cm (March) and 75 cm (January). Similarly, the dissolved oxygen (DO) ranged between 6.32mg/L and 8.72mg/L. The highest value of DO recorded was recorded in February and the minimum in March. Likewise, the minimum value of free CO<sub>2</sub> was observed in January (2.4mg/L) and that of maximum in October (10mg/L). The variation in CO<sub>2</sub> was due to the absorption by plants for photosynthesis and due to the activity of their living organisms. Total suspended solids (TSS) values ranged from 110 mg/L to 340 mg/L. The highest value was found during the monsoon (August), as this may be due to surface runoff. The present study recorded 30 species of phytoplankton belonging to 30 genera and families under the 4 classes (Table 1). Among these Chlorophyceae includes 11 species (belonging to 10 genera and 5family) followed by Bacillariophyceae 6 species (6 genera, 3family). The Cyanophyceae recorded 4 species belonging 4genera and 3 family. Family Zygnemataceae represents 5 species. Throughout the study Chlorophyceae was the most dominant class (Fig 1), it contributed about 48% of the total phytoplankton population. Diversity in this group was highest during the premonsoon and less during the monsoon. This class was represented by *Actinastrum* sp., *Arthrodesmus* sp., *Chlorococcum* sp., *Chlorosarcina* sp., *Closterium* sp., *Cosmarium* sp., *Dictyosphaerium* sp., *Hydrodictyon* sp., *Pediastrum* sp., *Scendesmus* sp., *Spirogyra* sp., and *Volvox* sp., Table 4 . Some species were more frequent, most abundant and encountered throughout the study period. Some were found in adequate numbers but it showed discontinuous distribution and were rare and showed site-

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specific distribution. *Navicula sp.*, *Chlorella sp.*, *Cladophora sp.*, *Cosmarium sp.*, *Oscillatoria sp.*, *Fragillaria sp.*, *Microspora sp.*, *Oedogonium sp.*, *Pediastrum sp.*, *Spirogyra sp.*, *Cymbella sp.*, *Gyrosigma sp.*, *Nitzschia sp.*, *Synedra sp.*, *Ulothrix sp.*, *Zygnema sp.*, *Anabaena sp.*, *Nostoc Sp etc* were rare and showed site –specific distribution. On the other hand, a total of 32 species of zooplankton belonging to 15 genera and 8 families under 4 classes were recorded (Table 2). 12 species of rotifer belonging 6 genera and 3 family, 7 species of copepod belonging to 7 genera and 3 families and 5 species of cladocera belonging to 5 genera and 3 families were recorded during the study period from the 4 study spots located at the village at Dhanuvachapuram. Among these, Zooplanktonic rotifer constituted 31% followed by copepod (26%) and cladocera 19% followed by crustaceans and protozoa each contributing 15% and 9% (Fig 2). Among the species like *Anuraeopsis fissa*, *Keratella cochlearis*, *Moina sp*, *Hexathra sp* were fairly common but they showed discontinues distribution. Few species like, *E. incise*, *Fillina longiseta*, *C.unicornis*, were less frequent and showed site specific distribution in all the seasons. Some species like *Cephalodella fortificula*, *Euchalanis dilates*, *Cypris sp* were found to be rare and encountered only certain seasons.

Fig 1 Percentage contribution of phytoplankton and zooplankton groups

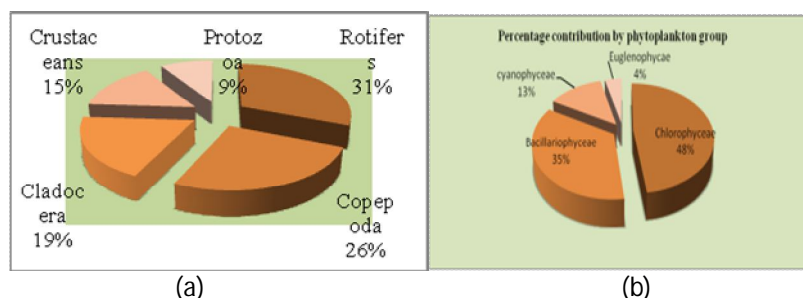


Table 1. List of phytoplankton and their seasonal abundance at Dhanuvachapuram pond

Name of Species	Monsoon	Postmonsoon	Winter	Premonsoon
Chlorophyceae				
<i>Ankistrodesmus sp</i>	+	++	+	+
<i>Actinastrum sp</i>	+	-	-	+
<i>Chlorella sp</i>	+++	+++	+	+++
<i>Chlamydomonas sp</i>	++	+++	+	+
<i>Closterium sp</i>	+++	++	++	++
<i>Cosmarium sp</i>	++	+++	++	+
<i>Cladophora sp</i>	+++	++	++	+++
<i>Desmedium sp</i>	+++	++	+	+
<i>Microspora sp</i>	++	++	-	++
<i>Oedogoniumsp</i>	++	+	+	++
<i>Pediastrum sp</i>	++	++	+++	+
<i>Spirogyra sp</i>	++	+	+	++
<i>Tetradesmus sp</i>	++	++	++	++
<i>Volvox sp</i>	+++	++	+	++
<i>Zygnema sp</i>	-	-	++	+
Bacillariophyceae				
<i>Diatoma sp</i>	++	+	+	+
<i>Fragillaria sp</i>	++	+	+	++
<i>Frustulia sp</i>	+	+	+	+
<i>Gyrosigma sp</i>	+	+	-	++

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<i>Gomphonema sp</i>	+	-	-	-
<i>Melosira sp</i>	+	+	-	+
<i>Navicula sp</i>	+++	+++	++	++
<i>Nitzschia sp</i>	++	-	+	++
<i>Synedra sp</i>	++	-+	+	+
Cyanophyceae				
<i>Anabaena sp</i>	+	+	+	++
<i>Nostoc sp</i>	+	-	-	+
<i>Oscillatoria sp</i>	+++	++	+++	+
<i>Spirulina sp</i>	+	+	+	++
Euglenophyceae				
<i>Euglena sp</i>	++	-	+	-
<i>Phacus sp</i>	++	+	+	-

Table 2. List of Zooplankton and their seasonal abundance at Dhanuvachapuram pond.

Name of Species	Monsoon	Postmonsoon	Winter	Premonsoon
Rotifera				
<i>Anuraeopsis fissa</i>	+	+	++	++
<i>Brachionus bidentatus</i>	-	+	+	+
<i>B. falclacatus</i>	-	+	+	+
<i>Cephalodella forficula</i>	-	-	+	-
<i>Collurella sulcata</i>	+	-	+	+
<i>C. uncinata</i>	-	+	+	++
<i>Conochilus unicornis</i>	-	+	++	+
<i>Depleuchlanis propatus</i>	+	-	+	+
<i>Euchlanis dilates</i>	-	-	-	+
<i>E. incise</i>	+	-	+	+
<i>Fillinia longiseta</i>	+	+	++	+
<i>Hexathra sp</i>	+	+	+	+
<i>Ketatella cochlearis</i>	+	++	++	+
Copepoda				
<i>Cyclops scutifer</i>	+	-	+	+
<i>Mesocyclops sps</i>	+	+	-	+
<i>Cypris sp</i>	++	+	-	+
<i>Cyclops viridis</i>	+	++	+	+
<i>Macroblachium</i>	+	+	+	+
<i>Neodiaptomas</i>	+	+	+	-
<i>Gammarus pulex</i>	+	+	+	+
Cladocera				
<i>Alona sps</i>	+	++	+	+
<i>Daphnia sp</i>	+	+	+	-
<i>Moina sp</i>	+	+	++	+
<i>Nauplii sp</i>	-	++	+	++
<i>Paracyclops sp</i>	+	+	+	+
Crustaceans				
<i>Bosmia cornuta</i>	+	+	+	+
<i>Cypris sp</i>	+	-	-	-

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<i>Cyclops viridis</i>	+	+	+	+
Protozoa				
<i>Euglena sp</i>	++	+	-	-
<i>Paramecium sp</i>	++	+	+	-
<i>Vorticella sp</i>	-	+	+	+
<i>Amoeba sp</i>	++	++	-	

Table-3: Physico-chemical characteristics (average value  $\pm$ SD) of the four sites of Pond

S.No	Parameters		Sites I,II,III,IV
1.	Atmospheric temp ( $^{\circ}$ C)	R	29.3-32.2 & M 32.0 ( $\pm$ 2.7)
2.	Water temp( $^{\circ}$ C)	R	26-30 & M 30.9 ( $\pm$ 3.2)
3.	pH	R	7.0-7.8 & M 7.4 ( $\pm$ 0.23)
4.	Transparency (cm)	R	17-75 & M 72 ( $\pm$ 58.9)
5.	Dissolved oxygen(mg/l)	R	6.32-8.72 & M 7.5 ( $\pm$ 1.5)
6.	Free carbon dioxide (mg/l)	R	2.4-10 & M 6.5 ( $\pm$ 2.6)
7.	Total suspended solids (mg/l)	R	110-340 & M 181.7 ( $\pm$ 100.6)

### V. CONCLUSION

To sum up, the present observations are limited to the qualitative observation from the four sites, though it provides useful information on composition and ecology of plankton yet it may not reflect the full heterogeneity of this interesting old village pond at Dhanuvachapuram. Further studies in quantitative aspect, hence are required.

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