



A STUDY ON PLANKTON DIVERSITY OF THREE URBAN PONDS IN KOLKATA OF WEST BENGAL STATE, INDIA

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ABSTRACT

The quantitative study of plankton diversity in three urban ponds (P-1, P-2 and P-3) of Kolkata in West Bengal were carried out for the months of January 2014 to June 2014. The lowest phytoplankton number (178 nos./l) was recorded in the month of January and the highest number (410 nos./l) in June in P-1. Similarly the lowest phytoplankton number (160,240 nos /l) was recorded in the month of January in both P-2 and P-3 respectively. Whereas, the highest phytoplankton number (508 and 489 nos/l) was recorded in the month of June in both P-2 and P-3 respectively. As well as the highest zooplankton number (1511 nos/l) in P-1, followed by P-3(1359 nos./l) and P-2 (1205nos/l) in the month of January. Three classes of phytoplankton (Chlorophyceae, Cyanophyceae and Euglenophyceae) and three groups of zooplankton (Rotifera, Copepoda and Cladocera) were recorded from all three ponds during the study period. Chlorophyceae was encountered as the most significant group of phytoplankton with a contribution of 65% in P-1 followed by Cyanophyceae (20%) and Euglenophyceae (15%) of total population. Similarly it was also dominant in both P-2 and P-3 with a contribution of 68% followed by Cyanophyceae (19%) and Euglenophyceae (13%) respectively. Among the zooplankton population Rotifers were the most dominant group in all three ponds which constituted 70% in P-1, followed by copepod (24%) and Cladocerans (6%). The similar pattern of distribution founds in both P-2 and P-3 with the dominancy of rotifer group. The main aim of this study was to documentation of the plankton community, its diversity and basic understanding of the productivity status of three ponds.

KEYWORDS: Plankton diversity, urban pond, Kolkata, productivity status.

INTRODUCTION

Plankton are microscopic organisms and float freely in the water from one place to another as they have small powers of locomotion. They drift in the water with the action of waves, current and other forms of water motion and equally distributed in the aquatic environment. Phytoplankton constitutes the very basis of nutritional cycles of an aquatic ecosystem. They form a bulk of food for zooplankton, fishes and other aquatic organisms. Phytoplankton are one of the initial biological components from which the energy is transferred to higher organisms through food chain by Ananthan *et al.* (2004). Productivity in aquatic ecosystem is directly depends on density of plankton diversity and density is controlled by water quality and other biotic communities in a water bodies. In any aquatic environment, phytoplankton considered as the main primary producers, which entrap solar energy by the biological process of photosynthesis and produce carbohydrates in the form of food by assimilating carbon dioxide, thus establish coordination between the abiotic and the biotifactors in the aquatic ecosystem by Saha and Choudhary (2000). Zooplankton community constitutes an

important component in the faunal composition of the water body. Zooplanktons occupy a central position in the food webs of aquatic ecosystem. They do not only form an integral part of the lentic community but also contribute significantly, the biological productivity of the fresh water ecosystem by Wetzell (2001). 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 by Pawar *et al.* (2006). Systematic enumeration of plankton is of great biological significance to understand the limnobiological dynamics of aquatic ecosystem by Shrivastava (2005) and Pandey *et al.* (2011). Several works have been done on the seasonal variations of plankton from lakes and small water bodies from West Bengal by Patra *et al.* (2010); Hassan *et al.* (2011) and Singh *et al.* (2017). But, study related to plankton diversity status from this municipal area in Kolkata, West Bengal is very rare. For that reason the present study was undertaken in selected ponds from municipal area to know the present plankton diversity status with different management practices of these urban ponds.

MATERIALS & METHODS

Study area

The present study was carried out for a period of six months from January 2014 to June 2014. The water bodies identified for the present study are situated within the municipal boundary of Kolkata, West Bengal. First pond (P-1), Bibeknagar jheel, moderately managed is situated near Jadavpur railway station with around 8000 m² area and surrounded by cemented wall. Second pond (P-2), situated at Panchasayar, an earthen well managed pond with 7500 m² area. The third pond (P-3), namely Baghajatin Park pond is situated near Highland Park, highly unmanaged with 6000 m² area.

Plankton collection

The phyto and zooplankton in the surface water of three ponds were collected by filtering 50 liters of water through a plankton net made by nylon net of 60 μ mesh size fitted to a metallic frame. Immediately after collection of the samples the plankton were preserved in 4% formaldehyde solution.

Counting of phyto and zooplankton

The counting of phyto and zooplankton was done by 'direct census method' of Jhingran *et al.* (1969). A Sedgwick rafter type plankton counting cell, divided into 100 equal squares made to hold 1 ml of the sample was used. Phyto and zooplankton present in 10 squares in the vertical row and 10 squares in the horizontal row were counted at random, identified and expressed in nos/l. Percentage of the dominant group and the total number of all the phyto and zooplankton were separately worked out.

RESULTS & DISCUSSION

Phytoplankton diversity

The lowest phytoplankton number (178 nos./l) was recorded in the month of January and the highest number (410 nos./l) in June in P-1 (Table 1) (Fig. 1). Similarly the lowest phytoplankton number (160,240 nos./l) was recorded in the month of January in both P-2 and P-3 respectively (Fig. 2 and Fig. 3). Whereas, the highest phytoplankton number (508 and 489 nos./l) was recorded in the month of June in both P-2 and P-3 respectively. Singh *et al.* (2017) reported the phytoplankton densities ranged from 1957 to 3652 organisms l⁻¹ in Haripota beel

in Bhamanghata, South 24 Parganas district of West Bengal. During this study it was observed that Chlorophyceae was encountered as the most significant group of phytoplankton with a contribution of 65% in P-1 (Fig:4) followed by Cyanophyceae (20%) and Euglenophyceae (15%) of total population. Similarly it was also dominant in both P-2 (Fig:6) and P-3 (Fig:8) with a contribution of 68% followed by Cyanophyceae (19%) and Euglenophyceae (13%). Bordoloi *et al.* (2013) studied that dominant group of phytoplankton was Bacillariophyceae (35.55%) followed by Chlorophyceae (32.66%) and Myxophyceae (31.76%) in the open wetland (Nahatia) of Jorhat district, Assam. Nandigam *et al.* (2016) studied the dominant members belonged to Chlorophyceae (60.95%), Cyanophyceae (20%), Bacillariophyceae (15.5%) and Euglenophyceae (3.55%) of Satyavaram ponds in Andhra Pradesh. The results obtained from the present study are similar to the study of her. Based on percentage and average composition the different planktons group were in the order of Chlorophyceae > Cyanophyceae > Euglenophyceae > Bacillariophyceae (Sinha & Jha, 1997). Nath *et al.* (2015) identified species, phytoplankton showed the complete dominance, especially, Chlorophyceae (48%) formed the dominant group, followed by Bacillariophyceae (35%), Cyanophyceae (13%) and Euglenophyceae (4%). Brraich O.S. and Kaur R (2015) also reported the same that majority of the species is dominated by Chlorophyceae (44%) then Bacillariophyceae (43%) and Cyanophyceae (13%). The classwise representation depicted following order of dominance in term of diversity of phytoplankton: Chlorophyceae > Bacillariophyceae > Cyanophyceae. Dhamgaye *et al.* (2016) also observed that Chlorophyceae group shows 53.57% of phytoplankton and Bacillariophyceae possess 21.43%, followed by Cyanophyceae possess 17.86% and very least number of Euglenophyceae groups possess only 7.12%. The total phytoplankton population was significantly highest in the month of June in both the P-1 and P-2, but there was no significant variation observed between the months in P-3. In this study it is clear that quantitative counts showed seasonal variation in phytoplankton cell numbers with maximum during early summer.

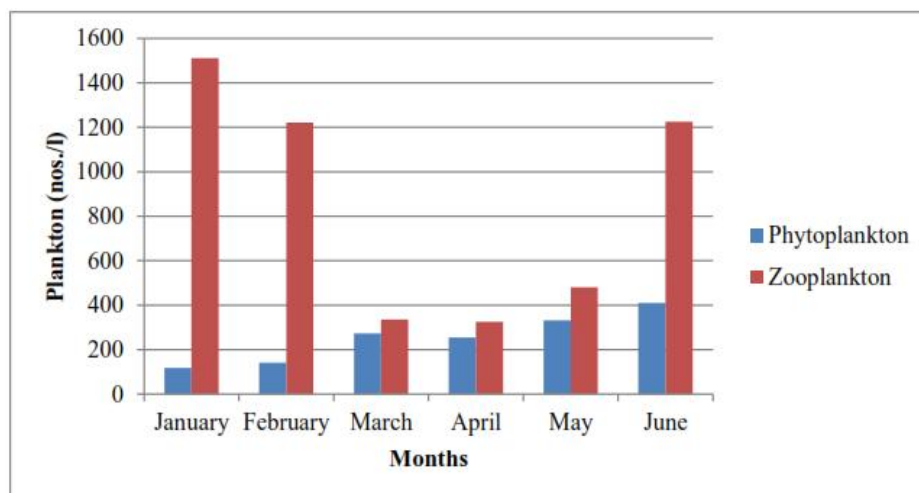


FIGURE 1: Plankton diversity in the Bibeknagar jheel (P1)

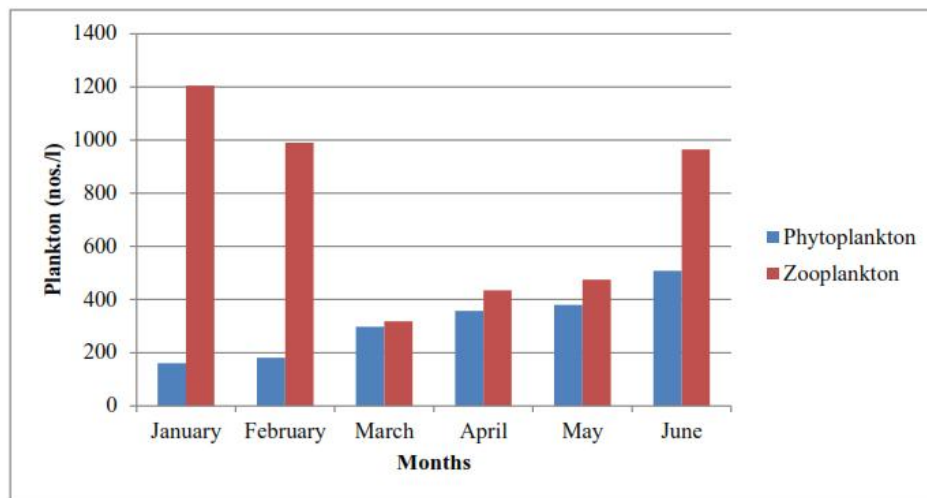


FIGURE 2: Plankton diversity in the Panchasayar Pond (P2)

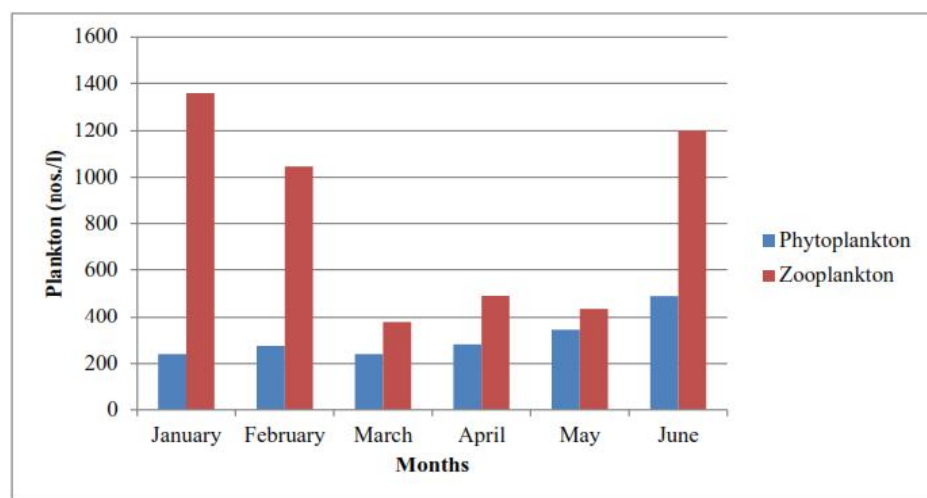


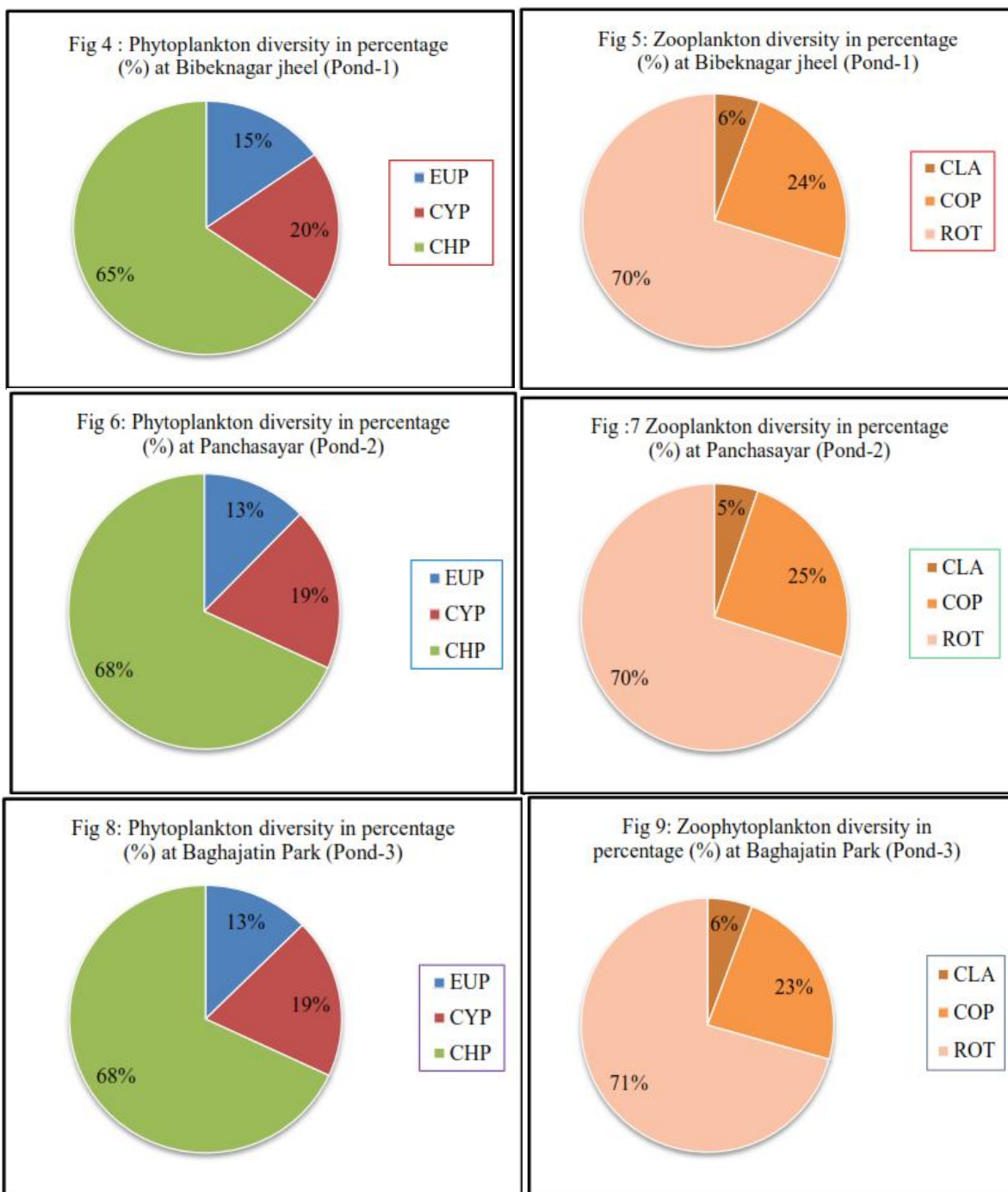
FIGURE 3: Plankton diversity in the Baghajatin Park Pond (P3)

Zooplankton diversity

The Table 1. shows that the highest zooplankton number (1511 nos/l) in P-1, followed by P-3(1359nos./l) and P-2 (1205nos./l) in the month of January. In all the ponds the Cyanophyceae were represented by *Microcystis* spp and *Oscillatoria* spp, the class chlorophyceae was represented by *Volvox* spp, *Pediastrum* spp, *Spirogyra* spp and *Cosmarium* spp. *Euglena* spp. was sole representative of euglenophyceae which was found in lower numbers. P-1 had lower plankton abundance in comparisons to both P-2 and P-3. In all the ponds the rotifers were represented by *Brachionus* spp and *keratella* spp. The group copepoda was represented by *Cyclops* spp and *Diaptomus* spp. and the group cladocerans by *Daphnia* spp. and *Moina* spp. Cladocerans are reported to be the indicators of eutrophic nature of water bodies by Sharma (2001). Among the zooplankton population Rotifers were the most dominant group in all three ponds which constituted 70% in P-1, followed by copepod (24%) and Cladocerans (6%) (Fig: 5). The similar pattern of distribution founds in both P-2 and P-3 with the dominance of rotifer group (Fig: 7; 9). Presence of *Brachionus* sp. is the indication that the ponds are organically polluted reported by Ahmed *et al.* (2012) Dutta and Patra (2013). Beenamma and Yamakanamardi

(2011) reported maximum abundance of rotifers in the month January 2009 in Kukkarahalli lake of Mysore, India. Nath *et al.* (2015) while amid the zooplankton, Rotifers constituted (31%) followed by Copepoda (26%), Cladocera (19%), Crustacean (15%) and the least Protozoans (9%). Singh *et al.* (2017) reported the zooplankton densities ranged 589 to 954 organisms l⁻¹, which was mostly dominated by Protozoan group comprised the maximum (30.7% in average) to the total zooplankton population, followed by Copepoda (20.1%), Rotifera (19.6%) and Cladocera (17.8%). Bashini *et al.* (2017) observed that *Ostracodans* and *Copepods* equal dominancy and constitutes 33%, *Rotifera* constitutes 15% and *Cladocerans* constitutes 19%. Mili *et al.*, 2017 noticed that total zooplankton varied from 32.67 no/l to 2608.67 no/l in three ponds of eastern Kolkata, West Bengal and among the zooplankton Copepods are the dominant group followed by Rotifer and Cladocera. The total zooplankton population was significantly highest in the month of January in all three water bodies under study. This result obtained from present study showed the high dominancy of zooplankton over phytoplankton and was maximum in P-1 followed by P-2 and P-3 during the months of January and February.

Plankton diversity of three urban ponds in Kolkata of West Bengal



*Phytoplankton: EUP- Euglenophyceae; CYP- Cyanophyceae ; CHP- Chlorophyceae.

**Zooplankton: CLA- Cladocera; COP- Copepoda; ROT- Rotifera.

TABLE 1: Plankton count (nos/l) in three sampling ponds

Sites	Bibeknagar jheel (P-1)		Panchasayar pond (P-2)		Baghajatin Park pond (P-3)	
	Phytoplankton	Zooplankton	Phytoplankton	Zooplankton	Phytoplankton	Zooplankton
January	118	1511	160	1205	240	1359
February	141	1221	181	990	275	1045
March	273	335	298	318	240	375
April	254	325	357	435	281	490
May	331	480	380	475	343	435
June	410	1225	508	965	489	1200

CONCLUSION

The aquatic environment is an area controlled by the changes in factors such as light, heat, humidity and contamination of various effluents in the water body. Contamination of water through domestic sewage was also been noticed which gradually reducing the productivity status of these ponds. Proper biological and chemical treatments of domestic sewage need to be done before discharge to the ponds for long run sustainable of the resources. To sum up, the present observations are limited to the quantitative observation from the three urban ponds, though it provides useful information on composition and ecology of plankton. The present basic information of the plankton distribution and abundance would form a useful tool for further ecological assessment and monitoring of the ecosystem of these three ponds in Kolkata, West-Bengal.

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