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SEASONAL VARIATION OF ZOOPLANKTON DIVERSITY AT NATURE PARK WETLAND, KOLKATA, INDIA

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Abstract

Nature park wetlands are one of the important wetlands, situated at the south west fringe of Kolkata. These wetlands receive raw sewage water from the surrounding industrial area and after phytoremediation the water is used in pisciculture. For the present study two impoundments of the Nature Park Wetland were selected and a comparative study was done between the two impoundments from July, 2012 to June, 2013. In this aspect, qualitative and quantitative estimation of zooplanktons and different physicochemical parameters of water like pH, temperature, DO, turbidity, alkalinity, total hardness, chloride, BOD and COD were done. A total of 15 zooplankton species at site-I and 8 zooplankton species at site-II were recorded. The present study also revealed that the density and diversity of rotifera was maximum at both the study sites than the other two major taxa (cladocera and copepoda).

KEYWORDS: Wetlands, zooplankton, phytoremediation, Sedgwick rafter counting chamber.

INTRODUCTION

Biodiversity refers to the variety and variability among living organisms and is defined as the total number of different species and their habitats. Biodiversity has also been defined as the

"global composite of genes, species and ecosystem" and it can be studied from different angles ranging from complete ecosystem to molecular level. India is recognized as a country uniquely rich in all aspects of biodiversity and is listed among the top twelve mega diversity countries in the world. It has perhaps the largest array of environmental stipulation by virtue of its tropical location, varied physical features and climatic types. With time India is facing a crisis due to loss of wetlands and water bodies and deterioration in the water quality of these life sustaining systems. According to WWF-India, wetlands are one of the most threatened of all ecosystems in India.Wetlands are one of the important, diverseand highly productive ecosystems. According to Schuyt and Brander,(2004) wetland has a high economic value. Wetlands yield fuels, fodder, and food, support a large number of fauna and flora, help in flood control, recharge ground water and provide habitats and breeding grounds for a number of animals. Any environmental disturbance can change the health of any wetland like any other biological system (Wilhm,1975). Increasing load of waste water due to rapid industrialization coupled with urban development is gradually becoming a threat to biotic communities, especially the planktonic, nektonic and benthic organisms who inhabit the aquatic environment. Plankton represent the first, second or third trophic levels of the food chain. Zooplanktons are an important component of freshwater and marine ecosystems and acts as biotic indicators (Mills *et al.*,1987; Johannsson *et al.*,1999; Conroy *et al.*,2008). High quality of zooplankton is also responsible for production at consumer's level. For the present study two different aquatic impoundments were selected within the Nature Park. These impoundments receive sewage water after undergoing phytoremediation process and are utilized for pisciculture. This study has been envisaged to understand the impact of phytoremediation on wetland ecosystem dynamics mainly on the zooplankton diversity.

MATERIALS AND METHODS

Physical features of the selected site

Kolkata and its urban areas have about 5500 hectors of wetlands extending over the eastern and

south western-periphery (Asian wetland Bureau, 1991). For the present study, impoundments selected are located (22° 31' 23"-22° 33' 00" N and 88° 17' 15"- 88° 18' 26" E) at the south-west fringe of Kolkata. These are in fact, shallow wetlands under the jurisdiction of Calcutta Port Trust (CPT) which has been taken as lease on yearly rent basis by the Mudiyally Fishermen Co-operative Society (MFCS) an association of the fishermen of the locality. In these wetlands, waste water after phytoremediationis used for production of fish, in turn, passing through canals open in river Ganga.

Seasons and Climate

For the present study three different seasonal sampling was done, mainly pre-monsoon (March - June) with highest atmospheric temperature and least rainfall, monsoon (July - October) with modest temperature, highest rainfall and humidity, and post-monsoon (November - February) with lowest level of temperature and occasional rainfall. The whole studywas done for one year (July,2012-June,2013).

Collection of Water Samples

Samples of water for the physicochemical analysis were collected directly into polythene bottle by deeping it to the required depth. Samplings were done once in a month during early morning.

Collection of planktons by using plankton net-

Pelagic planktons were captured by dragging plankton net made of fine mesh silk cloth (mesh size 54 micron) through water. The planktons in the net were transferred to a container by dip-ping the inverted net in the water of the container and with repeated flushing of water from above. Zooplanktons were preserved with 5% formalin (Battish,1992;Michael and Sharma, 1988) .

Analysis of Physicochemical Parameters of Water

Different physicochemical parameters of water like pH, temperature, DO,turbidity, alkalinity, total hardness, chloride, BOD and COD were estimated by standard methods (APHA,2005).The assessment of water quality was done on the basis of average values of physicochemical components during the whole period.

Qualitative and Quantitative Estimation of Zooplankton

Total number of zooplanktons were counted with Sedgwick Rafter Counting Chamber (Reddy, 2001 and Halder *et al.*,2008) under microscope and expressed in no./l. (Pradhan *et al*,.2006 and Bhunia *et al.*,2008). Identification of zooplanktons (cladocera, copepod and rotifer) were done with systematic keys (Reddy,2001; Benfield,2012 and Sontakke,2014).

Calculation of Similarity Index

Both the study sites were compared on the basis of total zooplanktonic population and also by total rotiferan, cladoceran and copepodan species composition using the following Similarity Index (Kumar, 2014).The value of the Index ranges from 0 to 1. 0 means no similarity and 1 means total similarity.The calculation of Similarity Index Equation is as follows-

$$S=2C/(A+B)$$

Where, S = similarity index, A = number of species at site-I, B = number of species at site-II, C = number of species common to both the sites.

RESULTS AND DISCUSSION

Physicochemical Parameters of Water

The temperature was maximum during the pre-monsoon season followed by monsoon and post-monsoon season. The pH of both site-I and site-II were slightly alkaline.The table-1 shows in detail the value range of different physicochemical parameters like turbidity, alkalinity, chloride, total hardness, BOD and COD of water of both the study sites.

Table-1 Value range of different physicochemical parameters of water observed at Study site I and Study site II.

	Study site I	Study site II
Turbidity	15-25 NTU	8-10 NTU
DO	5-8.6 mg/lit	4.9-9.03 mg/lit
Alkalinity	280-450 mg/lit	200-240 mg/lit
Chloride	600-800 mg/lit	100-200 mg/lit
Total Hardness	450-600 mg/lit	250-500 mg/lit
BOD	12-15 mg/lit	6-10 mg/lit
COD	90-98 mg/lit	70-75 mg/lit

Density and Species Composition of Zooplankton

From both the study sites, three different major taxa of zooplanktons mainly cladocera, copepoda and rotifera were identified. Figure-I shows the seasonal variation in relative abundance (%) of the above mentioned three major taxa at site-I. Figure-2 shows the same at site-II. At both the sites, during pre-monsoon and post-monsoon season the relative abundance of rotiferans was maximum whereas during monsoon the relative abundance of cladocerans was maximum followed by copepodans and rotirefans. The total number of zooplankton species was 15 at site-I and 8 at site-II. Both the sites were dominated by rotiferan species. Some zooplanktonic species were common at the both study sites. There were 5 genera of rotiferan zooplankton (Brachionus, Filinia, Polyartha, Horaella and Lecane), 3 genera of cladoceran zooplankton (Ceriodaphnia, Moinadaphnia, Chydorus) and 3genera of Copepodan zooplankton (Heliodiaptomus, Mesocyclops and Megacyclops) at site I. Site II was represented by 2 genera of rotiferan zooplankton (Brachionus, Filinia), 2genera of Copepodan zooplankton (Mesocyclops and Megacyclops) and 1 genera of cladoceran zooplankton (Moinadaphnia). Table-2 and Table-3 shows the Species composition of zooplanktons at site-I and site-II respectively.

Figure-1: Seasonal variation in relative abundance (%) of Rotifera, Cladocera and Copepoda at site-I.

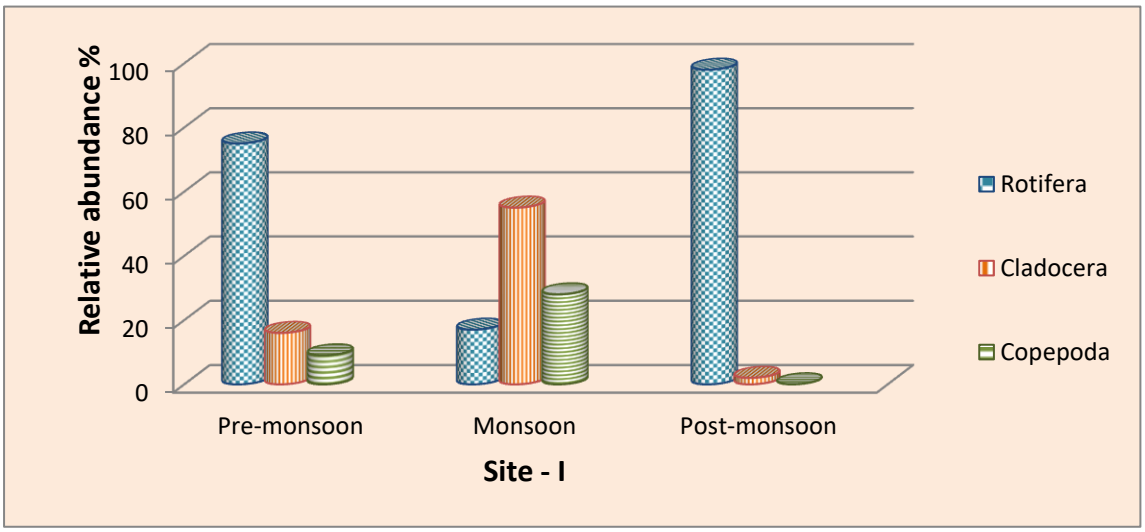

Figure-2: Seasonal variation in relative abundance (%) of Rotifera, Cladocera and Copepoda at site-II.

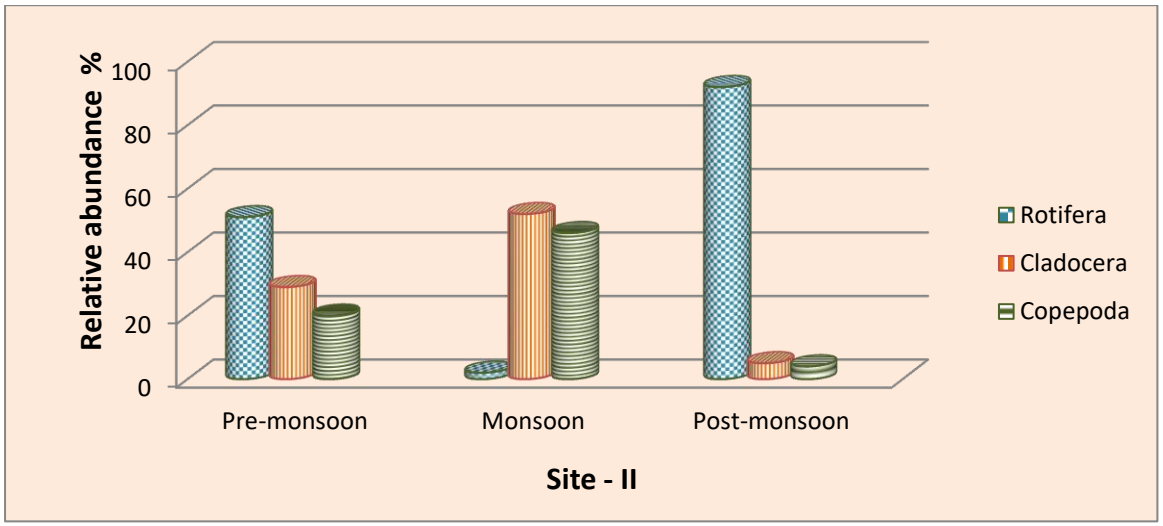

Table-2 Species composition of zooplanktons at site-I

Rotifera	*Brachionus quadridentata*
Rotifera	*Brachionus falcatus*
Rotifera	*Brachionus foficula*
Rotifera	*Brachionus angularis*
Rotifera	*Brachionus diversicornis*
Rotifera	*Filinia longiseta*
Rotifera	*Polyartha vulgaris*
Rotifera	*Horaella* sp.
Rotifera	*Lecanepapuana*
Cladocera	*Ceriodaphnia* sp.
Cladocera	*Moinadaphnia* sp.
Cladocera	*Chydorus* sp.
Copepoda	*Heliodiaptomus* sp.
Copepoda	*Mesocyclops* sp.
Copepoda	*Megacyclops* sp.

Table-3 Species composition of zooplanktons at site-II

Family	Species
Rotifera	*Brachionus rubens*
Rotifera	*Brachionus quadridentatus*
Rotifera	*Brachionus diversicornis*
Rotifera	*Brachionus falcatus*
Rotifera	*Filinia longiseta*
Copepoda	*Megacyclops* sp.
Copepoda	*Mesocyclops* sp.
Cladocera	*Moinadaphnia* sp.

The average population density (no./l) of rotifera , cladocera and copepoda from monsoon"12 to pre-monsoon"13 were 5.62, 0.72 and 0.35 respectively at study site-I. The population density of the above three major taxa were 2.20, 0.58, and 0.48 respectively at study site-II.The population density of rotifers was recorded maximum in post-monsoon which reached to minimum in monsoon at both study site –I and II. The density of cladocera was recorded minimum during post-monsoon and maximum during monsoon at both the sites. The density of copepoda was maximum in monsoon and minimum at post-monsoon.

Similarity Index

A similarity index with respect to total zooplanktonic species composition shows 60% similarity between the two study sites. On the basis of rotiferan species composition the similarity was 57%, in case of cladocera similarity was 50% and copepoda shows 80% similarity between the two study sites.

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