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Research Article

Study of Nutrient Status of Upper Lake Bhopal, M.P. India, Using Zooplankton Diversity As An Indices

Muzaffar U Zaman Khan
Lecturer, Higher Education, Government Degree College (GDC), Pulwama, Newa Road, Pulwama – 192301, Jammu & Kashmir, India

***Corresponding author**
Muzaffar U Zaman Khan
Email: muzaffarkhan722@gmail.com

Abstract: Upper Lake Bhopal is arguably the oldest man made lake in india, and was created by Raja Bhoj in the 11th century by constructing an earthen dam across the Kolans river. The Upper lake is a major source of portable water for the people of city of Bhopal, M.P. India. The present work aimed at the study of zooplankton diversity of Upper Lake Bhopal, and the zooplankton were collected by using a small meshed plankton net of nylobolting NO. 25 by filtering a known volume of water sample through it. Different zooplankton species were found, but the dominance of rotifera made it clear that the lake waters are nutrient enriched and hence eutrophicated. On the other hand least presence of ostracoda also ensured the results as the same donot occur in polluted waters.
Keywords: Upper Lake, Zooplankton, Rotifera, Ostracoda, Eutrophicated

INTRODUCTION

Plankton is a heterogeneous group of tiny (microscopic) plants and animals which inhabit the water. The term plankton was first coined by Victor Henson in 1887 to designate the heterogeneous assemblage of suspended microscopic materials, minute organisms and detritus in water which wander at the mercy of winds, currents and tides. However the use of the term has been confined to designate only the microscopic free floating organisms. They are also considered as the bio indicators of water quality and are therefore of much importance from limnological point of view. Zooplankton organisms respond more quickly to environment than fish and are also easier to identify than algae. Thus they can be used as bio indicators. Further certain taxa are useful in determining the origin or recent history of a given water mass. Being heterotrophic in nature, they play a key role in cycling of organic materials in an aquatic ecosystem [1]. In inland waters, zooplankton is mainly composed of the members of protozoa, rotifera, cladocera and copepoda. Out of these protozoans are mostly nannoplankters. In Rotifera typical planktonic form is Asplancha which is the largest of the rotifers and is also predacious (Planktonpredator), a secondary consumer or first level carnivore in planktonic ecosystem. The cladocerans possess photosensitive small eye which enables them to respond to changing diurnal system. The cyclopoids are widely distributed and are mostly littoral with a few limnetic species. The cyclopoids usually undergo a complex development by repeated metamorphosis upto six copepods stage, the sixth one being an adult. The species composition and the abundance of rotifers is intricately influenced by ecological changes / perturbations in their environments. The phenomenon of cultural eutrophication, siltation, predation, habitat destruction etc. excise drastic impact on their community structure [2]. Copepods and Cladocerans are of great importance not only as a major link in a food chain in an aquatic system but also, since they are used directly by fish and other larger animals. Planktonlogical study is an important parameter for assessment of water quality [3]. Planktons play an important role in trophic dynamics and forms an integral part of entire food chain on the basis of presence or absence of certain types of plankton species, status of water body can be assessed. Zooplankton organisms have great significance as pollution indicators. As a major element in aquatic biota, the zooplankton community often exhibits dramatic changes in response to changes in the physico-chemical properties of the aquatic environment. Hence zooplankton fauna or zooplankton association can be used as useful means for the assessment of water pollution.

Study Area:

Bhopal, the picturesque capital of the state of Madhya Pradesh, is also known as “City of Lakes” on account of a large number of water bodies present in and around Bhopal. The upper lake is the source of drinking water to urban populations,and is also known

as "Badah talab". Upper lake is surrounded by Van Vihar National Park on the south, human settlements on the east and north, and agricultural fields on the west. The water of the Upper Lake was used for drinking purposes up to year 1947 without any treatment, which proves that the waterquality was very good. After Bhopal become the capital of Madhya Pradesh in 1956, it noticed tremendous population inflow and consequent rapid urban development which adversely affected the lake. Upper lake in Bhopal is arguably the oldest man-made lake in India, and was created by Raja Bhoj in the 11th century by constructing an earthen dam across the Kolans River.The Upper Lake is a major source of portable water for the people of the city of Bhopal, Madhya Pradesh, India. For the present work water samples were taken from two sites of Upper Lake named as Site-I, at the shore of the lake and Site-II, at the center of the lake.

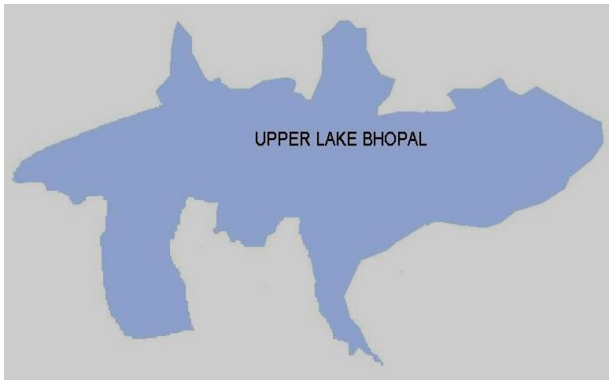

Fig-1: Map of Upper Lake Bhopal

Climate:

Bhopal, experiences a tropical climate with tropic of cancer passing through the state. It has hot summers and air temperature varies between 40-45degrees, winters are moderate. The maximum temperature recorded during the season is 45 degree.

MATERIALS AND METHODS

Various zooplankton forms were collected and observed in the present study. These were collected using a small meshed plankton net of Nylobolting Silk No. 25 by filtering a know volume of water sample throw it .Then the plankton net was transferred in 50 ml bottle and preserved in 5% formaline. Few drops of glycerine were also added to it. The sample was allowed to stand for a day to acquire the further concentration. The zooplankton settle down at the bottom of bottle. The supernatant plankton free water was removed with the help of a pipette and the sample was reduced to the described volume. The identification of zooplankton was done with the help of standard works viz, Adoni [4], Edmondson [5], Needham and Needham [6].

RESULTS:

List of zooplankton species encountered during the study period at site-I(Boat Club) is represented in table1. During the course of present investigation, 29 species of zooplankton have been recorded at site-I.Outof them 11 species belong to rotifera, 6 species to copepoda ,5 species both to cladocera and protozoa and 2 species to ostracada. So the order of dominance of zooplankton species is given as
Rotifera>Copepoda>Cladocera=protozoa>Ostracada.

Among rotifers, keratella tropica was the most dominant species occurring throughout the study period, while among the copepoda it was Cyclops and nauplis larvae occurring through out the study period at site-I (Table 1).On the basis of percentage composition of zooplankton at site-I the genus Rotifera contributed the highest i.e, 38% followed by Copepoda 21%, Cladocera and Protozoa 17% and then Ostracoda 7% .

List of zooplankton species encountered during the study period at site-II(Central Site) surface level is represented in table 2. A total of 23 zooplankton species were recorded during the course of investigation at central site at surface level. Out of which 11species belong to rotifera, 6 species to cladocera, 4 species to copepoda and 2 species of ostracada.The order of dominance of zooplanktonpecies is as
Rotifera>Cladocera>Copepoda>Ostracada.

Keratella cochlearis and Keratella tropica were the most dominant species among rotifera while among copepoda Nauplis larva was most dominant occurring through out the column at surface level of central site (Table 2). On the basis of percentage composition of zooplankton at surface level of site-II, the genus Rotifera contributed the highest i.e, 48% followed by Cladocera 26%, Copepoda 17% and Ostracoda 9%.

List of zooplankton species encountered during the study period at site-II(Central Site) middle level is represented in table 3. A total of 19 zooplankton species were recorded during the course of investigation at central site at middle level. The total zooplankton population was once again dominated by rotifera having 10 species out of 19 zooplankton species identified followed by copepoda having 5species and cladocera having 4species .The order of dominance of zooplankton species is given as
Rotifera>Copepoda>Cladocera.

Brachnious caudatus was the most dominant species occurring through out the study period while among copepoda it was Cyclops and Nauplis at middle of central site(Table 3). On the basis of percentage composition of zooplankton at middle level of site-II, the genus Rotifera contributed the highest i.e, 53%followed by Copepoda 26% and Cladocera 21 %.

Table-1: List of Zooplankton Species encountered during study period at site I (Boat club)

Class	Name of Species	**28 Feb. 07**	**15-Mar-07**	**30-Mar-07**	**15-Apr-07**	**30-Apr-07**
Rotifera	Brachnious Caudatus	-	+	+	+	+
	Brachnious Quadridentata	+	-	-	-	+
	Colurella Species	-	-	+	+	+
	Gastropus Species	+	-	-	-	-
	Harringia Species	+	-	-	-	-
	Keratella cochlearis	+	+	+	+	-
	Keratella tropica	+	+	+	+	+
	Lecane Species	+	+	-	-	+
	Monostyla Species	-	-	+	-	+
	Notholca Species	-	+	+	+	+
	Scardium Species	+	-	-	-	-
Copepoda						
	Calanoid copepod	-	+	+	-	-
	Cyclopoid copepod	-	-	-	-	+
	Cyclops species	+	+	+	+	+
	Diaptomus Species	-	+	-	-	+
	Ectocyclops Species	-	-	+	-	-
	Nauplis Larvae	+	+	+	+	+
Cladocera						
	Alona Species	-	-	+	+	+
	Bosmina Species	+	+	-	+	+
	Ceriodaphnia Species	-	-	-	+	+
	Sida Species	+	+	-	-	-
	Simocephalus Species	-	+	+	+	+
Protozoa						
	Amoeba Species	+	-	-	-	-
	Difflugia Species	+	-	-	-	-
	Euglypha Species	+	-	-	-	-
	Glaucoma Species	-	-	-	+	+
	Trinema Species	-	-	-	+	+
Ostracoda						
	Cypris Species	-	-	+	-	-
	Stenocypris Species	+	+	-	-	-

List of zooplankton species encountered during the study period at site-II(Central Site) bottom level is represented in table 4. During the course of present investigation, 18 zooplankton species were recorded at bottom level at central site. Out of total zooplankton species, 7 species belong to rotifera, 5 species to cladocera , 4 species to copepoda and 2 species to ostracoda. The order of dominance of zooplankton species is as under

Rotifera>Cladocera>Copepoda>Ostracoda.

Colurella was the most dominant species among rotifera occurring through out the column at bottom level of central site (Table 4). On the basis of percentage composition of zooplankton at bottom level of site-II,the genus Rotifera contributed the highest i.e,39% followed by Cladocera 28% Copepoda 22% and Ostracoda 11 %.

Table-2: List of Zooplankton Species encountered during study period at site II – Central site (surface Level)

Class	Name of Species	28 Feb. 07	15-Mar-07	30-Mar-07	15-Apr-07	30-Apr-07
Rotifera						
	Ascomorpha Species	-	+	+	-	-
	Brachnious Caudatus	+	+	+	-	+
	Brachnious Calcyflorus	-	+	-	-	-
	Brachnious Falcutus	-	-	+	+	+
	Brachnious Quadridentata	-	+	-	-	-
	Colurella Species	-	+	-	+	+
	Keratella Cochlearis	+	+	+	+	-
	Keratella Tropica	+	-	+	+	+
	Lecane Species	+	+	+	-	-
	Monostyla Species	-	-	+	-	+
	Notholca Species	+	+	+	-	+
Cladocera						
	Alona Species	-	-	+	-	-
	Bosmina Species	-	-	+	-	-
	Ceriodaphnia Species	-	-	-	+	+
	Scapholeberis Species	+	-	-	-	-
	Simocephalus Species	+	+	-	+	+
	Moina Species	-	-	-	+	+
Copepoda						
	Calanoid Copepod	-	-	-	+	+
	Cyclops Species	+	+	-	+	+
	Diaptomus Species	+	-	-	-	+
	Nauplis Larvae	+	+	+	+	+
Ostracoda						
	Cypris Species	+	-	-	-	-
	Stenocypris Species	+	-	+	+	+

Table-3:. List of Zooplankton Species encountered during study period at site II –Central site (Middle Level):

Class	Name of Species	28 Feb. 07	15-Mar-07	30-Mar-07	15-Apr-07	30-Apr-07
Rotifera						
	Ascomorpha Species	-	+	+	-	-
	Brachnious Caudatus	+	+	+	+	+
	Brachnious Calcyflorus	+	+	-	-	-
	Brachnious Falcutus	-	-	+	+	+
	Colurella Species	-	+	+	-	+
	Keratella Cochlearis	+	+	-	+	+
	Keratella Tropica	-	+	-	-	+
	Lecane Species	+	+	-	-	-
	Monostyla Species	-	-	-	-	+
	Notholca Species	-	+	+	+	+
Copepoda						
	Calanoid Copepod	+	-	-	-	+
	Cyclopoid Copepod	-	-	+	+	-
	Cyclops Species	+	+	+	+	+
	Diaptomus Species	-	-	-	+	+
	Nauplis Larvae	+	+	+	+	+
Cladocera						
	Alona Species	-	-	+	+	-
	Bosmina Species	-	-	-	-	+
	Scapholeberis Species	+	-	-	-	-
	Simocephalus Species	+	-	+	+	+

Table 4 List of Zooplankton Species encountered during study period at site II – Central site (BottomLevel)

Class	Name of Species	28 Feb. 07	15-Mar-07	30-Mar-07	15-Apr-07	30-Apr-07
Rotifera						
	Brachnious Caudatus	-	-	+	-	-
	Brachnious Calcyflorus	-	-	+	-	-
	Brachnious Falcutus	-	-	-	+	-
	Brachnious Quadridentata	+	+	-	-	-
	Colurella Species	+	+	+	+	+
	Keratella Cochlearis	+	-	+	+	+
	Notholca Species	+	+	+	+	-
Cladocera						
	Alona Species	-	-	-	+	-
	Bosmina Species	-	+	+	-	-
	Diplanosoma Species	-	-	-	+	+
	Scapholeberis Species	+	-	-	-	-
	Simocephalus Species	+	+	-	+	+
Copepoda						
	Calanoid Copepod	-	-	+	-	-
	Cyclopoid Copepod	-	+	-	-	+
	Cyclops Species	-	+	+	-	-
	Nauplis Larvae	+	-	+	+	-
Ostracoda						
	Cypris Species	-	-	-	-	+
	Stenocypris Species	+	-	-	+	-

DISCUSSION

The current study was conducted for a period of three months from February to May 2007. Changes in the zooplankton species composition have been often used as indication of increases of eutrophication of fresh waters. In the present investigation a total of 29 zooplankton species were recorded at site-I,whereas 23 zooplankton species were recorded at surface at site-II, 19 zooplankton species at middle level of site-II and only 18 zooplankton species were recorded at the bottom level of site-II. The rotifera was dominant at both the sites which indicates the eutrophic nature of the water body as was also reported by Wanganeo and Wanganeo [7] while studying variation in zooplankton population into morphologically dissimilar rural lakes of Kashmir valley. The dominance of rotifers were also observed by Kundangar and Zutshi [8]. According to Brooks and Dodson selective predation by planktivorous fish results in the shifting of zooplankton communities with the dominance of rotifers [9]. The investigated lake had a high fish population that may be exercising considerable predatory pressure. In summers rotifers dominated at both the sites followed by Copepoda. The dominance of rotifers in summer months has a directly relationship with the rise in atmospheric temperatures. The rotifers have versatile capacity to survive in different environments as some of them are primary consumers feeding on various phytoplanktons, some feed on detritus element and bacteria and some have been described as raptorial predators [10]. Among rotifers, Keratella tropica was dominant at site–II and Keratella cochlearis was dominant at site –II which indicates the alkaline nature of water body [11]. The overall presence of Brachnious caudatus and Keratella cochlearis also confirms that the lake water is slightly enriched. Such results were also reported by Kundangar and Zutshi [8]. During the period of investigation the presence of Cyclops and Diaptomus at both the sites among Copepods indicates the continuous breeding behavior without being affected by prevailing environmental conditions [12]. The abundance of Cladocerans and least contribution of protozoa in the community structure indicate less organic load in the system. Similar results have also been recorded [13]. On the basis of percentage composition of rotifers of site-II, site-I wasfound to be less diverse as compared to the site –II.

The present study reveals an overall dominance of rotifers at both the sites that indicates the lake is under the influence of eutrophication. The least presence of Ostracods in the present investigation reveals that the quality of lake water is polluted as Ostracods do not occur in polluted waters.

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