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Research Article

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A Study of Plankton diversity in Bichnaiyya lake (wetland) Basti U.P.

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Abstract

Planktons contributes the basic food source of any aquatic ecosystem, which supports fish and other aquatic organism. An assessment of plankton diversity was carried outin three different sites of Bichnaiyya lake during February 2021 to January 2022.Phytoplanktonic diversity was observed in five groups, i.e., Chlorophyceae, Cyanophyceae, Bacillariophyceae, Euglenophyceae and Dinophyceae including34 species. Among them Cyanophyceae was dominant with12 species. Zooplanktonic diversity is one of the important parameters in water quality assessment as they are good indicators of the change in water quality and they are strongly affected by environmental changes and show quick response. Diversity of zooplanktons also included five groups i.e., Protozoa, Rotifera, Copepoda, Cladocera and Ostracoda. Among these Rotiferans were dominating with 11 species. The main aim of present study is to observe the population and diversity of planktonic community in the lake.

Keywords: Planktonic diversity, Bichnaiyya lake,Bioindicators, water quality

Introduction

Planktons are the tiny organisms living and drifting in the direction of the water current. They act as main source of food in lotic and lentic water ecosystem. Climate of the earth is changing every year due to naturally occurring processes and by human activities like use of pesticides, civilization, industrialization, dam construction. The mean surface temperature of earth is increasing at an average of 1^0Celsius per century due to industrialization. The quality water is also changing due to accumulation of greenhouse gases and water pollution. Now a days the demands of lakes, ponds, reservoirs and rivers is increasing for drinking purpose and other uses but on the other hand water pollution is rising rapidly due to Industrialization (Ghose and Basu, 1968, Patil and Tijare, 2001; Mathur 2005). Lakes play a crucial role in supporting biodiversity and climate conditioning. It serves as vital habitat for a diverse range of plant and animal species. They

support a unique ecosystem, providing food, shelter, and breeding grounds for numerous aquatic animals, including fish, amphibians, and Waterfowl. It also contributes to maintaining a stable water supply for drinking, agriculture, and industrial purposes. It also facilitates nutrient cycling, where they act as nutrient sinks and sources, regulating the flow of essential elements like nitrogen and phosphorus. The phosphate and nitrate are two important nutrients in the lake. This process is vital for supporting healthy aquatic life and overall ecosystem productivity. It also offer recreational opportunities for people to engage in activities like boating, fishing, and swimming. The pollution in the water body acts as a limiting factor for survival of organisms and it becomes an important need to check the quality of water regularly. The physico-chemical characteristics of water body directly influence the life inhabiting it. Phytoplanktons in the aquatic community serve as food for development and growth of zooplanktons (Hutchinson, 1967) Zooplanktons are important linkage in aquatic food chain and thus play a major role in energy transfer, (Kedar *et.al* 2008). Zooplanktons constitute the food source of organisms at higher tropic levels. Rotifers, Copepods, Cladocerans are the major groups of zooplanktons which transfer the energy from low trophic level to high trophic level, (Water *et.al.* 1987). Zooplanktons are the most important biotic components and play an important link in aquatic food chain, food web, cycling of matter (Dadhick and Saxena1999: Sinha and Islam 2002) and energy flow in freshwater Ecosystem, (Sharma *et. al* 1998). The distribution and concentration of zooplanktons community depend on a complex of factors like change in climatic conditions, physical and chemical changes of water, (Ahmad *et.al* 2011) and vegetation. Most of the planktonic species are cosmopolitan in distribution, (Mukherjee, 1997).

Materials and Methods

Study Area and geographical distribution:

The samples are collected from Bichnaiyya Lake seasonally from February 2021 to January 2022. The Bichnaiyya Lake is located near Bichnaiyya Pandey village, under tehsil Harraiya of District Basti (U.P.). This lake is situated at 26º55’15.7” N latitude and 82º25’29.9” E longitude. The total area of this lake is 279,855.00 m2 (3,012,334.12 ft2) with peripheral total distance of 1.94 km (1.21m).

Location of Bichnaiyya Lake

Collection site:

To study the plankton diversity water samples were collected from Bichnaiyya lake during the period of one year i.e., from February 2021 to January2022.The samples were assessed in each season and collected during morning hours in between8:00 a.m.to 10:00 a.m. from the three sites of the lake. To study seasonal variations, the water samples were collected in amber colour bottle to prevent the discolouration of algae. The water samples were collected during summer (February to May 2021), Monsoon (June to September 2021) and winter (October to January2021) To study the planktonic diversity 50 litres of water samples was filtered through plankton net made of bolting silk no.25 with pore size 45µ.The collected samples were allowed to settle down by adding Lugol's Solutions and70% alcohol which maintain the fragile structure and also help in setting the samples. Normally sedimentation requires 24 hrs. After which supernatant was removed and the concentration was then preserved 4%formalin and few drops of glycerine was added to prevent the hardening of planktons. Planktons samples were identified qualitatively under microscope using micro slide with the help of standard dropper using drop count method. Plankton identification was done to identification keys and standard reference given by Pennak(1953), Prescott (1954), Needham and Needham (1962), Edmondson (1965), Tonapi (1980), Adoni (1985) Battish 1992, A.P.H.A (1995),Pennark(1953), Ward and Whipple (1945).

Results and Discussion

The planktonic community of the Bichnaiyya lake is quite distinctive their classwise dominance and their contribution is shown in Table-1. Phytoplankton's belonging to 16 genera and 34 species were recorded and Zooplanktons belonging to 17 genera and 24 species were recorded.(Table No-1)

Table No 1

Phytoplanktons			**Zooplanktons**		
Class	**Genus**	**Sp.**	**Class**	**Genus**	Sp.
Chlorophyceae	5	11	Protozoa	4	4
Cyanophyceae	5	12	Rotifera	4	11
Bacillariophyceae	4	8	Copepoda	5	5
Euglenophyceae	1	2	Cladocera	3	3
Dinophyceae	1	1	Ostracoda	1	1
Total	16	34	Total	17	24

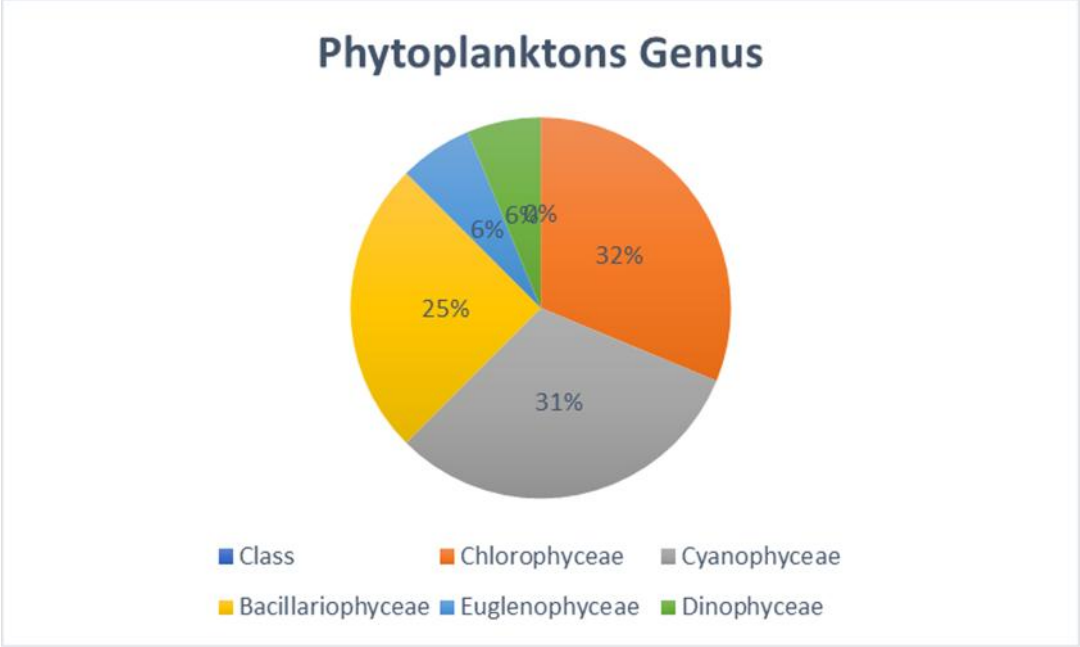

Phytoplanktons Genus
32%
31%
25%
6%
6%
Class
Chlorophyceae
Cyanophyceae
Bacillariophyceae
Euglenophyceae
Dinophyceae

Fig.1 (a)

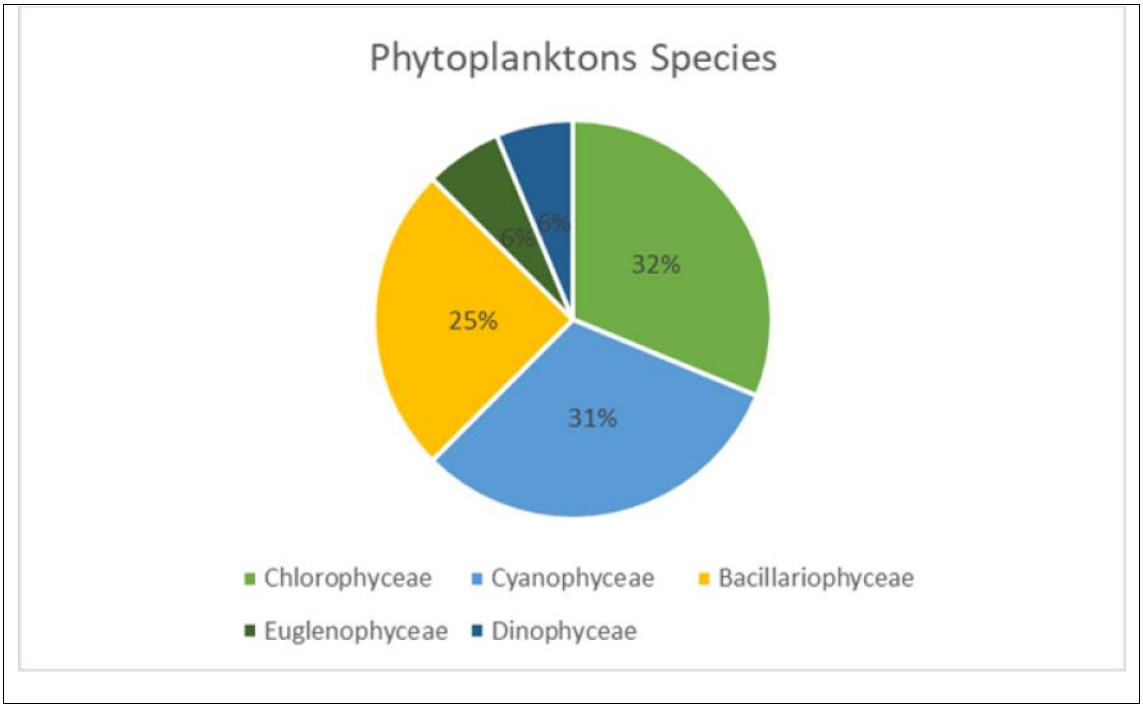

Phytoplanktons Species
32%
31%
25%
6%
6%
Chlorophyceae
Cyanophyceae
Bacillariophyceae
Euglenophyceae
Dinophyceae

Fig.1(b)

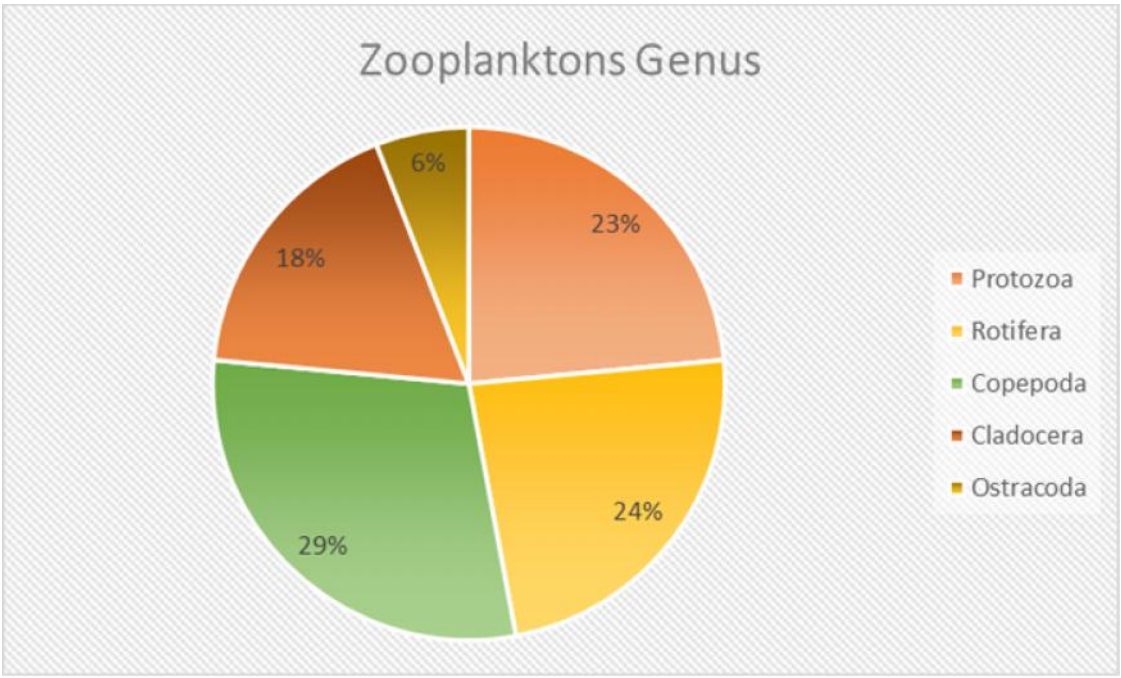

Zooplanktons Genus
6%
23%
18%
24%
29%
Protozoa
Rotifera
Copepoda
Cladocera
Ostracoda

Fig.2(a)

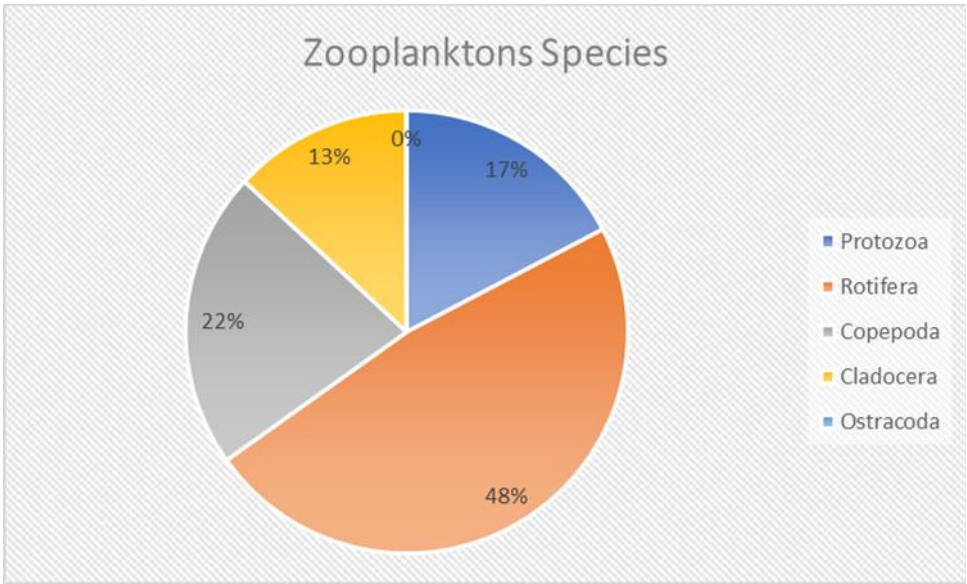

Zooplanktons Species
0%
13%
17%
22%
48%
Protozoa
Rotifera
Copepoda
Cladocera
Ostracoda

Fig2(b)

Table No-2 Composition of Phytoplanktons population in Bichnaiyya Lake

Phytoplanktons							
Bacillariophyceae	S-1	S-2	S-3	**Chlorophyceae**	S-1	S-2	S-3
Navicula sp.	D	D	D	Scenedesmus sp.	D	D	S
Navicula rostellata	R	S	R	Scenedesmus armatus	D	D	D
Navicula grimmii	S	D	-	Scenedesmus dimorphus	R	D	S
Navicula tumida	-	D	S	Scenedesmus abandans	R	D	S
Navicula subrhyncocephalus	D	D	D	Scenedesmusquardicauda	-	S	S
Navicula cryptocephala	R	S	D	Scenedesmus obliquus	R	R	D
Achnanthesminutissima	R	R	-	Scenedesmus westii	R	S	R
Cymbellatumida	S	D	D	Scenedesmus bijugatus	S	D	D
Melosiragranulata	D	D	S	Ulothrix sp.	S	S	-
Euglenophyceae				Dictyosphaericumreniforme	D	D	D
Euglena sp.	D	D	S	Staurastrum sp.	S	D	D
Euglena proxima	R	S	R	Closterium sp.	D	D	D
Euglena vagans	-	R	-				

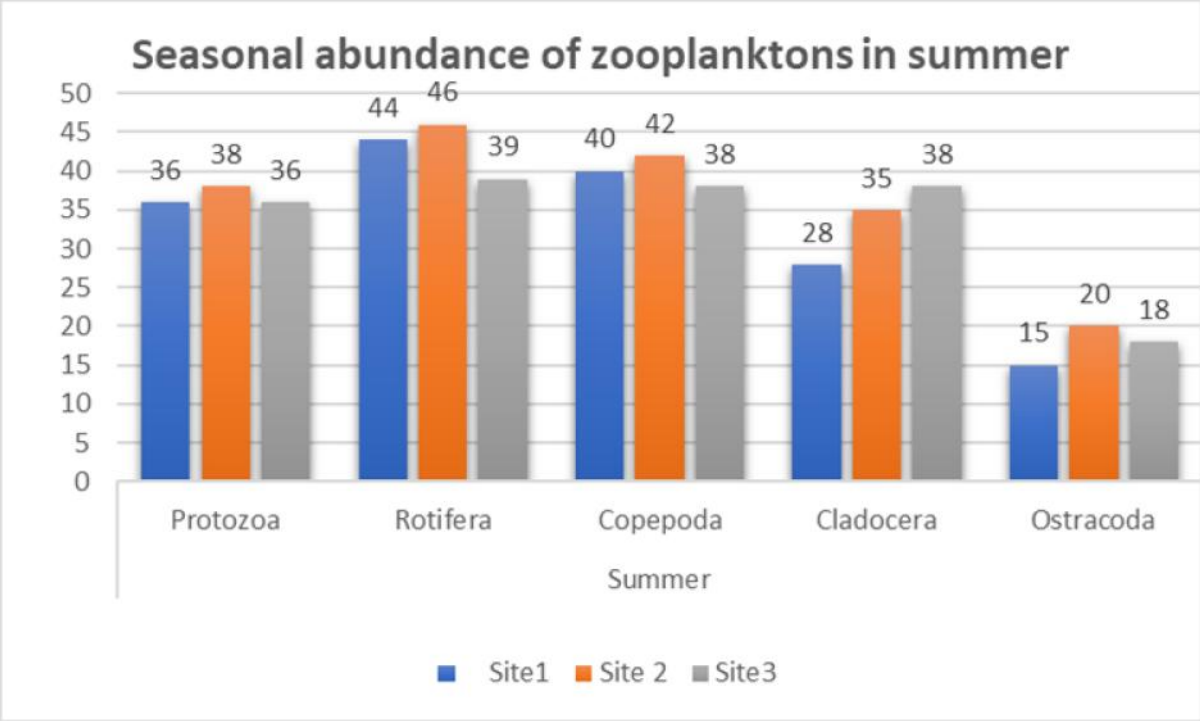
Table No 3 Composition of zooplanktons population of Bichnaiyya lake in different sites

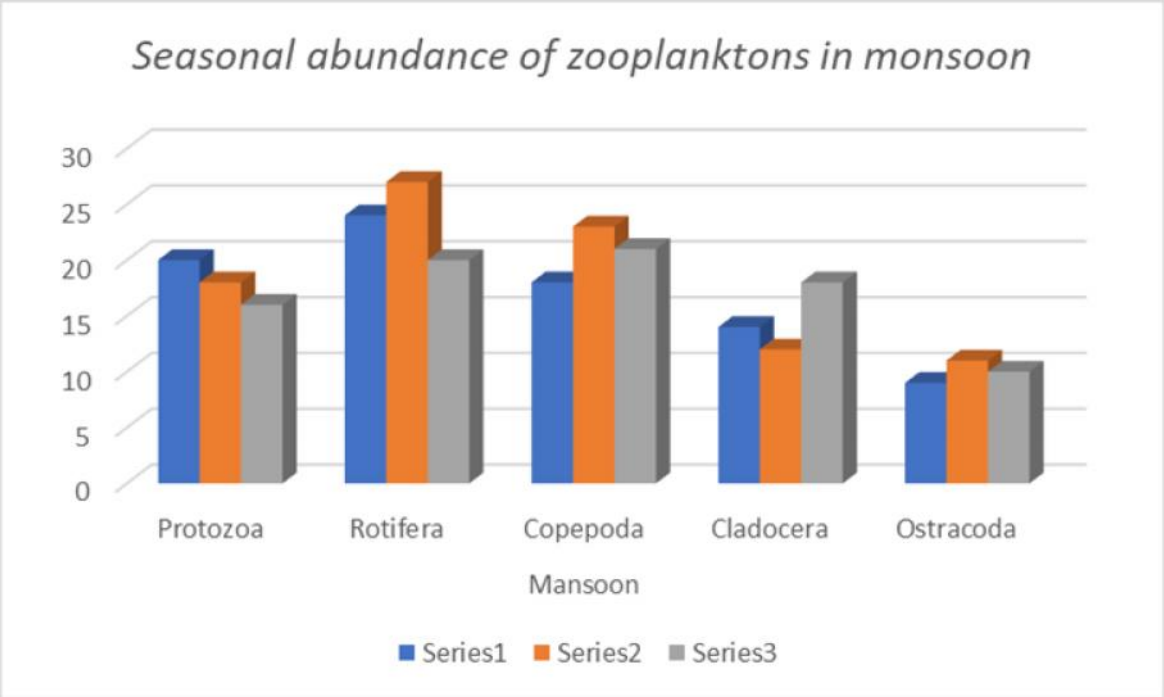
Cyanophyceae	**Site1**	**Site2**	**Site3**
Anabaena sp.	-	S	S
Anabaena spiroides	-	R	R
Oscillatoria sp.	D	D	D
Oscillatoria pseudogeminata	R	S	R
Oscillatoria curviceps	S	D	-
Oscillatoria subbrevis	D	D	S
Oscillatoria limosa	R	R	S
Oscillatoria limenetica	R	D	D
Nostoc sp.	-	S	S
Merismopedia sp.	D	D	-
Merismopedia glauca	D	D	D
Merismopedia punctata	-	S	R
Phormidium tenue	S	D	D
Dinophyceae	Site1	Site2	Site3
Ceratium sp.	-	S	R

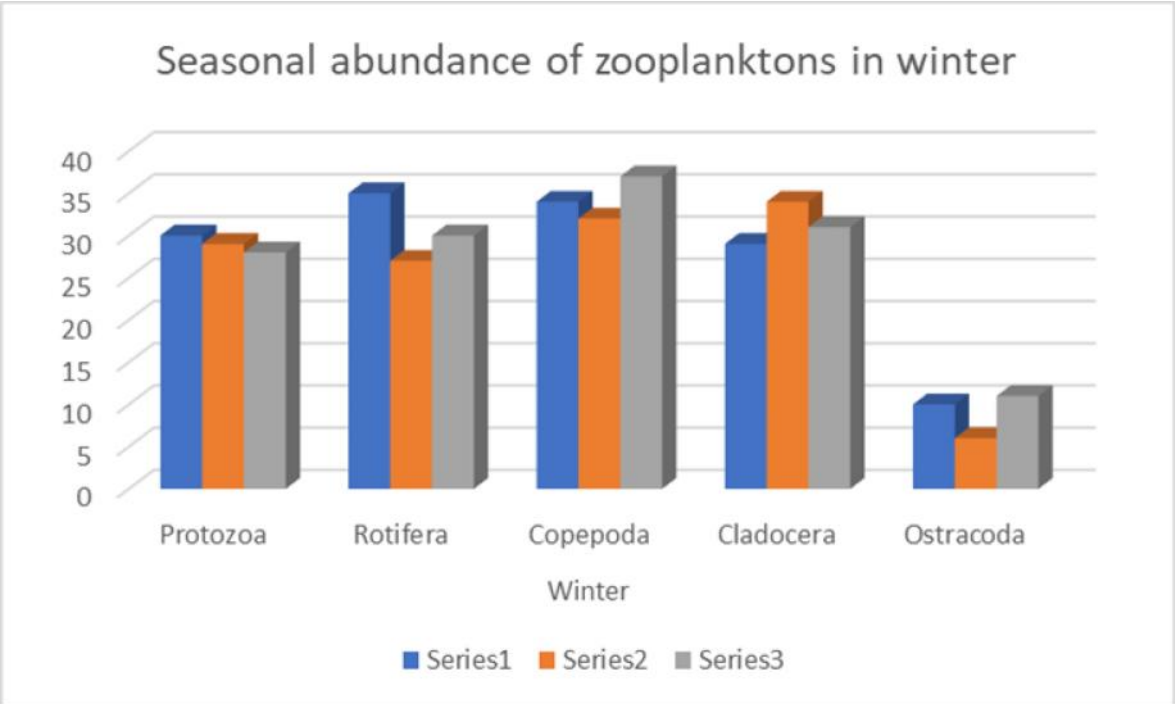
Zooplanktons			
Protozoa	Site 1	Site2	Site 3
Diffugia sp.	D	D	S
Paramecium sp.	R	S	-
Arcella sp.	-	S	R
Centeropyxis sp.	D	D	D
Rotifera			
Asplanchna*brightwellii*	D	D	S
Branchious f*orficula*	D	D	D
Branchious *calyciflorus*	S	D	D
Branchious caudatus	S	S	D
Branchiousfalacatus	-	S	-
Branchious angularis	S	D	S
Lecane sp.	D	D	D
Lecaneluna	S	S	R
Lecane bulla	D	D	D
Keratellatropica	R	S	R
Keratellacochlearis	D	D	S
Keratellatropica	D	D	D
Ostracoda			
Cypris sp.	S	S	D
Copepoda			
Cyclops sp.	S	D	D
Mesocyclopshyalinus	D	D	D
Phyllodiaptomusblanci	D	D	D
Nauplius larvae	S	D	S
Thermocyclops sp.	S	S	-
Cladocera			
Bosmina longirostris	D	D	D
Daphina sp.	D	D	D
Daphinapulex	R	D	R
Pleuroxus sp.	-	S	-

D-dominant, S-Subdominant. R-Rare S-site

Season	Group	Site1	Site 2	Site3
Summer	Protozoa	36	38	36
	Rotifera	44	46	39
	Copepoda	40	42	38
	Cladocera	28	35	38
	Ostracoda	15	20	18
Monsoon	Protozoa	20	18	16
	Rotifera	24	27	20
	Copepoda	18	23	21
	Cladocera	14	12	18
	Ostracoda	09	11	10
Winter	Protozoa	30	29	28
	Rotifera	35	27	30
	Copepoda	34	32	37
	Cladocera	29	34	31
	Ostracoda	10	06	11







The Planktonic Community of Bichnaiyya lake is quite distinctive, their classwise dominance and distribution is shown in Fig 1(a, b) and 2(a, b).A total of 58 plankton's species belonging to 16 phytoplanktons and 17 zooplanktons genera were recorded (Table 2). Out of 34 species12 species belong to Cyanophyceae, 11 species to Cholorophyceae, 8species to Bacillariophyceae,2 species to Euglenophyceae and 1 species to Dinophyceae. (Table-1) The dominance of species count of Cyanophyceae indicates the eutrophic nature of water. The sequence of dominance of phytoplanktons of various classes is as:

Cyanophyceae>Cholorophyceae> Bacillariophyceae>Euglenophyceae> Dinophyceae

Water bodies rich in Ca^{++}ion show thick population of of algae especially Cyanophyceae as Ca++ is required for sheath formation of Blue green algae. (Kaul et.al. 1978). During the present study the dominance of cyanophyceae indicates eutrophic nature of the lake water. (Prescott, 1939). In present study among zooplanktons total 17 genera and 24 species of zooplanktons were recorded belonging to five major groups i.e. Rotifera, Copepoda, Cladocera, Protozoa and Ostracoda. Out of these11 species were of Rotifera, 5 species Copepoda,4 species Protozoa, 3 species Cladocera and 1 species of Ostracoda. (Table No 1). Rotifers are tiny wheel animals, considered as water purifiers as they perform cleanup service in slow moving aquatic bodies. In present study Rotifers were dominant indicating the eutrophic nature of lake. (Wanganeo and Wanganeo, 2006) Among Rotifers *Brachoinus forficula, Lecane bulla and Keratella tropica,* Copepods *Mesocyclops hyalinus, Phyllodia potomusblanci* Cladocera *Bosmnia longirostrix, Daphnia sp.* and Protozoa *Centeropyxis s*p. were found dominant from all the three selected sites of the lake. All these species have been considered as an indicator of eutrophication as reported by Berzins (1949), Arora (1966), Sharma (1986). Rotifers were also dominant in Hawkesbury-Nepean River Kobayashi *et.al.* (1998). Jeelani et.al. (2005) reported species diversity and seasonal distribution of Rotifers in Dal Lake. Similar studies have been observed by Jindal *et.al*, (2010*)* who reported 6 species in Hill stream Nogli at Rampur Bhusnar District, Shimla. Copepods (5 species) are next dominant to Rotifers water depth, pH, Transparency and predators determine distribution and abundance of Copepods, Raghunathan (1983) reported Copepods in ponds, lakes, rivers and reservoirs. Similarly7 species of copepods reported from aquatic bodies of Dharwad district (Patil and Goudar (1989). 4 species of Copepods were observed by Suresh *et.al. (*2009) from Tungabhadra River. Kamble *et.al*. (2013) observed 2 species in Krishna River. Protozoans are next dominant to Copepods. Similar protozoans' dominance (11 species) was recorded in Gurha Brahmara, Jammu. (Dutta et.al. 2009). In river Chenab zooplanktonic analysis show dominance of protozoa which concides with the findings of Zutshi (1992) Sharma (2009) Cladocerans are useful components of microfaunal food webs as gazers of phytoplanktons or as food supplements for macrovertebrates. They prefer to live in clear water. In present study 3 species of cladocerans were reported. Our study matches with Dutta and Verma (2010) who observed 3 species in river Chenab. 4 species of cladocerans reported from Tungabhadra River Suresh et.al. (2009) and Kamble et.al. (2013) reported 4 species of cladocerans from krishna river ghat Miraj, Maharastra Ostracods are small poorly segmented crustacean whose body parts are enclosed within a calcareous bivalved carapace. In present study they constitute minimum abundance of zooplanktons illustrated by single species Cypris sp. they serve as food for benthic macro invertebrates and fish. Maximum population of ostracods was found in site 3.

Conclusion

Zooplanktons are delicate aquatic heterotropic planktonic weak swimmers' animals floating in the surface of water. Zooplanktons of all the groups were observed in summer season. In summer season the population maxima of zooplanktons is related with low transparency, high temperature and high standing crop of primary producers leading the greater availability of food. Monsoon is related low population density due to dilution effect and decreased photosynthesis by primary producers. The population rises to higher level in winter due to favourable environmental conditions, dissolved oxygen and availability of food in form of bacteria, suspended detritus and nanoplanktons (Table 3). They exists in wide range environmental conditions and are good bioindicators to access the pollution in water body (Dutta and Patra, 2013) Most of the zooplankton's species during present investigation indicates high trophic Paremecium sp. and Centropyxis sp.

Protozoans support the high trophic status of water. (David and Roy, 1966). Among Cladocerans *Bosmina longirostris, Daphnia sp.* and Copepods *Mesocyclops sp.* also support the eutrophic nature of lake water (Adoni, 1985 and Kulshresth*aet.al.1989).* Phytoplanktons are primary producers and a useful tool in bio monitoring of water body with regard to pollution status. Studies have shown that Oscillatoria, Scendesmus, Navicula are dominant in site 2 which show that the lake is rich in organic content of lake. Allergenic algae such as Anabena, observed in study sites, so it has been suggested to avoid bath and intake of water. Hence the present study gives season wise distribution of diversity among zooplanktons and phytoplanktonic diversity from given study area which can be useful as a data to identify the biological aspects of the same.

Recommendations

The present study shows that the lake can be useful for fish culture and can be used as tourist spot for local and outside population., Some significant recommendation for lake are as follows:

- Washing clothes and bathing activity should be prohibited.
- Idol immersion in lake should be banned
- Religious festivals should not be celebrated in lake water to avoid various pollutants to enter on lake water
- To create public awareness for cleaning of lake should be done regularly.
- Some sign boards with slogan should be put all around the lakeon its safety grills.

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