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Zooplankton Diversity and their Seasonal Variations of Bhadra Reservoir, Karnataka, India

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Abstract

A study on zooplankton species abundance and diversity of Bhadra reservoir, chikkamagalur district, Karnataka, India was conducted to check the status in the area and provide new insights into its ecology. Samples were collected during June 2010 to May 2011. A total of 23 species were found in this reservoir. Among these, rotifers comprise of 8 species (22.78%), Cladocera 5 (22.17%), Copepods 3 (25.13%), Ostracoda 2(14.69 %) and 5 protozoan species (13.25%). Some of the dominant zooplanktons present throughout the year. The season wise zooplankton analysis showed an average abundance of species in winter, lower in winter and maximum occurrence in summer due to the different environmental and inflow characteristic s of the water body.

Keywords: Bhadra reservoir, zooplankton, diversity, rotifers.

Introduction

Zooplanktons are the smallest organisms present in almost all the water body and they can be observed only through microscope. They invariably form an integral component for fresh water communities and contribute significant to biological productivity. Zooplankton acts as main sources of food for many fishes and plays an important role in early detection and monitoring the pollution of water. Zooplankton community distribution depends on some of the complex factors viz, change of climatic conditions, physical and chemical parameters and vegetation cover[1,2] Most of the planktonic organisms are cosmopolitan in distribution[3].

A number of studies has been carried out on the condition of ecology and freshwater bodies in various parts of India[4-6] but in some parts of southern Karnataka, the ecological studies of freshwater bodies especially zooplankton studies is very scanty. So that the present investigation made an attempt to study the zooplanktons species in Bhadra Reservoir.

Material and Methods

Study area: Bhadra reservoir is located near Kuvempu University, Shankaraghatta, a tributary of Tungabhadra in Chikkamagalur district of Tarikere taluk in Western parts of Karnataka in South India with latitude: 13º 42'.00" N, and longitude: 75º 38'.20" E. Some of the benefits getting from the reservoir storage are irrigation potential of 162, 818 hectares (402,330 acres), hydropower generation, fisheries, drinking water supply and industrial use.

Zooplankton sample Collection, Preservation, Identification and Density Analysis: Water samples were collected randomly in different locations of the reservoir during an early hours of the day (7am to 9am) to a period of 1 year (June 2010– May 2011) and such samples were pooled together to consider a final sample for analysis. The plankton net is made by the bolting nylon silk (mesh- size 50µm) is used for collection of zooplankton and which is conical shape and reducing cone with the bottle at its end. For a precise collection of zooplankton, the plankton net is towed horizontally and obliquely (for Qualitative) in surface water of the study area and for quantitative analysis, 10 liters of water samples were filtered out through the net. After transferring the sample in air tight plastic bottles, it would keep carefully with labeling and preserved immediately using 4% formaldehyde. Later, the collected samples were brought to laboratory and analyzed qualitatively under the microscope for different types of zooplanktons and identified using various authenticated monographs[7- 11]. After an accurate identification of each genus, the density of zooplankton was calculated as per the Lackey's drop method.

Results and Discussion

The obtained zooplankton forms were represented by five groups of Phylum viz Rotifera, Cladocera, Copepoda, Ostracoda and Protozoa. Among these, Rotifera comprise of 8 species, Cladocera 5 species, Copepoda 3 species, Ostracoda 2 and protozoa 5 species.

The total numbers of species recorded were 1039 of which rotifers are 245 (22.78%), Cladocerons 242 (22.17%) copepods 258 (25.13%), Ostracods 159 (14.69%) and protozoa 135 (13.25%). All the dominant group of zooplankton were present throughout the year.

It is reported that five genera amongst zooplankton population of Janatal at Gwalior[12]. Five genera of rotifers, three genera of

cladocerans and ostracods and two genera each in respect of protozoans and copepods in virla reservoir, Madhya Pradesh were observed[13]. While analyzing seasonal dynamics of rotifers in relation to physic-chemical conditions of lotic water body made similar observations in increased densities of zooplanktons in summers and reduced densities in winters[14]. In summer season, the absence of inflow of the water brings stability to the water body. The availability of food is more due to production of organic matter and decomposition[15].

In this study the occurrence of zooplankton groups was in the following increasing order.
Winter: Copepoda > Cladocera > Rotifera > Ostracoda > Protozoa
Summer: Rotifera > Copepoda > Cladocera > Ostracoda > Protozoa
Rainy: Cladocera > Copepoda > Rotifera > Protozoa > Ostracoda

Rotifers: These are considered as the most important soft bodied invertebrates[16] and they play a major role in aquatic food chain and major food for fishes. In rotifers zooplanktons *like Brachinous calcyflorus* and *Brachinous caudatus* found to be present throughout the year whereas cladocera was represented by *Bosmina longirostris, Alona davidi davidi, Macrothrix spinosa, Simocephalus exspinosus* and *Diaphonosoma species*

According to observation the Brachionus species are very common in temperate and tropical waters[16], indicates alkaline nature of water. Excess growth of rotifers in lakes and reservoirs indicates eutrophic conditions[17]. Presence of rotifers is also an indication of eutrophic as observed in Govind Sagar, Chhattri tank,Sawarkar Sarova and Matsya sarovar in Gwalior[18], the rotifers dominance followed by copepods in Virla reservoir at Madhya Pradesh was also reported[13].

Cladocerons: Cladocera is an order of small crustaceans commonly they are called by "water fleas"[5]. Around 620 species have been identified so far, with many more undescribed. It has been reported that the density and biomass of cladocerans was primarily determined by food supply[5]. In the present study, similar observations were made where cladocerans were abundant when the food supply (phytoplankton) was maximum. In the present study, similar observations were made where the cladocerans were abundant when the food supply (phytoplankton) was maximum. During summer the cladoceron population was moderate due to dense growth of rotifers and thus avoiding competition. It is found that the temperature is the primary factor affecting the occurrence and distribution of cladocerons[19].

Copepods: These constitutes a major zooplankton communities occurring in almost all the water bodies, which serve food for many fish and play a vital role in ecological pyramids. Nearly 120 species recorded from India[20]. The important factors which controlled the distribution of copepods were rainfall, river discharge and decreased phytoplankton abundance due to increased turbidity[21,22]. In our studies the copepods recorded were *Cyclops strenuous, Cyclops scutifer and mesocyclops hyalinus.*

Ostracods: The ostracods are bivalve crustaceans found in both fresh and marine water. About 1700 known species are freshwater forms which inhibit a wide variety of freshwater like pool, pond swamps, streams and polluted areas[7]. Occurance of of some species of ostracods in Dharwad district has been reported[23]. In the present study, only two species of ostracods were found and these are represented by Cypris species and heterocypris species.

Protozoa: These are the very diverse group of unicellular eukaryotic organisms[24] any of which are motile. We have recorded *Aspidisca species, Didinium nasutum, Centropyxis aculeate, Coleps hirtus and Amoeba.*

In this particular observation the density of zooplanktons showed distinct seasonal variation. All the groups have shown their own maximum and minimum peaks in which the density of rotifers was maximum during summer (26.79 %) and minimum in rainy season (18.60%). But the densities of highest groups in rainy season were cladocerons and copepods (28.92% and 27.28 %) and cladocerons were lowest during summer season (20.08%) while copepods minimum in winter season (23.8%). However in winter season ostracods showed their maximum population (17.20 %) and minimum during rainy season (10.33%). The protozoan density was highest in rainy season (14.88 %) and low in summer (12.28 %). Similar observations were also made[25-27].

Conclusion

The overall view in this study reveals that the fluctuation of zooplankton occurs distinctly in the study area and normally in rainy season there is a less population due to the dilution factors and its effects leads to less photosynthetic activity by primary producers[5]. The population raises a bit higher level during winter season due to favorable environmental conditions and presence of excess of food in the form of bacteria and suspended detritus, but in summer where inflow is less to compare with other seasons resulted in stability of water body and availability of food is more due to decomposition of organic matter and the density of zooplankton might be high due to less predators.

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Table-1
Zooplankton diversity in Bhadra Reservoir, Karnataka

Rotifera	**Cladocera**	**Copepoda**	**Ostracoda**	**Protozoa**
Keratella tropica	Bosmina longirostris	Cyclops strenuus	Cyrpris species	Aspidisca species
Brachinous calcyflorus	Alona davidi davidi	Mesocyclops haylinus	Heterocypris sp.	Didinium nasutum
Brachinous caudatus	Macrothrix spinosa	Cyclops scutifer		Centropyxis aculeate
Brachinous falcatus	Simocephalus exspinosus			Coleps hirtus
Brachinous forticula	Diaphonosoma species			Amoeba
Brachinous rubens				
Lepodella species				
Lecane species				

Table-2
Seasonal variation of Zooplanktons in Bhadra Reservoir

Season	**Rotifera**	**Cladocera**	**Copepoda**	**Ostracoda**	**Protozoa**
Winter	22.92(80)	23.50(82)	23.8(83)	17.20(60)	12.60(44)
Summer	26.79(120)	20.08(90)	24.33(109)	16.51(74)	12.28(55)
Rainy	18.60(45)	28.92(70)	27.28(66)	10.33(25)	14.88(36)
Total	**22.78(245)**	**22.17(242)**	**25.13(258)**	**14.69(159)**	**13.25(135)**

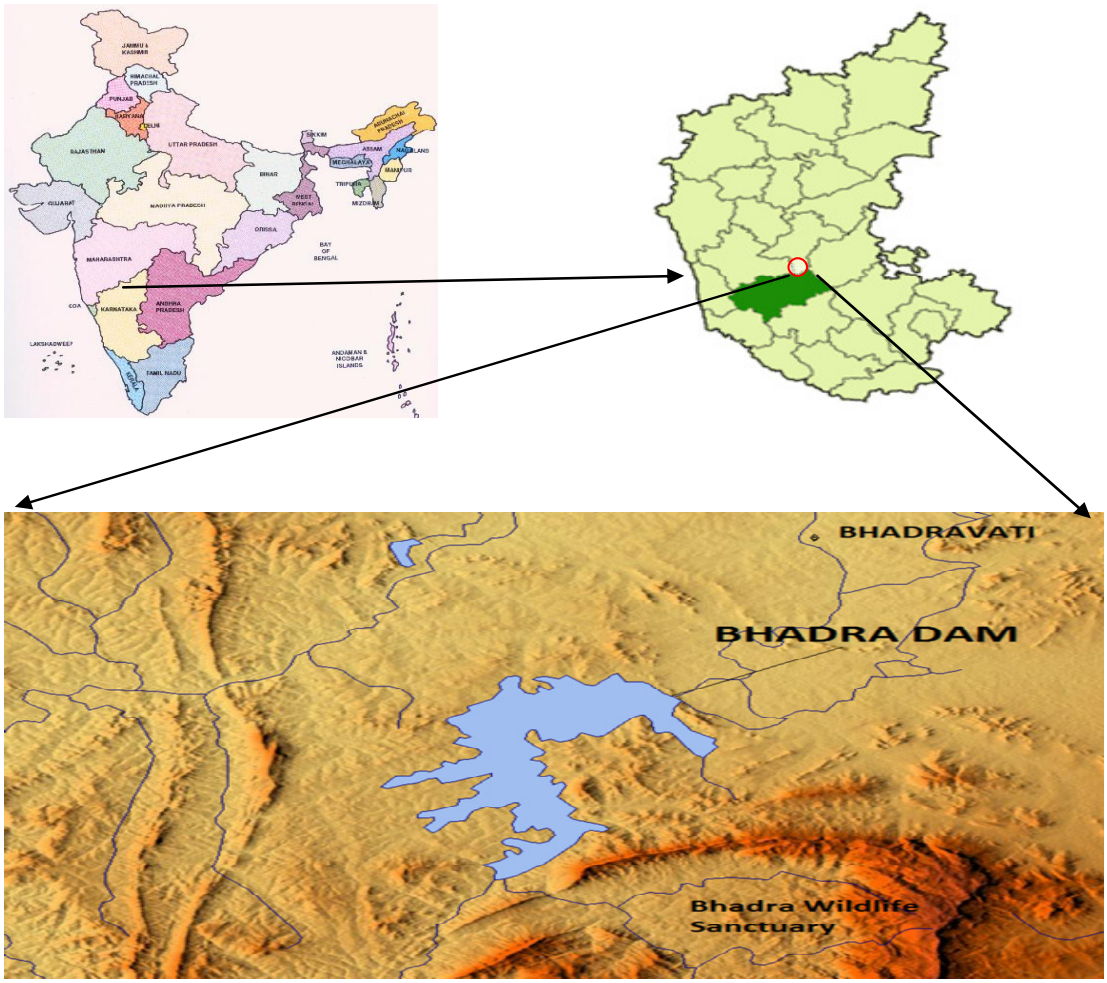

Figure-1
Map showing Bhadra Reservoir

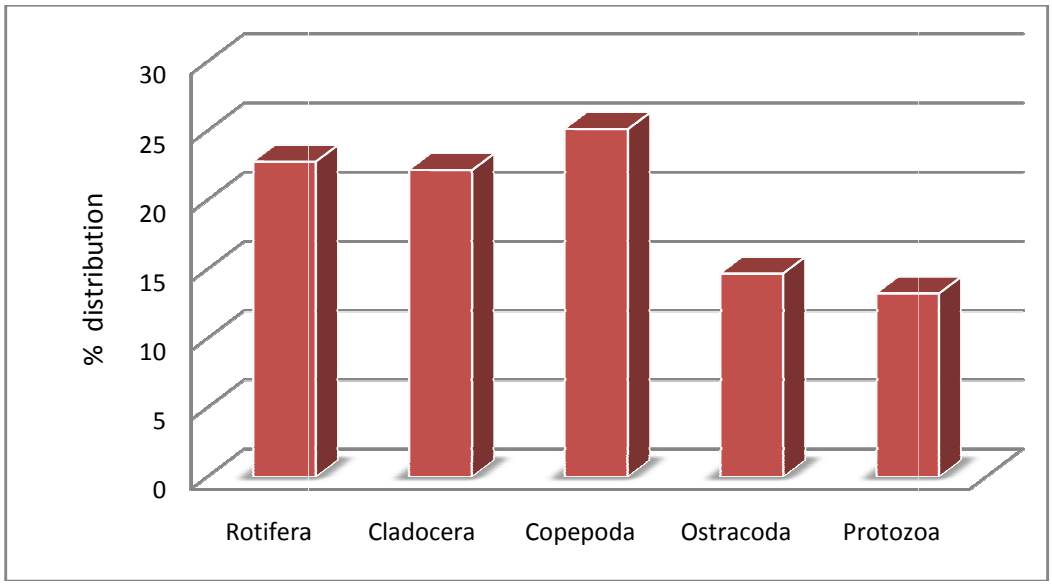

Figure-2
Percentage representation of different orders of zooplanktons in Bhadra reservoir

Reference

1. Rocha O., Matsumura-Tundisi, T., Espindola, E.L.G.,Roche K.F.,and Rietzler A.C. Ecological theory applied to reservoir zooplankton. In: Theoretical reservoir ecology and its application (Eds.:J.G. Tundisi and M.Straskraba). *Internat, Inst. Ecol.,* Sao Carlos,.457-476 **(1999)**
2. Neves I .F., Rocha O. Roche K.F. and Pinto A.A., Zooplankton community structure of two marginal lakes of river Cuiaba (Mato Grasso,Brazil) with analysis of Rotifers and Cladocera diversity, Braz. *J.Biol.***63 (3)**:329-343 **(2003)**
3. Mukherjee B., Environmental Biology, Tata McGraw Hill Publishing Company Limited, New Delhi **(1997)**
4. Sinha B. and Islam M.R., Seasonal variation in zooplankton population of two lentic bodies and Assam State Zoo cum Botanical garden, Guwahati, Assam, *Eco. Environ. Cons*., 8, 273-278 **(2002)**
5. Singh, S.P., D. Pathak and R. Singh: Hydrobiological studies of two ponds of Satna (M.P), India, *Eco. Environ. Cons*., **8,** 289-292 **(2002)**
6. Smitha, P.G., Byrappa K. and Ramaswamy S.N., Physico-chemical characteristics of water samples of bantwal Taluk, South-estern Karnataka, India. *J. Environ. Biol.,* 28, 591-595 **(2007)**
7. Edmondson, W. T: Freshwater Biology (2nd edition). John Wiley & Sons, New York, 1248 **(1959)**
8. Needham, J. G. and Needham P.R., A guide to the study of fresh water biology (5th eds.), Holden Day Inc. San Francisco, Califonia. USA.104 **(1966)**
9. Sharma, B. K., Rotifera. In: Faunal Diversity in Indic. Eds. J. R. B. Alfred, A. K. Das and A.K. Sanyal, Envis center, Zool. Sur.y of India, 57-70 **(1998)**
10. Sharma, B.K. & Sharma, S. Freshwater Rotifers (Rotifera: Eurotatoria). In: *State Fauna Series:* Fauna of Tripura, Zoological Survey of India, Calcutta, **7(4):** 163–224 **(2000)**
11. Altaff, K, A manual of Zooplankton. Department of Zoology, the New College, Chennai **(2003)**
12. Agarwal S.S Hydrobiological survey of Janaktal tank, Gwalior (Madhya Pradesh) India, Proceedings of all India seminar on Ichthyology 20-26 **(1978)**
13. Pathak S. K. and Mudgal L. K., A preliminary survey of zooplankton of Virla Reservoir of Khargaon. (Madhya Pradesh) India. Indian, *J. Env. & Ecoplan*. **6 (2)**: 297 – 300 **(2002)**
14. Arora, J. and Mehra, N. Seasonal dynamics of Rotifers to physical and chemical conditions of river Yamuna (Delhi), India, *Hydrobiologia,* **491**, 101–109 **(2003)**
15. Kiran B.R., puttaiah E.T and Kamath D., Diversity and seasonal fluctuation of zooplankton in fish pond of Bhadra fish farm, Karnataka, *J .Zoos Print*., 22, 2935-2936 **(2007)**
16. Hutchinson, G. E., A treatise on Limnology, Vol. II: Limnoplancton. Wiley. New York.1015 **(1967)**
17. Schindler D.W. & Noven. B., Vertical distribution and seasonal abundance of zooplankton in two shallow lakes of the Experimental Lakes Area, northwestern Ontario, *J. Fish. Res. Board Can.,* 28, 245-256 **(1971)**
18. Saksena, D N. & Sharma S.P., Zooplankton fauna of some lentic water of Gwalior. Govinda sagar, Chhattri tank,

Sawarkar Sarovar and Matsya Sarovar, *Environment India* 13-17 **(1981)**

19. Qadri M.Y. and Yousuf, A.R. Limnological studies on Lake Malpur Sar 1, The Biotope Geobios 117-119, **(1980)**

20. Uttangi J.C.: Conservation and management strategy for the water fowls of minor irrigation tank habitats and their importance as stopover site in the Dharwad district, Trends in wildlife and management, Daya Publishing house, New Delhi, India: 179-221 **(2001)**

21. Bijoy Nandan S. and P.K. Abdul Azis: Organic matter of sediments from the retting and the non-retting areas of Kadinamkulam estuary, Southeast coast of India, *Ind. J. Mar. Sci*., **25**, 25-28 (**1994)**

22. Hashemzadeh Farshad and G. V. Venkataramana: Impact of Physico-Chemical Parameters of Water on Zooplankton Diversity in Nanjangud Industrial Area, India, *Int. Res. J. Environment Sci.* Vol. **1(4),** 37-42, **(2012)**

23. Patil C.S. and Gouder B.Y.M. Freshwater invertebrates of Dharwad (Karnatak State, India), Prasaranga Karnatak University, Dharwad, India, 144, **(1989)**

24. Edward Alcamo, Jennifer M., Warner Schaum's Outline of Microbiology Mc Graw Hill Professional, 144- ISBN 978-0-07-162326-1 **(2009)**

25. Sampaio E.V., Rocha O., Matsumura-Tundisi T., Tundisi J.G. *Brazilian J. of Biol.,* **62**: 525-545 **(2002)**

26. Kudari V.A., R.D Kanamadi & G.G Kadadevaru Limnological studies of Attiveri and Bachanki reservoir of Utar Kannada district, Karnataka, India, *Eco. Env. and Conser.* **13(1)** 1-6 **(2006)**

27. Thirupathaiah M., Sravanthy .Ch and sammaiah. Ch: Diversity of zooplankton in lower manair reservoir, Karimnagar, AP India, *I. Res. Biological Sci*., **1(7),**27-32 **(2012)**

28. Sharma V., Bhoopendra Kumar V., and Madhu Sudan Sharma : Zooplankton Fauna in Relation to Physico-Chemical Characteristics in Madar Tank, Udaipur, Rajasthan, India, *I. Res. J. Environment Sci.* Vol. **1(3),** 5-10, **(2012)**