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Original Research Article

Zooplankton Diversity of Bhogaon Reservoir in Parbhani District Maharashtra, India

Sandhya S. Kadam

Department of Zoology and Fishery Science, Dnyanopasak College, Parbhani-431 401 (M.S.).

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ABSTRACT

The paper deals with the study of zooplanktons of Bhogaon reservoir in Parbhani district of Maharashtra, India. Seasonal count of the zooplanktons is investigated for the period of two years from 2014 to 2015. The species of zooplanktons investigated are copepods, cladocera, ostracoda and rotifers representing the forms that are found in freshwater Bhogaon reservoir. Among the zooplanktons copepods are the most abundant, followed by rotifers, cladocera, while ostracoda are less in number as compared to others. It is observed that all the zooplanktons are found to be minimum in monsoon period and maximum in post-monsoon period during both the years 2014 and 2015.

Keywords: Zooplanktons, Bhogaon Water reservoir, Parbhani district.

INTRODUCTION

Zooplankton organisms are essential in fresh water ecosystem as they indirectly convert the food energy due to their role as prays of economically important fishes. With reference to their heterotrophic activity zooplankton organisms initially handled and manage the biogenic organic materials of primary and secondary production to the great extent. In self regulatory ecosystem the gamut of zooplankton dynamics functions in a space and time persist so that allochthonous and autochthonous organic materials are processed and a dynamic equilibrium manifests between imputes of processing and processed materials respectively. It is a fact that zooplankton can survive under a wide range of environmental conditions such as dissolved oxygen, temperature, salinity etc. They play an important role in indicating the presence or absence of certain fish species or in determining the population densities of the zooplankton.

The load of pollutants is reflected in the biotic community of fresh water in the form of their occurrence, abundance pattern and diversity as only living organisms are capable of combating pollution (Gurunadha Rao et al 2004). It is vital and also logical that the fresh water biota and zooplankton particularly should be evaluated. Zooplankton has been subject of study in India and several researchers during last five decades including Saksena and Sharma (1981), Adoni (1985), Singh (2000), Kumar (2001), Pinto-Coelho (2005), Karekal (2009), Jaybhaye (2010) Salve and Hiware (2010) and Kadam et al. (2014) considered these from various lakes, ponds and reservoirs of India.

The seasonal variations in the zooplankton population at all stations followed the same trend as that of phytoplankton showing significant direct relationship between two groups of organisms (i.e. phytoplankton and zooplankton). It has been pointed out by

several researchers that there exists an inverse relationship between the quantities of phytoplankton and zooplankton (Kumar 2001, Karekal 2009, Jaybhaye 2010, Salve and Hiware 2010 and Kadam et al 2014). The factors like dissolved oxygen, pH, alkalinity, temperature light and grazing affect the zooplankton population (Rajshekhar et al 2010).

The major zooplankton groups varied in their relative abundance. The major groups of zooplankton were copepods, cladocera, Ostracoda and rotifers (Fig. 1). Although most of the zooplankton species survive under decreased environmental factors, their growth and population densities depend on a number of physico-chemical and biological factors (Kedar et al, 2008). The availability of food plays an important role in their growth and also affects the fertility of females. The amount of food available to zooplankton is proportional to the gross production of the water body. Copepoda and cladocera are the dominant represented group of crustacea in fresh water habitat. They are cosmopolitan in distribution and play a vital role as primary consumers. The occurrence and abundance of a zooplankton depends upon its productivity, which in turn is influenced by physico-chemical parameters and the level of nutrients. These groups in recent times are considered as live food organisms for storage scale seed production of commercially important species in hatcheries (Abdus Saboor and Altaff 1995). The important contribution on Indian copepods are those of Balkli Masood (1992) and Babar and Choube (1997) etc.

Many aquatic organisms exhibit diurnal rhythms in their activities. The factors such as light, temperature, food, sex and size have been attributed as probable cause for such behavior of organism (Michel 1968). Sharma and Pathak (1985) reported the maximum density in April and minimum density of copepods in November. Balkli Masood (1992) reported that calanoid (Copepoda) were generally abundantly found in the oligotrophic water bodies whereas the cyclopoids were abundant in mesotrophic/ eutrophic waters. Richly vegetated water bodies recorded greater number of crustacea than water without or with very little vegetation. The copepods are generally regards as pollution sensitive taxa as they disappear in polluted waters Rana (1990). They reported that Cyclops, a dominant genus of copepods as pollution tolerant form is abundant among the zooplanktons.

Zooplankton is the intermediate link between Phytoplankton and fish. Hence qualitative and quantitative studies of zooplankton are of great importance (Salve and Hiware 2010). In the present study an attempt has been made to study the occurrence, distribution and species number of zooplankton from seasonally at three stations selected for study. The zooplanktons of Masooli reservoir shows the presence of rotifers, cladocera, copepoda and ostracoda (Kadam and Babar 2012) as the dominant part and they do not show any bloom but indications of about their large number are available during summer. They reported that the concentration of zooplankton is more at station ‘A’ and ‘B’ whereas at ‘C’ due to dilution and more turbid water have small concentration of zooplankton at Masooli reservoir.

The findings of zooplanktons have been tabulated in Table 1, while the graphical representations are given in Fig. 2 for three seasons of 2014 and Table 2 and Fig. 3 for three seasons of 2015.

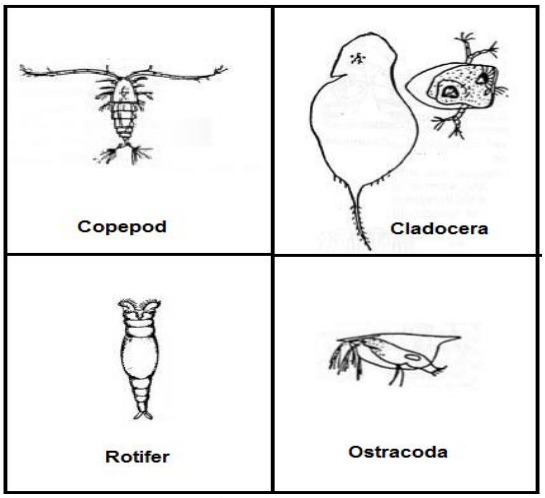

Fig. 1 Diagrammatic sketch of Common Zooplanktons (Kadam 2016).

Following are the different zooplankton species obtained during the investigation from the major groups of organisms.

Table 1. Zooplankton count per litre for 2014.

Name of Zooplankton	Pre-monsoon	Monsoon	Post-monsoon
Copepoda	36	22	51
Cladocera	15	12	18
Ostacodes	13	08	12
Rotifera	35	24	28

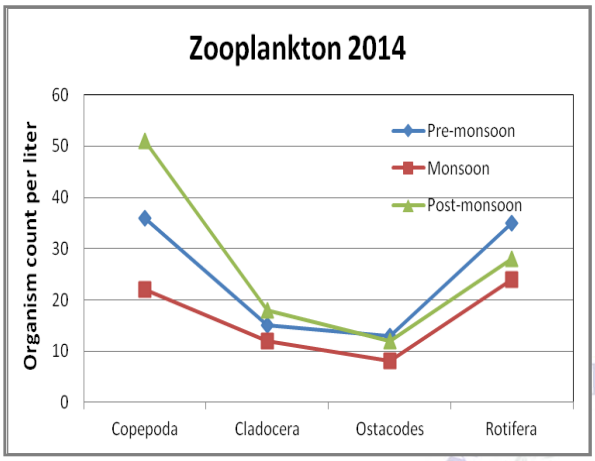

Fig. 2: Seasonal Variation in Zooplankton count per litre at Bhogaon reservoir in 2014.

Table 2. Zooplankton count per litre for 2015.

Name of Zooplankton	Pre-monsoon	Monsoon	Post-monsoon
Copepoda	32	18	45
Cladocera	14	10	15
Ostacodes	19	14	15
Rotifera	32	22	25

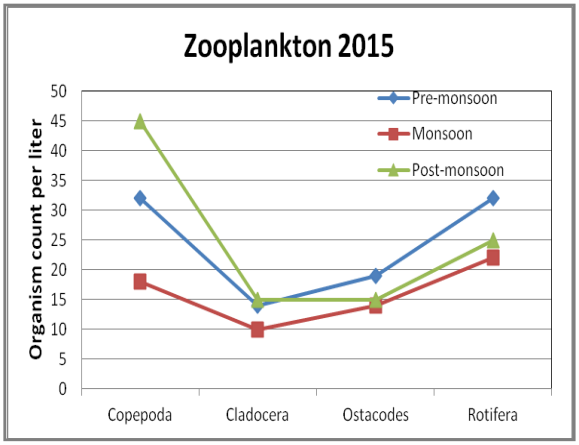

Fig. 3: Seasonal Variation in Zooplankton count per litre at Bhogaon reservoir in 2015.

1. COPEPODA

Singh and Sahai (1981) pointed out maximum copepod density during February and March in Jalwania pond. Sharma and Saxena (1983) reported maximum copepods in February and September at Janaktal pond. Rao and Durve (1992) observed the copopada with its two components of cyclopoida and calanoida showed a marginal increase in monsoon and very high increase in winter in Lake Rangasagar, Udaipur. Abdus Saboor and Altaff (1995) observed that quantitative analysis of zooplankton during summer shows lower density than that of the rainy season. This decrease in the zooplankton population may be attributed to the high temperature. The fall in the density of zooplankton during summer may also be due to the decrease in nutrient and phytoplankton population. Temperature, dissolved oxygen and organic matter are the important factors which control the zooplankton growth (Bhatti and Rana 1987). However, some researchers have reported the zooplanktons groups as biological indicators of eutrophication. Bais and Agrawal (1995) reported that maximum number of organism of all groups of zooplankton were recorded during summer in Sagar lake and Military Engineering lake, whereas copepods were minimum during winter season in Military Engineering lake, they further pointed that it could be due to low water temperature and comparatively high water level than during summer which minimized the density of organisms.

Systematic Account of Copepods Observed in Bhogaon Reservoir:

- *Cyclop sp.*
- *Nauplii*
- *Mesocyclops leucarati*
- *Calanoid copepods*
- *Diaptomus sp.*
- *Neodiaptomous sp.*

2. CLADOCERA

Cladocera species were found at almost all stations in all samples. Sharma and Patnaik (1984) indicated that population of zooplankton can be increased by addition of organic manure. They also mentioned that the organic manure by providing suitable substrate helps in increasing the population of micro-organisms in water. These micro-organisms are best utilized by fish as well as filter feeders like

ceriodaphnia. Rao and Durve (1992) in lake Rangasagar Udaipur reported the cladocerans dominating in summer and gradually declining in Winter. Sharma and Saini (1992) suggested that the pig manure had positive impact on the zooplankton production. It is clear that zooplankton population increased remarkably after fertilization. Pandey et al (1992) observed that cladocera and Copepoda showed the maximum growth during summer and lowest during winter, they also emphasized that cladocereans did not show any remarkable differences in seasonal population fluctuation, the summer peak might be due to pattern of life and presence or absence of predators. Chauhan (1993) observed zooplankton population and revealed tri-modal peaks. The first peak was recorded in July during rainy season. The second peak was found in October and the third peak was recorded in April during summer as cladocereans and copepoda in Renuka lake, Himachal Pradesh. Abdus Saboor and Altaf (1995) observed in pond that quantitative analysis of zooplankton species indicates the descending order of major dominant group is copepoda > Cladocera > Rotifera > Ostracoda and the time of occurrence of these species varies. Bais and Agrawal (1995) reported the total zooplankton ranged from 519 to 4813 organisms/lit in Sagar lake whereas in Military engineering lake, these varied between 388 and 997 organisms/lit, they conclude that only reason was deficiency of algal food in Military engineering lake, while in the Sagar lake it was available in abundance. High density of copepods and cladocera during winter and low density during summer population and they also emphasized that as compared to zooplankton population of maintained and manure fish pond, the zooplankton populations substantially lower in the natural pond. This fact suggests that the natural fresh water ponds show lower productivity. These natural water bodies are adopted and maintained with proper fertilization. Their productivity can be increased considerably as a result of which these fresh water bodies can be very efficiently used for fish culture.

Systematic Account of Cladocera Observed in Bhogaon Reservoir:

- *Daphnia carinata*
- *Ceriodaphnia sp.*
- *Monia dubia*
- *Bosmina sp.*
- *Simocephalus sp.*

3. ROTIFERS

Rotifers occur in almost all kinds of fresh water and have attracted global attention as an indicator of water quality particularly in population studies. The maximum numbers of rotifers were recorded at all the stations during the summer. The rotifers population was quite low during the period of monsoon at all the three stations. However, in the present investigation no significant relationship could be established between pH and rotifers. Similarly, the range of total alkalinity values did not show any significant influence on the abundance of rotifera. Rotifers play an important role as grazers, suspension feeders and predators within the zooplankton community.

Datta et al (1987) observed seasonal abundance of rotifer in a perennial fresh water pond, that population showed remarkable fluctuation around the year. Higher numbers were found in March, April, September and October, however, the minimum number is found in February and June. Datta et al (1987) in a perennial freshwater pond at Calcutta also could not find any correlation between temperature and rotifers number. However, Datta et al (1987) never found a significant correlation between rotifers population and pH of water. Fluctuation in dissolved oxygen value did not correspond with variations in rotifers densities but the carbon dioxide values indicated a direct relationship with rotifers population. They also recorded the maximum number of rotifers in summer while found maximum number of rotifers in the post monsoon season. They could not find any significant relationship between

dissolved oxygen and free CO_2 on one hand and the rotifers population, on other hand, Kadam and Babar (2012) reported some relationship between dissolved oxygen and abundance of rotifers. The alkalinity and nitrate influence the rotifer population while other abiotic factors may have some indirect role. Rao and Durve (1992) reported that rotifers dominating in summer and gradually declining in winter.

Systematic Account of Rotifers Observed in Bhogaon Reservoir:

- *Filinia terminalis*
- *Filinia longiseta*
- *Keratella tropica*
- *Keratella cochlearis*
- *Testudinella sp.*
- *Asplanchna sp.*
- *Brachionus caudatus*
- *B. rubens*
- *B. forticula*
- *B. calyciflorus*
- *B. angularis*
- *B. falcatus*
- *Chlorella sp.*

4. OSTRACODA

The Ostracoda are one of the most successful crustacean groups with approximately 8000 living species. Ostracods are generally small, ranging in length from 0.1 to 32 mm (that's smaller than a poppy seed to the size of a meatball). As indicated by its name, *Gigantocypris* a planktonic ostracod, is by far the largest member of this group reaching up to 32 mm. *Gigantocypris's pelagic* life style (continuously swimming in the open water) sets it apart from many other ostracods as well. Most other ostracods are found crawling on or burrowing into the sediments at the bottom of the ocean or lakes. A few species, for example *Mesocypris* sp., are also found crawling around in moist terrestrial habitats such as mosses. In these habitats, they feed on dead organic material, suspended organic particles, microscopic plants, or they are predators.

Ostracods consist of little more than a head. They have the typical five pairs of appendages on their head but only 1-3 pairs of appendages on the rest of the body. Their bivalved carapace may cause you to mistake them for tiny clams or mussels, thus the common name of "mussel shrimp". The two parts, hinged carapace encloses the entire body, similar to the branchiopod Conchostraca. However, their appendages distinguish them from the conchostracans. Another feature that differentiates these groups is a lack of growth rings on the carapace. Ostracods shed the carapace with each molt, whereas the conchostracans simply add material to the carapace as they grow.

The ecology of ostracods is often reflected in the shape and structure of their carapaces hence making them useful palaeoenvironmental indicators. Freshwater ostracods in general tend to have smooth, thin, weakly calcified simple bean-shaped carapaces. They feed on a wide range of food stuffs including diatoms, bacteria and detritus. Pelagic ostracods also tend to have thin, smooth shells and may have long powerful swimming appendages or antennules which have led to the formation of rostral incisures at the anterior of the carapace to allow freer movement of these appendages. Benthic ostracods are commonly detritivores or filter feeders; they either burrow into the substrate, in which case their carapaces tend to be smooth, small, robust and sometimes elongated. Epifaunal types may have flattened ventral surfaces sometimes with projecting alar wings, frills, keels or lateral spines. Those found on coarser substrates in higher energy environments tend to have more robust heavily ribbed or reticulated carapaces.

Systematic Account of Ostracods Observed in Bhogaon Reservoir:

- *Cypris*
- *Meta cypris*

CONCLUSION

The zooplanktons are divided into four groups including of copepods, cladocera, Ostracoda and rotifers. During two years of investigation period for 2014

and 2015, zooplankton species are found to be of highest density in summer and winter season (pre and post-monsoon periods) and lower in rainy season (monsoon period). All the observations in this lake are having a productive nature. Zooplankton composition is generally higher in the summer months, moderate in winter and lower in the monsoon months. The above study shows that the reservoir with the presence of these zooplanktons is good potential for fish production.

REFERENCES

- Abdus Saboor and K. Altaff (1995). Qualitative and quantitative analysis of zooplankton population of a tropical pond during summer and rainy season. Ecobiol. 7 (4) 269-275.
- Adoni, A.D. (1985). Work book on limnology. Indian MAB committee, Department of Environment, govt. of India, Pratibha Publishers, Sagar, pp. 216.
- Babar, Vijayshree and Usha Choube (1997). Studies on the copepod fauna of Gandhi Sagar reservoir. Perspectives in Hydrobiology Sec. IV (26), 135-138.
- Bais V.S. and N.C. Agrawal (1995). Comparative study of the zooplanktonic spectrum in the Sagar lake and military engineering lake. J. Environ. Biol. 16 (1), 27-32.
- Balkhi Masood H. (1992). Community structure of crustancean plankton in relation to tropic conditions. International Journal of Ecology and environmental Sciences 18: 155-168.
- Bhatti, D.P.S. and Rana, K.S. (1987). Zooplankton in relation to abiotic components in the fort moat of Bharatpur. Proc. Nat. Acad. Sci. India. 57 (13): 237-242.
- Chauhan Ramesh (1993). Seasonal fluctuations of zooplankton in Renuka Lake, Himachal Pradesh. Uttar Pradesh J. Zool. 13 (1): 17-20.
- Datta N.C., N. Mandal and B.K. Bandyopadhyay (1987). Seasonal abundance of rotifers in a perennial freshwater pond in Calcutta. J. Environ. Biol., 8 (1) 63-71.
- Gurunadha Rao V.V.S., Mitsuo Yoshida, B.A. Prakash, S.V.N. Chandrasekhar, and K. Mahesh Kumar (2004). Environmental Impact of Human activities to Urban Lake Sediments: Potentially Toxic Elements (PTEs) Contamination in Hussainsagar Lake, Hyderabad. The 11th National Symposium on Hydrology National Institute of Hydrology, Roorkee (India), November 22-23, 2004, pp. 1-9.
- Jayabhaye U.M. (2010). Studies on Zooplankton Diversity Of River Kayadhu, Near Hingoli City, Hingoli District, Maharashtra. Shodh, Samiksha aur Mulyankan (International Research Journal), Vol. II, Issue-11-12, pp.47-49.
- Kadam Sandhya S. (2016). Book "Hydrobiology of the Reservoir: Enhancement in Capacity and Assessment of Quality" Authored by Kadam S.S., published by Lambert Academic Publication, Germany.
- Kadam Sandhya S., Kadam S.U. and Md. Babar (2014a). Zooplankton Diversity of Masooli and Yeldari reservoirs in Parbhani district, Maharashtra, India with Reference to the Physico-Chemical Parameters. The International Journal's Research Journal of Science and IT Management: Volume: 03, Number: 11, pp. 1-6.
- Kadam S.U. and Md. Babar (2012). A Monograph on "Biodiversity of Reservoirs: In Humid Tropics' Authored by Kadam S.U. and Md. Babar, published by Lambert Academic Publication, Germany.
- Karekal S.M., M. Rajashekhar, K. Vijaykumar and Zeba Parveen (2009). Seasonal variations of zooplankton community in freshwater reservoir Bijapur district, Karnataka, South India. J. Ecophysiol. Occup. Hlth. 9, pp. 105-111
- Kedar, G.T., Patil G.P. and Yeole, S.M. (2008). Effect of the physico-chemical factors on the seasonal abundance of Zooplankton population in Rushi lakes. Sengupta and Dalwani Editors Proceedings of TAAL 2007: 12th World Lake conference, 88-91.
- Kumar, K.S. (2001). Studies on the freshwater copepods and cladocerans of

Dharmapuri Dist. Tamil Nadu. *J. Aqua. Biol*, 16, 5-10.

- Pandey B. N., A.K. Mishra, A.K. Jha and R.N. Lal (1992). Studies on qualitative composition and seasonal fluctuation in Plankton composition of river Mahananda, Katihar (Bihar). J. Ecotoxicol. Environ. Monit, 2 (2) 93-97.
- Pinto-Coelho, R.M., Bezerra-Neto, J.F. and Morais, C.A., Jr. (2005). Effects of eutrophication on size and biomass of crustacean zooplankton in a tropical reservoir. *Braz. J. Biol*., 65, 325-338.
- Rajashekhar M., Vijaykumar K. and Zeba Paerveen (2010). Seasonal variations of zooplankton community in freshwater reservoir Gulbarga District, Karnataka, South India. International Journal of Systems Biology, ISSN: 0975-2900, Volume 2, Issue 1, 2010, pp-06-11.
- Rao N.G. and V.S. Durve (1992). Structure and dynamics of zooplankton community in Lake Rangasagar, Udaipur, India. J. Environ. Biol 13 (3), 343-355.
- Saksena, D.N. and Sharma, S.P. (1981). Zooplankton fauna of some lantic water of Gwalior I Govind Sagar Chattritank, Sawarkar Sarovar and Matsya Sarovar Environment, India, 4: 113- 17.
- Salve, V. B. and Hiware C. J. (2010). Zooplankton Diversity of Wan Reservoir, Nagapur (MS) India. Trends Research in Science and Technology, 2 (1), 39-48.
- Sharma O.P. and V.P. Saini (1992). Evaluation of Pig manure fertilization in relation to zooplankton production and water quality. J. Ecobiol. 4(1) 27-31.
- Sharma, A. L. N. and Pattnaik (1985). Ecology studies on zooplankton of freshwater ponds in and around Bhubaneshwar. J. Environ Biol., 6 (4): 245 - 266.
- Sharma, B. K. and Saksena, D. N. (1983). Seasonal variation of the copepod component of zooplankton in a perennial tank, Janaktal, Gwalior (India). Acta Hydrochim. et hydrobiol. 11: 479- 484.
- Singh D.N. (2000). Evaluation of physico-chemical parameters in an ox-bow lake. Geobios 27: 120-124.
- Singh N.K. and L.C. Sahai (1981). Diurnal cycle of abiotic parametes at Ramsar well, Bhagalpur. Comp. Physiol. Ecol., Vol. 6, No. 1, pp. 38-40.

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