

DIVERSITY AND SEASONAL FLUCTUATION OF ZOOPLANKTON IN FISH POND OF BHADRA FISH FARM, KARNATAKA

B.R. Kiran¹, E.T. Puttaiah² and Devidas Kamath²

^{1,2} Department of Environmental Science, Bio-Science Complex, Kuvempu University, Shankaraghatta, Karnataka 577451, India
Email: ¹gangadk_2001@yahoo.co.in

Zooplankton support the economically important fish population. They are the major mode of energy transfer between phytoplankton and fish (Howick & Wilhm, 1984). The study of zooplanktonic composition, abundance and seasonal variations is helpful in planning and successful fishery management (Jhingran, 1974).

A number of workers such as Ayyappan & Gupta (1980), Chakravarthy (1983), Balkhi *et al.*, (1987), Fasihuddin & Kumar (1990) and Choudhary & Singh (1999) have reported on different aspects of zooplankton inhabiting Indian freshwaters. The aim of the present study is to know the diversity of zooplankton groups and their seasonal variations in fish culture pond of Bhadra fish farm, Karnataka during January to December 1998. The fish pond is situated in the Bhadra reservoir project area, which is located about 2km away from Kuvempu University campus (13°45'N-75°30'E). The area of the waterbody is 600m². Cow dung and poultry wastes are used as manure.

Zooplanktonic samples were collected at monthly intervals from January to December 1998 and were preserved in 5% formalin. The quantitative analyses were done with the help of Sedgewick Rafter plankton counting cell and the results were expressed as organisms per litre. The identification of zooplankton was done with the help of standard texts and monographs (Edmondson, 1959; Battish, 1992).

The diversity of zooplankton groups and its seasonal variation of fish ponds are summarized in Tables 1 and 2. The population of zooplankton consisted of rotifers, copepods, cladocerans, ostracods and protozoans. Total numbers recorded were 1018 per litre of which rotifers were 259 (25.44%), cladocerans 234 (22.99%), copepods 254 (24.95%), ostracods 175 (17.19%) and protozoans 96 (9.43%). All the dominant groups of zooplankton were present throughout the year.

Diversity analysis showed that rotifers had seven species, cladocerans four, copepods two, ostracods two and protozoans two species. *Brachionus angularis* and *B. falcatus* among rotifers were found throughout the year, whereas, copepods were represented by *Cyclops scutifer* and *Mesocyclops hyalinus*. The group Cladocera was represented by *Daphnia carinata*, *Ceriodaphnia reticulata*, *Moina Daphnia* and *M. brachiata*. The ostracods were represented by *Cypris subglobosa* and *Heterocypris* species of which *C. subglobosa* was the most abundant. *Arcella vulgaris* and *Diffugia lobostoma tuberosa* of protozoans were also recorded.

Moitra & Bhowmik (1968) observed members of three main zooplanktonic groups i.e., Rotifera, Cladocera and Copepoda, which dominate in freshwater fish pond in Kalyani, West Bengal. Agarwal (1978) reported five genera amongst zooplankton

population of Janatal at Gwalior. In Ramaua reservoir four genera of Rotifera and Cladocera and two genera under Copepoda were observed by Agarwal (1980). However, Pathak & Mudgal (2004) observed five genera of rotifers, three genera of cladocerans and ostracodans and two genera each in respect of protozoans and copepodans in Virla reservoir, Madhya Pradesh.

The numerical variation in peak periods of different group of zooplankton might be due to different biological parameters. In fish pond rotifers were found dominant over the other groups. This findings is in agreement with Chakravarthy and Asthana (1989), Kohli *et al.* (1982), Balkhi *et al.* (1987). Numerical variations in rotifers may apparently be influenced by the water quality.

Hutchinson (1967) observed that *Brachionus* species are very common in temperate and tropical waters, which indicates alkaline nature of the waterbodies. Schindler & Noven (1971) reported enormous growth of rotifers in lakes and reservoirs indicating eutrophic conditions. Presence of rotifers are also an indication of eutrophy as observed in Govind sagar, Chhatttri tank, Sawarkar sarovar and Matsya sarovar in Gwalior by Saksena & Sharma (1981). Pathak & Mudgal (2004) noticed dominance of rotifers followed by copepods in Virla reservoir at Madhya Pradesh.

The density of zooplankton showed distinct seasonal variations. Each group of zooplankton showed their own maximal and minimal peaks. In the current study, density of rotifers was maximum during summer season (29.30%) and minimum in rainy season (20.08%). But the Cladocerans and Copepods densities were highest in rainy season (28.63% and 26.92%) and lowest during summer season (19.16% and 24.22%). However, ostracods showed their maximum population during winter season with 18.12% and minimum during rainy season (11.97%). The density of protozoans was highest during rainy season (12.40%) and lowest in winter season (6.88%). Rotifers taxonomic richness is common in tropical freshwaters. Similar observations were made by Sampaio *et al.* (2002), Kudari *et al.* (2004) and Kudari *et al.* (2006). Zooplanktonic fauna of fish pond is abundant during summer season and lower during rainy season. Similar findings were observed by Sharma & Pant (1984), Singh (1990) and Srivastava *et al.* (1990).

Ostracods are bivalve crustaceans found in both freshwater and marine water. There are over 1700 species of known ostracods of which about one-third are freshwater forms. They inhabit a wide variety of freshwaters like lakes, pools, swamps, streams and heavily polluted areas (Edmondson, 1959). Patil & Goudar (1989) reported occurrence of seven species of ostracods in Dharwad district. In the present study, only two species of ostracods were found.

Arora & Mehra (2003b) while analyzing seasonal dynamics of rotifers in relation to physico-chemical conditions of lotic waterbody made similar observations in increased densities of zooplanktons in summers and reduced densities in winters. 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. The above factors contribute for high species density in that season. Addition of cowdung and poultry manure are the major causes for the nutrient enrichment in fish ponds and favours zooplankton growth. If waterbodies have to be preserved for their intended use, a

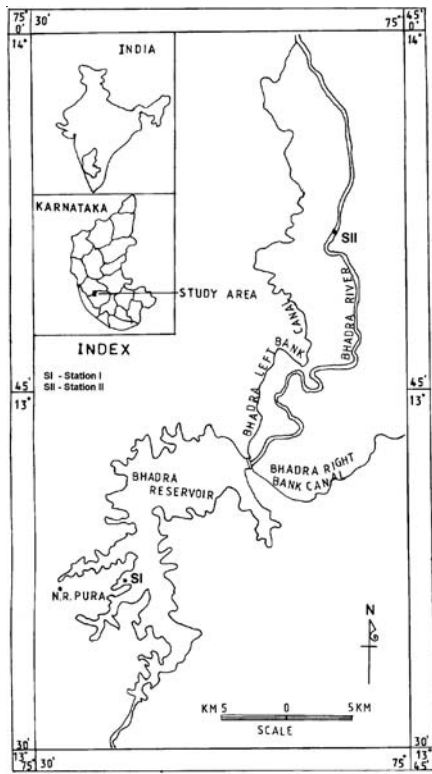


Figure 1. A sketch map showing the location of Bhadra fish farm, Karnataka

sustainable and holistic management planning is necessary for conservation of fish ponds.

REFERENCES

Agarwal, S.S. (1978). Hydrobiological survey of Janaktal tank, Gwalior (Madhya Pradesh) India. *Proceedings of All India Seminar on Ichthyology* 20-26pp.
 Agarwal, S.S. (1980). Some aspects of Limnology of Ramaua dam with special reference to

phytoplankton and zooplankton. Ph.D. Thesis, Jiwaji University, Gwalior.
 Arora, J. & N. Mehra (2003b). Seasonal dynamics of the rotifers in relation to physical and chemical conditions of the river Yamuna (Delhi), India. *Hydrobiologia* 491: 101-109.
 Ayyappan, S. & T.R.C. Gupta (1980). Limnology of Ramasandra tank. *Journal of Inland Fisheries Society of India* 12: 1-12.
 Balkhi, M.H., A.R. Yousuf & M.R. Quadri (1987). Hydrobiology of Anchar Lake, Kashmir. *Comparative Physiology and Ecology* 12: 131-139.
 Battish, S.K. (1992). *Freshwater Zooplankton of India*. Oxford and IBH Publishing Co., Pvt., Ltd., New Delhi.
 Chakraborty, N.M. & A. Asthana (1989). Plankton succession and Ecology of a sewage treated pond in West Bengal. *Environment and Ecology* 7: 549-554.
 Chakravathy, T.K. (1983). Role of a biotic factors in the plankton. Population of a fish pond at Maoghlyr (Bihar). *Proceedings of First Indian Symposium of Life Science* 171-175.
 Choudhary, S. & D.K. Singh (1999). Zooplankton populations of Boosra lake at Muzaffarpur, Bihar. *Environment and Ecology* 17(2): 444-448.
 Edmondson, W.T. (1959). *Freshwater Biology*. 2nd edition. John Wiley and Sons, New York, USA.
 Fasihuddin, M. & T. Kumar (1990). Seasonal variations in physico-chemical properties and plankton periodicity in a freshwater fish pond at Bhagalpur. *Environment and Ecology* 8 : 929-932.
 Howick, G.L. & J. Wilhm (1984). Zooplankton and benthic macroinvertebrates in lake Carl Blackwell. *Proceedings of Okla Academy of Science* 64 : 63-65.
 Hutchinson, G.E. (1967). *A Treatise on Limnology, Vol. 2. Introduction to Lake Biology and Limnoplankton*. John Wiley and Sons Inc., New York.
 Jhingran, V.G. (1974). *Fish and Fisheries of India*. Hindustan Publishing Corporation, New Delhi.
 Kohli, M.P.S., Thakur, N. Kumar & S.K. Munnet (1982). Seasonal changes in plankton population of some fresh water ponds at Patna. *Journal of Inland Fisheries Society of India* 14: 69-76.
 Kudari, V.A., R.D. Kanamadi & G.G. Kadadevaru (2004). Present status of Naregal tank (District Haveri, Karnataka) with reference to water quality, Plankton and Wetland birds. *Environment and Ecology* 22(1): 182-187.

Kudari, V.A., R.D. Kanamadi & G.G. Kadadevaru (2006). Limnological studies of Attiveri and Bachanki reservoirs of Uttar Kannada district, Karnataka, India. *Ecology Environment and Conservation* 13(1): 1-6.
 Moitra, S.K. & M.L. Bhowmik (1963). Seasonal cycle of Rotifers in fresh water fish pond in Kalyani, West Bengal. *Proceedings of Symposium on Recent Advances in Tropical Ecology*, 359-367pp.
 Pathak, S.K. & L.K. Mudgal (2004). Biodiversity of zooplankton of Virla reservoir Khargone (M.P.) India, pp.317-321. In: Arvind Kumar (ed.). *Biodiversity and Environment*. A.P.H. Publishing Corporation, New Delhi.
 Patil, C.S. & B.Y.M. Goudar (1989). *Freshwater Invertebrates of Dharwad*. Prasaraanga, Karnatak University, Dharwad.
 Saksena, D.N. & S.P. Sharma (1981). Zooplankton fauna of some lentic water of Gwalior. I. Govind Sagar, Chhattri tank, Sawarkar Sarovar and Matsya Sarovar. *Environment, India* 4: 13-17.
 Sampaio, E.V., O. Rocha, T. Matsumura-Tundisi & J.G. Tundisi (2002). Composition and abundance of zooplankton in the limnetic zone of seven reservoirs of the Paranapanema river, Brazil. *Brazilian Journal of Biology* 62(3) : 525-545.
 Schindler, D.W. & B. Noven (1971). Vertical distribution and seasonal abundance of Zooplankton in two shallow Ontario. *Journal of Fisheries Research, Canada* 28: 245-256.
 Sharma, P.C. & M.C. Pant (1984). Abundance and community structure of limnetic zooplankton in Kumayun lake, India. *Hydrobiology* 69: 91-110.
 Singh, A.K. (1990). A review on limnological status of some lakes in U.P. *Recent Trends in Limnology* 271-280pp.
 Srivastava, K.N., P. Srivastava & A.K. Sinha (1990). Zooplankton studies of Ganga river between Kala Kanker (Pratap Garh) and Phamphaman (Allahabad) Uttar Pradesh. *Recent Trends in Limnology* 129-133.



Table 1. Diversity of zooplanktonic groups of fish culture pond of Bhadra fish farm (Karnataka)

Rotifera	Cladocera	Copepoda	Ostracoda	Protozoa
<i>Brachionus caudatus</i>	<i>Moina brachiata</i>	<i>Cyclops scutifer</i>	<i>Cypris subglobosa</i>	<i>Diffugia lobostoma tuberosa</i>
<i>Brachionus calciflorus</i>	<i>Moina daphnia</i>	<i>Mesocyclops hyalinus</i>	<i>Heterocypris</i> sp.	<i>Arcella vulgaris</i>
<i>Brachionus angularis</i>	<i>Daphnia carinata</i>			
<i>Brachionus plicatilis</i>	<i>Ceriodaphnia reticulata</i>			
<i>Brachionus rubens</i>				
<i>Brachionus falcatus</i>				
<i>Keratella tropica</i>				

Table 2. Seasonal variation (%) of zooplankton in the fish pond during January to December 1998, Bhadra reservoir project (Values in the parenthesis indicate)

Season	Rotifera	Cladocera	Copepoda	Ostracoda	Protozoa
Winter	24.69 (79)	25.00 (80)	25.31 (81)	18.12 (58)	6.88 (22)
Summer	29.30 (133)	19.16 (87)	24.22 (110)	17.40 (79)	9.92 (45)
Rainy	20.08 (47)	28.63 (67)	26.92 (63)	11.97 (28)	12.40 (29)
Total	25.44 (259)	22.99 (234)	24.95 (254)	17.19 (175)	9.43 (96)