



A Review On Studies Of Zooplankton Diversity In Freshwater Bodies Of India

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Abstract : Water is one of the precious natural resources for all living organisms for their various metabolic activities. Zooplanktons are the important components of aquatic ecosystem and found in all types of water bodies including polluted, industrial and municipal waste water. Zooplanktons act as the bioindicators and their diversity can be used to indicate the pollution status and the chronic water pollution problem.

Index Terms: Zooplanktons, aquatic ecosystem, metabolic activities, bioindicators.

Introduction:

Water is the important component of all living beings. It performs unique and indispensable activities in earth ecosystem, biosphere and biogeochemical cycles. The water quality of the freshwater resources is undergoing deterioration at the faster rate day by day and now has become a global problem. Intensive farming has led to severe disturbance of watersheds throughout the world, resulting in fundamental changes in the structure and functioning of stream ecosystems. (Jagadeeshappa and Vijaya kumara 2013). Zooplanktons are the important components of aquatic ecosystem and play a fundamental role in the flow of energy and nutrient cycling. Their rapid growth rate can provide meaningful and quantifiable indication of ecological change in short and long-time scales (Karuthapandi et al., 2016). Studies of zooplankton diversity in the water bodies indicate the water quality. In aquatic habitats, zooplankton have a vertical as well as horizontal distribution (Chakrabarty et al., 2017). The aquatic ecosystems present a great contrast to terrestrial ecosystems and the aquatic organisms display wide range of adaptations. Zooplanktons and Photoplanktons form one of the major constituents of aquatic organisms. Zooplanktons are the minute drifting invertebrates in both marine and fresh water column. They are indispensable members of the aquatic food chain, connecting primary producers to higher trophic levels including economically important population of fishes. The change in abundance, species diversity and community composition of zooplanktons indicates the changes in the physico-chemical properties like pH, temperature, nitrates, phosphates, total dissolved solids, nutrient levels, alkalinity etc., in water. They are the sensitive indicators of pollution in comparison with phytoplankton (Umadevi, 2013). In the fresh water ecosystems, zooplanktons transfer energy at the secondary level between autotrophs and heterotrophs of aquatic food webs as they are inherently active with high density, high biodiversity and tolerance to stress (Bhat et al., 2014).

Methodology:

A literature review methodology involves the various sources like academic articles, books, reports, government websites and research papers to assess this review paper.

Literature review:

Jadhav et al., (2012) recorded 13 genera of Zooplankton from Sina kolegoan Dam, Osmanabad District, Maharashtra. Density of Rotifera was least in the monsoon season. Maximum density of Cladocera and Copepoda observed in summer season and Ostracoda did not show any seasonal remarkable fluctuation.

Thakur et al., (2013) investigated the diversity of plankton in three lakes located in Himachal Pradesh to examine the presence, absence or dominance of certain species related to the status of lakes. They recorded 79 species belonging zooplanktons of which they found some species as bioindicators of oligotrophic state (*Actinophrys* sp., *Bosmina longirostris*, *Coleps* sp., *Cyclops bicuspidatus*, *Daphnia* sp., *Euchlanis dialata*, *Keratella procurva*, *Notholca* sp., *Voritcella nebularia*.) While others were found to be bioindicators of eutrophic state (*Alona pulchella*, *Aspidisca* sp., *Asplanchna brightwelli*, *Brachionus angularis*, *Brachionus calyciflorus*, *Chydorus* sp., *Colpidium* sp., *Epistylis* sp., *Eucyclops* sp., *Glaucoma* sp., *Lecane* sp., *Stylonychia* sp., *Voritcellaconvallaria*).

Biodiversity of zooplankton communities in a Perennial pond at lake Kolleru region of Andhra Pradesh was assessed by Madhusudhana et al., (2014) and explored the following species of Zooplanktons-Rotifera (*Brachionus* spp., *Filinia longiseta*, *Polyarthra remata*, *Hexathra* sp., *Keratella tropica*), Cladocera (*Ceriodaphnia cornuta* *Moina micrura*, *Diaphnosoma excisum*), Copepodes (*Mesocyclops* sp., *Heliodiaptomus cinctus*, *Diatoms* sp.,). Among the rotifers, the dominance of *Branchionus* sp., indicated a nutrient rich water body and further suggested the state of eutrophication. As the runoff is rich with abundant food sources, they observed high zooplankton density during the monsoon period and minimum density during the summer.

Gadekar (2014) investigated Railway pond of Gondia city and observed 20 species of zooplanktons, of which 3 species belong to Protozoa, 10 species to Rotifera, 3 species to Cladocera, 3 species to Copepoda and only 1 species to Ostracoda. The maximum diversity was recorded in winter season while minimum was observed in monsoon season.

Sakhare and Kamble (2014) documented the planktonic diversity from Hiranyakeshi River in Kolhapur of Maharashtra and they recorded 24 species of zooplanktons. 9 species belong to Rotifera, 2 species of Ostracoda, 4 species of Cladocera, 4 species of Copepoda and 5 species of Protozoa. The highest species richness of zooplanktons was observed during the summer season, which was attributable to the quantity of phytoplankton on which zooplankton survives.

Raut and Solunke (2015) recorded 20 species of zooplanktons in Nagapur Dam, Parli. Out of these 15 species were identified as pollution indicators. The occurrence of *Branchionus calyciflorus*, *Branchionus quadridentate*, *Branchionus angularis*, *Branchionus havanaensis* species indicated the high polluted condition of the water.

Bhavimani et al., (2016) studied the biodiversity of lentic Zooplanktons of Madikoppa and Benachi ponds in Karnataka. During their study period, the Zooplanktons biodiversity was represented by 17 species of Rotifera, 12 species of Cladocera, 6 species of copepoda and 2 species of Ostracoda. They concluded that zooplankton population was dominated by Rotifera followed by Cladocera, Copepoda and Ostracoda.

Khan and Pathan (2016) identified and recorded 19 species of zooplanktons from Triveni lake of Amravati. Zooplanktons are represented by five different groups like Protozoa, Rotifera, Cladocera, Copepoda and Ostracoda. Rotifera was found dominant among zooplanktons.

Kar and Kar (2016) studied the zooplankton diversity of the Narsingtola pond in Cachar District of Assam. They recorded 42 species of zooplanktons of which 25 species of Rotifera, 13 species of Cladocera and 4 species of Copepoda. Abundance status and population density of the zooplankton groups were also recorded. The findings suggest that the pond is very much suitable for aquaculture.

Abbai and Shivshankar (2017) studied the Zooplankton Diversity of Sogal pond in Belagavi District, North Karnataka. During the study period, 16 different Zooplanktons species belonging to 3 different groups were recorded. The Zooplanktons population of pond is highly influenced by contamination by the discharge of domestic waste, floral offerings, washing clothes, cleaning vehicles, bathing and other anthropogenic activities.

Manickam et al., (2018) studied the physicochemical parameters of water and biodiversity of zooplanktons in Ukkadam lake of Coimbatore. They recorded 7 species of Rotifera, 9 species of Cladocera and 5 species of Copepoda. The researchers noticed that there was a clear correlation between temperature and biodiversity

abundance. Biodiversity reached its peak during the summer and decreased during the monsoon season. They also linked the impact of global warming to the rise in zooplankton diversity.

Sharma and Kumari (2018) studied zooplankton community of Prashar lake in Himachal Pradesh and was represented by Rotifera 10 species, Cladocera 6 species, Protozoa 6 species, Copepoda 3 species and Ostracoda 2 species. They opined that a species presence or absence depends significantly on the microclimate and seasonal variations of the given area. The winter months in Prashar lake had the highest zooplankton density, while the monsoon season had the lowest. Low densities of zooplanktons were the result of high turbidity and heavy rainfall during the monsoon.

Kaur and Sidhu (2019) explored the diversity of river Ghaggar of Punjab and recorded 27 genera of zooplankton. Among these, Rotifera consisted of 14 genera, Cladocera 3, Copepoda 7, and Protozoa with 3 genera. Rotifers constituted the major zooplankton diversity in the river. The highest zooplankton diversity was during pre-monsoon season and least was recorded in monsoon season. During pre-monsoon, high rate of decaying vegetation due to high temperature caused abundance of zooplankton while during monsoon, dilution of nutrients due to rain water and high level of turbidity resulted in decreased diversity of zooplankton.

Majagi et al., (2019) investigated the zooplankton diversity of Chikklingdalli Dam of Karnataka and recorded Rotifera (*Brachionus* spp., *Euchlanis oropa*, *Asplancha brightwelli*, *Asplancha priodont*, *Filinia longiseta*), Cladocera (*Ceriodaphnia corunata*, *Coronotella rectangula*, *Alona pulchella*, *Indialona globulosa*, *Daphnia* sp., *Diaphanosoma sarsi*, *Macrothrix laticornis*, *Moina*) Copepoda (*Mesocyclops leuckart*, *Neodiaptomus strigilipes*, *Cyclopoid nauplii*) and Ostracoda (*Hemicypris* sp., *Pirocypris* sp.) They observed that temperature plays a major role in the distribution of zooplanktons. Abundance of zooplankton was maximum during summer due to high temperature and high standing crop of producers and was less during monsoon and winter.

Yogesh (2020) studied biodiversity of zooplankton of Lony Dam reservoir in Reva, Madhya Pradesh and found 6 species of Protozoa, 11 species of Rotifera, 6 species of Cladocera and 5 species of Copepoda. He found that Rotifers were discovered to be the most prevalent, predominant and extensively spread among all zooplanktons.

Patel and Lahari (2021) has studied zooplankton diversity of a freshwater perennial Singada Lake in Wani city of Yavatmal. He observed 42 species of Zooplanktons belonging to five different classes. *Keratella cochlearis* of Rotifera was found to be the dominant species among the Zooplankton species observed.

Shivaraju and Venkateshwaralu (2021) studied the faunal diversity in Durgadahalli Lake of Tumakuru, Karnataka state, India. A total of 20 species of zooplanktons were recorded, 14 Rotifers, 4 Cladocerans and 2 Copepods. They observed most commonly occurring species in lake included *Brachionus angularis*, *Brachionus caudatus*, *Keratella tropica*, *Filinia longiseta*, *Ceriodaphnia cornuta* and *Moina micrura*. The Rotifer showed highest number of species whereas Copepoda showed lowest number of species of Zooplanktons. They reported that order Rotifera was found to be abundant followed by the order Cladocera and Copepoda in the study area.

Study of Pandya et al., (2023) aimed to assess the diversity of Zooplanktons in the Surendranagar District of Gujarat, India and recorded total of 35 species of Zooplanktons belonging to five distinct groups namely Protozoa 15 species, Rotifera 12 species, Copepoda 3 species, Cladocera 4 species and Ostracoda 1 species. Highest zooplankton diversity was observed in winter and lowest zooplankton diversity was observed during monsoon season.

Rankhamb and Mulgir (2024) recorded four groups of zooplanktons namely Rotifera with 7 species, Cladocera with 5 species, Copepoda 3 species and Ostracoda 2 species in Godavari river at Mudgal Dam, Pathari District. With the results, they concluded that the dam shows a good diversity of Zooplanktons indicating the lowest level of pollution.

Conclusion:

Zooplanktons play an important role as intermediate between producers and top consumers. Zooplanktons are good bio indicators to check the pollution level and quality of water. This review has highlighted the fresh water zooplanktons of both lentic and lotic communities of India and emphasis have been given on the impact of seasonal variations, pollution and anthropogenic activities on the diversity and importance of zooplanktons.

It is therefore clear that at present there is a lot of gap concerning zooplanktons in India. This created a lot of scopes in this field and more studies are required in unexplored rivers and lakes to bridge the gap.

Competing Interests

Authors have declared that no competing interests exist.

References:

- 1) Abbai, & Shivashankar, S. (2017). A study on zooplankton diversity of Sogal pond in Belagavi District, North Karnataka. *International Journal of Innovative Research in Science, Engineering and Technology*, 6(9), 19071-19074.
- 2) Bhat, N. A., Wanganeo, A., & Raina, R. (2014). The composition and diversity of net zooplankton species in a tropical water body (Bhoj Wetland) of Bhopal, India. *International Journal of Biodiversity and Conservation*, 6(5), 373-381.
- 3) Bhavimani, H., Puttaiah, E. T., & Naik, M. (2016). Zooplankton Study and some Physico-Chemical Parameters Analysis of Madikoppa and Benachi Ponds, Alnavar, Dharwad Taluk/District, Karnataka, India. *GJRA* 5(3),101-104.
- 4) Chakrabarty, M., Banerjee, A., Mukherjee, J., Rakshit, N., & Ray, S. (2017). Spatial pattern analysis of zooplankton community of Bakreswar reservoir, India. *Energy, Ecology and Environment*, 2, 198-206.
- 5) Gadekar, G. P. (2014). Seasonal Variations in Zooplankton Diversity of Railway Pond, Gondia, District Gondia (MS). *International Journal of Life Sciences, Special Issue A2*:169-171.
- 6) Jadhav, S., Borde, S., Jadhav, D., & Humbe, A. (2012). Seasonal variations of zooplankton community in Sina Kolegoan Dam Osmanabad district, Maharashtra, India. *Journal of Experimental Sciences*, 3(5),19-22.
- 7) Jagadeeshappa, K. C., & Kumara, V. (2013). Impact of physico-chemical conditions on seasonal fluctuation of plankton diversity in certain wetlands of Tiptur taluk, Tumkur district, Karnataka, India. *Global Journal of Biology, Agriculture and Health Science*, 2(4),143-150.
- 8) Kar, S., & Kar, D. (2016). Zooplankton diversity of a freshwater pond in a Cachar District of Assam, India. *International Journal of Life Science*, 4(1), 125-128.
- 9) Karuthapandi, M., Rao, D. V., & Xavier Innocent, B. (2016) Zooplankton composition, diversity and physicochemical features of Bandam Kommu Pond, Medak District, Telangana, India. In *Proceedings of the Zoological Society*, 69(2), 189-204. New Delhi: Springer India.
- 10) Kaur, S., & Sidhu, H. K. (2019). Diversity and distribution of zooplankton in river Ghaggar of Punjab with special reference to pollution bioindicators *Ecology, Environment and Conservation*,26 (February Suppl. Issue):242-247
- 11) Khan, R. M., & Pathan, T. D. (2016). Study of Zooplankton diversity in Triveni lake at Amravati District of Maharashtra. *Journal of Global Biosciences*, 5(7), 4315-4319.
- 12) Madhusudhana Rao, K., Krishna, P. V., Jyothirmayi, V., & Hemanth Kumar, V. (2014). Biodiversity of zooplankton communities in a Perennial pond at lake Kolleru region of Andhra Pradesh, India. *International Journal of Advanced Research*, 2(7), 33-41.
- 13) Majagi, S., Naik, J., & Chitra, J. (2019). Seasonal investigation on the zooplankton diversity and distribution in relation to water quality at Chikklingdalli dam, Karnataka. *Int. J. Res. Anal. Rev*,6(1), 754-767.
- 14) Manickam, N., Bhavan, P. S., Santhanam, P., Bhuvaneswari, R., Muralisankar, T., Srinivasan, V., & Karthik, M. (2018). Impact of seasonal changes in zooplankton biodiversity in Ukkadam Lake, Coimbatore, Tamil Nadu, India, and potential future implications of climate change. *The Journal of Basic and Applied Zoology*, 79, 1-10.
- 15) Pandya, M., Teraiya, S., & Vyas, A. (2023) Comparative analysis of zooplankton diversity and physico-chemical parameters of various freshwater reservoirs in Surendranagar, Gujarat, India, *International Journal of Entomology Research*, 8 (2), 117-122.
- 16) Patel, P., & Laharia, R. (2021). Zooplankton diversity of a fresh water perennial pond in wani city of Yavatmal District in Maharashtra, India. *Journal of Emerging Technologies and Innovative Research*, 8(12), 42-52.
- 17) Rankhamb S. V, & Mulgir V.S. (2024). Zooplankton Diversity of Godavari River at Mudgal dam, Pathari District, Parbhani (MS), India, *International Journal of Biological Innovations* 6(1), 65-68.

- 18) Raut K. S. and Solunke R. V. (2015). Exploitation of zooplankton as indicators of water Quality at Nagapur dam near Parli. V. Town Dist. Beed Maharashtra, India. International Journal of Scientific Research,4(8), 109-114.
- 19) Sakhare, S., & Kamble, N. (2014). Biodocumentation of Planktonic Diversity from Hiranyakeshi River, Gadhinglaj, Maharashtra. Asian Journal of Multidisciplinary Studies, 2(6), 208-219.
- 20) Sharma, R. C., & Kumari, R. (2018). Seasonal variation in zooplankton community and environmental variables of sacred Lake Prashar Himachal Pradesh, India. International Journal of Fisheries and Aquatic Studies, 6(2), 207-213.
- 21) Shivaraju, & Venkateshwarlu, M. (2021). Faunal Diversity of Durgadahalli Lake of Tumakuru, Karnataka State, India, J Environ Stud ,7(1),1-6.
- 22) Thakur, R. K., Jindal, R., Singh, U. B., & Ahluwalia, A. S. (2013). Plankton diversity and water quality assessment of three freshwater lakes of Mandi (Himachal Pradesh, India) with special reference to planktonic indicators. Environmental monitoring and assessment, 185(10), 8355-8373.
- 23) Umadevi, T. (2013). Limnological Investigation and Zooplankton Diversity of Karanja River, Karnataka, India. International Journal of Science and Research (IJSR), 2(3),133-136.
- 24) Yogesh, M. (2020). Study of zooplankton community structure for aquaculture planning in Lony dam reservoir. GSC Biological and Pharmaceutical Sciences, 11(1), 161-165.

