ABUNDANCE OF ZOOPLANKTON GROUPS IN BHINDAWAS RESERVIOR, DISTRICT JHAJJAR, HARYANA

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Abstract

The zooplankton occupies a central position between the autotrophs and other heterotrophs and an important link in food web of a fresh water ecosystem. Zooplankton occurrence in the fresh water ecosystem is dependent on its productivity, which in turn has affected by physico-chemical parameters and nutrient level. The Bhindawas Reservoir is a large perennial reservoir of the Jhajjar district. Zooplankton groups in the reservoir of Bhindawas consisting of three main groups, namely Rotifers, Crustaceans and Protozoans. However, Protozoans are common in almost all the sampling points attained 54% of total protozoan group. The zooplankton invariably interacts with phytoplankton and help in the regeneration of nitrogen. The maximum number of zooplankton occurred in the winter season as compared to monsoon and summer season. The abundance of zooplankton groups will help to determine the potential of reservoir and are the best indicators to assess the organic pollution.

Paper Identification

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Introduction

Study of zooplankton gives us a scientific basis so that we can understand climate change and effects of human activities on the water body. Plankton has occurred in both natural water and in artificial impoundments such as tanks, ponds, irrigation channels and reservoirs. The worldwide fresh water bodies are collectively undergoing high rates of degradation leading to eutrophication. In view of all this, considerable attention is now being paid towards the study of inland water. The inland water bodies are closed ecosystems, in which zooplankton hold occupies a central role in the water body's metabolism, food chains, trophic levels, as well as energy flow. In transforming energy from one trophic level to a next, planktons play a significant role. At higher level of trophic which leads to fish production is the final product of aquatic environment. Zooplankton occurrence in the fresh water ecosystem is dependent on its productivity, which in turn has affected by physico-chemical parameters and nutrient level. The tributaries which bring water to the reservoir and the surrounding soil have greater impact on water quality and in turn, influence the plankton diversity in the reservoir.

Review of Literature

Rajendran (1973), Goudar and Patil (1985), Hazarika and Dutta (1994) and Singh (2000) has documented the diversity of zooplankton including copepods, cladocerans, ostracods and rotifers of Indian water reservoirs. Fresh water zooplankton is a significant group because the majorities of them feed and include primary producers into their bodies and make themselves available in the food chain to higher organisms (Michael, 1973). Various secondary consumers which include commercially significant groups of crustaceans like fishes and prawns, has consumed zooplanktons. In India, various ecological aspects of zooplankton have been studied extensively (Zutshi *et al*, 1981; BabuRao, 1997). Zooplankton has a significant role to increase photosynthesis (Porter, 1976). Grazing by zooplankton alters phytoplankton's composition and quantity, the nanoplankton specifically (Porter, 1977). The zooplankton group analysis is significant because it offers the way to predict productivity (Idem, 1976). Morgan (1978) opined that zooplankton cannot serve as the indicators of the levels of pollution and consequently are not always characteristic of the environment at sampling site. Stemberger and Gannon (1978) claimed that zooplanktons are important indicators because they are bigger in size, easier than algae to detect and adapt to environmental changes more quickly as compared to fish. Zooplanktons are universally accepted as biological indicators of water pollution and have been used in the quality assessment studies. Tamil Nadu's copepod fauna was widely researched by Rajendran, 1973. Zooplankton comprises an important link in the ecosystem's food chain, and the yield of fish is more dependent on its abundance. Zooplankton abundance is largely regulated by the interaction between number of biological and physico-chemical processes. Cladocera are the important components of food web and an integral link in aquatic food chain in fresh water (Bhattis and Parvinder, 1986). Rotifers are almost ubiquitous in occurrence in aquatic habitat especially in the freshwater biome and as a water quality indicator have drawn worldwide attention (Hakkari, 1978) and Maemetes (1983) characterized the rotifers taxa according to their water bodies. The Zooplankton invariably interacts with phytoplankton and help in the regeneration of nitrogen. Altaff & Abdus Saboor (1995) and Kumar (2001) reported that the maximum number of zooplankton occurred in the winter season as compared to monsoon and summer season. Zooplankton diversity in river Cauvery was carried out by Narayana *et al* (2002), and concluded zooplanktons are the best indicators to assess the organic pollution. Dutta and Verma (2016) have studied and opined that limnological characters of any water body alter the zooplankton. Temperature has the greatest impact on zooplankton frequency amongst many factors. However, a regular food cycle can be observed in shallow tropical seasonal or perennial ponds. Thus, zooplankton in any aquatic environment does not only engage in food transfer from primary to secondary stages, but also transforms detritus into edible animal food.

Results and Discussions

Zooplankton collections has been made using an update d Haron-Trantor net having a square metallic frame of area with 0.0625 m^2 area. The filtering cone consisted of nylon bolt silk plankton net (50 µ No. 25 mesh size) for zooplankton collection. Attention has been taken to prevent floating debris from being trapped when towing the net. The net has been towed over 10 metres. The samples obtained had been transferred to labeled 4% formalin bottles. Zooplankton groups in the reservoir of Bhindawas consisting of three main groups, namely Rotifers, Crustaceans, and Protozoans, are described in this study. In this analysis, 13 species belong to 11 genera have been described. The species namely,

Arcella sp., *Euglypha* sp., *Difflugia* sp. belongs *to* Protozoa and *Daphnia carinata, Eucyclops agilis, Mesocyclops hyalinus, Moina daphnia, Nauplius* larvae belongs to Crustaceans and *Brachionus falcatus, B. quadridentatus, B. diversicornis, Keratella tropica and Lecane luna* belongs to Rotifer group. On an average Protozoans showed less diversity as well as density associated with *Arcella* sp. *Euglypha* sp.and *Difflugia sp*. However, Protozoans are common in almost all the sampling points attained 54% of total protozoan group. Besides, the highest density of protozoan group has been reported during January 2017. Season-wise highest fluctuation was noticed both in post-monsoon and monsoon season.

At Station I, *Eucyclops agilis*, *Mesocyclopshyalinus* and Nauplius larvae were recorded constituting 21%. On the other hand, monthly variations reveal that density of Crustaceans represents maximum of 1000 org/L during June 2018. Species diversity observed maximum during monsoon season compared to other seasons.

At Station II supported *Daphnia carinata*, *Eucyclops agilis*, *Mesocyclops hyalinus*, *Moina daphnia* sp. and Nauplius larvae constituting 21% of total group of Crustaceans. Whereas, monthly density is considered, Crustaceans recorded maximum of 800 org/L during January 2017 and minimum of230org/L during November 2016 and October 2017. In post-monsoon seasons, minimum Crustacean density observed.

At Station III, namely *Mesocyclops hyalinus* and Nauplius larvae were recorded constituting 21% of total group of Crustaceans. Monthly variations reveal that protozoan density recorded maximum of 1500 org/L in January 2017. However, maximum density 680 org/L of crustacean recorded in the month of July 2017. While, season-wise data represents maximum during pre-monsoon and least of 692org/L in November 2018.

At Station IV comparatively a greater number of species were recorded namely, *Daphnia carinata, Eucyclops agilis, Mesocyclops hyalinus, Moina daphnia sp*. and *Nauplius* larvae constituting 19.6% of total group. Whereas, density is considered, Crustaceans recorded minimum of 266 org/L during September 2016 and maximum of 538org/L during January 2017. However, during the post-monsoon season, crustacean density is maximum and during monsoon season is minimum.

Station V also supported similar taxa namely, *Daphnia carinata, Eucyclops agilis, Mesocyclops hyalinus, Moina daphnia sp. and Nauplius* larvae constituting 20% of total group were recorded. While, density of Crustaceans recorded maximum of 666 org/L during July 2018 and minimum of 285 org/L during November 2017.

At Station I the highest density of protozoan group has been reported during January 2017. Season-wise highest fluctuation was noticed both in post-monsoon and monsoon season. Similar condition also observed at Station II. The percentage attained 54% of total protozoan group. Maximum density 1500 org/L during July 2017and January 2018 were recorded.

At Station III also Protozoans species constituting 55% of total group. Monthly variations reveal that protozoan density recorded maximum of 1500 org/L in January 2017and least of 692 org/L in November 2018. While, season-wise density recorded minimum in monsoon and minimum in pre-monsoon season.

At Station IV very few species and genera were recorded,which comprises 57% of total protozoan groups. Moreover, monthly variations reveal that, protozoan density recorded the highest of 1500 org/L during February 2017 and least value of 769org/L in the month of October 2018. There is a significant variation was recorded on density of protozoan groups.

At Station V protozoan occupied 56% of total group.

Monthly variations reveal that maximum density of protozoan recorded 1545 org/L in April 2017 and lowest density recorded 769 org/L in October 2011. Season wise variations reveals that maximum density of protozoan group reported in pre-monsoon compared to other seasons.

However, only few species of rotifers such as *Brachionus falcatus, B quadridentatus, B. diversicornis, Keratella tropica and Lecane luna* were dominated in almost all the seasons.

At Station I reported *Brachionus falcatus. B.quadridentatus and Keratella tropica* constituting 25% of total group of rotifers. While, density of Rotifers found to be maximum of 900 org/L during June 2017 and January 2018 and a minimum of 200 org/L during April 2016. But it exhibited higher in monsoon compared to other seasons.

Similar to Station I, Station II also encountered *Brachionus falcatus, B. quadridentatus, B. diversicornis, Keratella tropica and Lecane luna.* However, maximum density of rotifers recorded 700 org/L in January 2017 whereas the lowest density recorded 272 org/L during April 2017. Season-wise, high density of rotifers recorded during pre-monsoon and low during post-monsoon seasons.

At Station III, *Brachionus quadridentatus and Keratell*a sp. comprising 24% of total group of Rotifers. Density of Rotifers recorded maximum of 750 org/L during July 2016 and January 2016 and minimum density recorded is 285 org/L during November 2016, May and October 2017. Despite, maximum density recorded during monsoon season compared to other seasons.

S. No	Zooplankton	2016-17			2017-18			2016-18		
		Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon
1	Protozoans	970	965	1275	1048	1144	927	1009	1054	1101
2	Crustaceans	530	366	449	347	387	320	438	376	384
3	Rotifers	574	409	554	440	488	414	507	448	484

Table: Seasonal Variations of Zooplankton diversity in Station I

S. No	Zooplankton	2016-17			2017-18			2016-18		
		Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon
1	Protozoans	952	990	858	1068	1314	976	1010	1102	917
2	Crustaceans	458	451	423	418	374	296	438	412	359
3	Rotifers	502	523	460	454	481	408	478	502	434

Table: Seasonal Variations of Zooplankton diversity inStation II

Station IV, supported *Brachionus falcatus, Keratella tropica and Lecane luna*, comprising 23%. Maximum density of 666 org/L in July 2017 whereas the lowest density 266 org/L during November 2017. Whereas, maximum density recorded during pre-monsoon compared to other seasons.

At Station V, more or less similar as Station IV but attained 24% of total group of rotifers. Density of rotifers recorded maximum of 750 org/L during July 2017 and minimum density recorded 333 org/L in the month of February 2018. But maximum density has been observed in monsoon season, whereas, the lowest has been reported in post-monsoon season.

S. No.	Zooplankton	2016-17			2017-18			2016-18		
		Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon
1	Protozoans	1026	1259	1127	1122	1169	941	1074	1214	1034
2	Crustaceans	470	451	516	348	443	347	409	447	431
3	Rotifers	582	515	516	438	389	401	510	452	458

Table:Seasonal Variations of Zooplankton diversity in Station III

S.No.	Zooplankton	2016-17			2017-18			2016-18		
		Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon
1	Protozoans	1181	1313	1057	1043	1377	1086	1112	1345	1071
2	Crustaceans	391	411	409	354	405	427	372	408	418
3	Rotifers	433	563	489	447	425	476	440	494	482

Table:SeasonalVariations of Zooplankton diversity inStationIV

S. No	Zooplankton	2016-17			2017-18			2016-18		
		Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon	Monsoon	Pre-Monsoon	Post-Monsoon
1	Protozoans	1235	1365	1114	1103	1278	1164	1169	1321	1139
2	Crustaceans	428	456	409	409	383	432	418	419	420
3	Rotifers	562	545	429	547	499	506	554	522	467

Table: Seasonal Variations of Zooplankton diversity in Station V

Conclusion

A significant part of the aquatic ecosystem is the Zooplankton population and several species are suitable for live feed in aquaculture. Zooplankton abundance is more or less dependent on the relationship between the amount of Physico-chemical and biological possesses. In the fresh water habitats, the cladocera and copepoda are the dominant crustacean groups. Environmental conditions affecting microorganisms and they vary as per the locality and season. Each species of the characteristic lifestyle has associated with their rate of growth, food habits, physiological tolerance and habitat preference.Various secondary consumers which include commercially significant groups of crustaceans like fishes and prawns, has consumed zooplanktons. Those groups also have an important role to make it clear that some fish species are present and missing. In India, various ecological aspects of zooplankton have been studied extensively.

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