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Zooplankton Diversity and Seasonal Variation in Population Density of Harsool Dam, Aurangabad

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ABSTRACT

Zooplankton is a microscopic organism that forms the basis of food chains and food networks in all aquatic ecosystems. All secondary production in aquatic ecosystems is based directly or indirectly on plankton. They also play an essential role in recycling nutrients and energy in their respective environments. They located in the pelagic area of ponds, lakes, rivers and oceans, where light enters. Plankton releases large amounts of organic matter, which dissolve and integrate into the biomass of various bacteria. Zooplankton is an essential food for omnivores and carnivore fish. In the present study, seasonal fluctuations, correlation coefficients were established from Harsool dam in Aurangabad, India. A total of 25 zooplankton species were recorded, belonging to the orders Cladocera (8 species), Copepoda (5 species), Rotifera (10 species), and Ostracoda (2 species). The present study found that a total of 19220 (organisms/liter) zooplankton noticed in Harsool dam in summer 8120 (organisms/liter), in monsoon 6310 (organisms/liter) and winter 4790 (organisms/liter) that constituted 29.76% of Cladocera, 30.28% of Copepoda, 37.04% of Rotifera and 2.91% Ostracoda were recorded during the current study period. The study showed that the most critical factors for the growth of zooplankton are calcium and free CO_2. A high value of biodiversity, in summer, shows a longer food chain than other seasons. According to the Shannon index, the values show that the waters of the Harsool dam are contaminated. Evenness indices indicate whether all species are equally common in a sample.

1. Introduction

Zooplankton plays a vital role in aquatic ecosystems as it acts as the primary consumer and contributor to the next tropical level. The plankton biomass available in an ecosystem is essential for fish production. Appropriate and scientific management is required to develop fisheries and increase current levels of production, in which knowledge of water quality and natural productivity plays an important role. In aquatic ecosystems, most animal species belong to crustaceans, rotifers, insects. Ponds and lakes also show plankton and peripheral algae, as well as various life forms of microphytes. Several factors, abiotic and biotics, which act on different scales, affect freshwater biodiversity. Environmental disturbances can cause direct lethal effects on organisms or a decrease in biodiversity due to more complex interactions between multiple factors [1].

Zooplankton is small animals that float freely in the water column of lakes, dams, and oceans; their distribution is determined mainly by water currents and mixing. The zooplankton community of most lakes has sizes ranging from a few tens of micrometers (protozoa) to > 2 mm (macro-zooplankton). In terms of biomass and productivity, shellfish and rotifers are the dominant zooplankton groups in most lakes, and these protocols focus on these groups. Zooplankton plays a crucial role in food networks in the water because it is an essential nutrient for fish and invertebrate predators and deeply fed to algae, bacteria, protozoa and other invertebrates. Zooplankton communities are often diverse (> 20 species) found in almost all lakes and ponds. Zooplankton is rarely critical in rivers and streams because it cannot maintain favorable net growth rates compared to downstream losses. In freshwater, biodiversity decreases much more than the most affected terrestrial ecosystems. If people demand water remains unchanged, and biodiversity loss continues at the current pace, the ability to preserve most of the biodiversity remaining in freshwater. The freshwater biodiversity of the world threatens less than five excessive use, water pollution, rivers change, habitat degradation and invasion of exotic species. They also suggested that mixed and interactive effects led to a decrease in population and a global drop in freshwater biodiversity [2]. The Harsool dam is ancient constructed over Harsool river in times when Aurangabad was under (ruled) Nizam of Hyderabad state in the year 1954. The purpose of the dam was only to supply drinking water to a limited population of Aurangabad city that time. Till today the water is provided to a restricted area of the town. The perineal waters selected for the study differed significantly in the water source due to their rivers and their intended use. This study carried out to assess monthly fluctuations, seasonal fluctuations by group, total percentages by group, biodiversity, species uniformity and frequency variations of zooplankton concerning the changes, establish the correlations between zooplankton and various physico-chemical parameters in Harsool dam.

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2. Experimental Methods

The plankton net [25 µm mesh size] was rinsed in the surface water [Secchi disk transparency zone], and the plankton collected from the net was quickly transferred to a separate plastic bottle/container. 100 litres of surface water were sieved through the plankton net to obtain plankton. These were fixed and stored in 4% formalin. The formalin-fixed plankton samples were twisted at 1500-2000 rpm for 10-12 minutes. The zooplanktons were settled at the bottom, diluted to the desired concentration in such a way that they could be easily counted individually, under compound binocular microscope and zooplanktons were measured and multiplied with the dilution factors, using Sedgwick Rafter cell [3-5]. Species diversity, species richness, and species evenness calculated as per Ludwik and Reynolds [6]. Diversity index values were obtained by using the following equation [7],

$$H' = -\sum^{S} (\text{Pi In Pi}) \text{ (Shannon's index)} \quad i = I$$

where, Pi = Proportion of the first species, given by Pi = ni/N. Species equitability or evenness was determined by using the expression, Evenness index (E_1) = In (N_1)/ In (N_0).

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3. Results and Discussion

Detailed microscopic examination of zooplankton revealed that 4 groups were consisting of 25 genera of zooplankton in orders of Cladocera (08 genera), Copepoda (05 genera), Rotifera (10 genera) and Ostracoda (2 genera). The species observed were as *Ceriodaphni cornuta, Alona pulchella, Diaphanosoma excisum, Chydorus reticulates, Chydorus barroisi, Macrothrix goeldi, Biapertura karua*, and *Pleuroxus denticulatius*, among the group of Cladocera (08 species). *Paracyclops fimbriatus, Tropocyclops parasinus, Mesocyclops leuckarti, Mesocyclops hylinus* and *Copepod larvae* among the grpup Copepoda (05 species). *Brachionus caudatus, Brachinous falcatus, Brachionus forficula, Keratella tropica, Keratella cochlearis, Trichocera sylindrica, Brachionus calyciflorus, Filinia longiseta, Brachionus plicatilis*, and *Brachionus diversicomis* among the group of Rotifera (10 species). *Llyocypris gibba* and *Hemicypris fossulate* among the group Ostracoda (2 species).

The highest species diversity of Harsool dam was that of the Cladocera in December, Copepoda in October, Rotifera in January, and Ostracoda in August during the year 2009-2010. Otherwise average seasonal variation and seasonal total population density of zooplanktons maximum Cladocera recorded were 72.5±88.24 (organisms/liter) and 2320 (organisms/liter) in summer, minimum Cladocera recorded were 49.37±32.62 (organisms/liter) and 1580 (organisms/liter) in monsoon and Grand Total 5720 (organisms/liter). Maximum Copepoda recorded were 128±75.45 (organisms/liter) and 2560 (organisms/liter) in summer, minimum Copepoda recorded were 66.5±49.01 (organisms/liter), and 1330 (organisms/liter) in winter and Grand Total 5820 (organisms/liter). Maximum Rotifera recorded were 76.25±57.88 (organisms/liter) and 3050 (organisms/liter) in summer, minimum Rotifera recorded were 43.75±24.49 (organisms/liter) and 1750 (organisms/liter) in monsoon and Grand Total 7120 (organisms/liter). Maximum Ostracoda recorded were 30±16.69 (organisms/liter) and 240 (organisms/liter) in monsoon, minimum Ostracoda recorded were 16.25±19.27 (organisms/liter) and 130 (organisms/liter) in monsoon and grand total 560 (organisms/liter). A total of 19220 (organisms/liter) zooplankton noticed in Harsool dam in summer 8120 (organisms/liter), in monsoon 6310 (organisms/liter) and winter 4790 (organisms/liter) that constituted 29.76% of cladocera, 30.28% of Copepoda, 37.04% of Rotifera and 2.91% Ostracoda were recorded (Fig. 1 and Table 1).

Summer: Ostracoda < Cladocera < Copepods < Rotifera

Winter: Ostracoda < Cladocera < Copepods < Rotifera

Monsoon: Ostracoda < Copepods < Cladocera < Rotifera

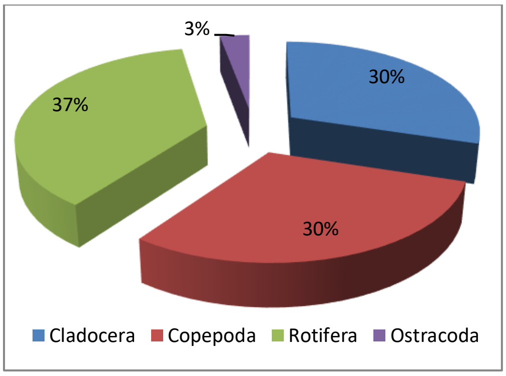

Fig. 1 Annual order wise Population Density of Zooplanktons, Harsool Dam

Table 1 Order wise average and total seasonal variations of zooplanktons (organisms/liter) in Harsool dam

Order	Average			Total			Grand Total	Total%
	Summer	Monsoon	Winter	Summer	Monsoon	Winter		
Cladocera	72.5± 88.24	56.87± 38.86	49.37± 32.62	2320	1820	1580	5720	29.76
Copepoda	128± 75.45	96.5± 54.58	66.5± 49.01	2560	1930	1330	5820	30.28
Rotifera	76.25± 57.88	56.33± 33.41	43.75± 24.49	3050	2320	1750	7120	37.04
Ostracoda	23.75± 23.14	30± 16.69	16.25± 19.27	190	240	130	560	2.91
Total				8120	6310	4790	19220	

A maximum number of Rotifers occurred during summer, indicating the influence of temperature supported by the positive relationship between temperature and Rotifer population. Rotifers respond more quickly to environmental changes than crustacean plankton and appear to be more sensitive indicators of change in water. Because the genus Brachionus connected with the eutrophic waters. The high density of zooplankton species in the summer season due to physicochemical factors greatly influenced by the plankton population. During the rainy season, cloudy weather, low transparency and massive flood caused the decline of zooplankton density and physico-chemical parameters. Remarkably, the Rotifera population was the most abundant group followed by Cladocera, Copepoda and Ostracoda. Quantitatively also Rotifera dominated over other groups and contributed as much as (38 %) of the total zooplankton population. In both dams, the Rotifera population was most abundant during the summer months. Devika et al. [8] also recorded a high population during summer. Physical and chemical conditions in which the water temperature and transparency had a direct relationship with phytoplankton and zooplankton population.

In Harsool dam, during (2009-10) the Cladocera group was positively correlated with Copepods ($r=0.844$, $P<0.01$) and Rotifers ($r=0.923$, $P<0.01$) and negatively correlated with calcium ($r=0.617$, $P<0.05$). Copepod population showed strong positive correlation with Cladocera ($r=0.845$, $P<0.01$) and Rotifera ($r=0.751$, $P<0.01$); no negative correlation was observed. Rotifera population showed positive correlation with free calcium ($r=0.623$, $P<0.05$), Cladocera ($r=0.940$, $P<0.01$), Copepods ($r=0.750$, $P<0.01$); no negative correlation was observed. Ostracods populations have no any observable correlation (Table 2).

Table 2 Correlation of zooplankton groups with physico-chemical variables and other zooplankton in Harsool dam

Parameters	Cladocea	Copepoa	Rotifera	Ostracoa
Air Temp.	0.091	0.295	0.119	0.250
Water Temp.	0.109	0.264	0.253	0.158
pH	-0.615	0.557	-0.484	-0.337
TDS (mg/L)	0.416	0.446	0.451	0.140
DO (mg/L)	-0.396	-0.547	-0.295	-0.472
Free CO_2 (mg/L)	0.520	0.460	0.414	0.614*
Ca+ (mg/L)	-0.617*	-0.310	0.623*	-0.481
Mg + (mg/L)	-0.543	-0.481	-0.504	-0.512
TH (mg/L)	0.565	-0.229	-0.566	-0.783*
Chloride (mg/L)	-0.163	-0.198	-0.280	-0.660*
PO_4 (mg/L)	-0.177	-0.380	0.012	0.534
SO_4 (mg/L)	-0.475	-0.455	-0.434	-0.661*
Cladocea	1.000	0.845**	0.940**	0.709**
Copepoa	0.844**	1.000	0.750**	0.618*
Rotifera	0.923**	0.751**	1.000	0.702**
Ostracoa	0.729*	0.659*	0.710**	1.000

*** Correlation is significant at the 0.01 level (2-tailed)*

** Correlation is significant at the 0.05 level (2-tailed)*

In the present investigation, the zooplankton groups have used as indexes for the classification of reservoirs. Although most zooplankton species live in a variety of environmental conditions, their growth and intensity depend mainly on physical, chemical, and biological factors [9]. Several studies have shown that temperature regulation of the zooplankton population is characteristic of in terms of birth rate, and longevity. The growth of zooplankton is an indicator of the fertility of the water. Plant food is not only converted into animal food but also as a food source for higher organisms, including fish. Among many factors, the temperature has a significant impact on zooplankton productivity [10].

During the summer, increasing temperature also increases the rate of decomposition, which makes water similar to nutrients, similarly in concentration, followed by evaporation in the summer season. Nutrient levels increase, and zooplankton contains abundant food in the form of phytoplankton and microorganisms, so during the summer, the population density of zooplankton may be related to stable hydrological factors and low water levels. In contrast, low-frequency rains cause severe flooding and freshwater inflows. They have resumed due to low water levels during the rainy season [11,12]. The highest species diversity of *Cladocera* found in February, *Copepod* in August, *Rotifera* in August and *Ostracoda* in July during the year of 2009-10. The species richness was high in February and March, and it was low in June and July. Hence the maximum zooplankton was recorded in the months of peak summer and the minimum recorded in the months of pre-monsoon (Table S1).

The zooplankton biodiversity index, the Shannon index (H), combines the typical components of biodiversity and spices as standard indices of diversity. Z.S.D.I. value of zooplankton is higher in summer. The biodiversity shown in the Shannon index (H) is the highest value. More considerable biodiversity means more extensive food chains and more interaction cases, as well as more significant opportunities to control negative feedback, which reduces vibrations and thereby increases

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community sustainability [6]. The evenness index pattern shows whether all species are in equal proportions. This means that the increasing size of the zooplankton population reduces the uniformity of the species [13].

The highest value of Shannon's index (H') is the variety of plankton. The lows in Shannon's index recorded after the monsoon after the Haransol dam. This may be due to a higher recorded recession. They reported that the low value of the plankton population in Shannon's index during the rainy season was due to media depletion, lack of water from outlets, and siltation [13]. The present study shows that there are individual species in Rotifera and Cladocera that tolerate organic pollution and resist stress caused by pollutants. The frequency of these species in polluted habitats suggests the possible use of an "indicator organism". The hydrobiological and organic properties of some species of *Brachionus* from the Harsool dam indicate an overload of organic matter (nutrients) and hyperbolic tendencies. Zooplankton organisms have previously reported as the biological indicator of eutrophication. The results of this survey show that the water from the Harsool dam has already reached the eutrophication phase. However, these waters must be preserved for their intended use to protect their biota. Sustainable and holistic management planning is necessary to maintain these dams [14,15].

4. Conclusion

The present study concluded that Rotifera was the dominant group of zooplankton during the study period. The zooplankton population density of the Harsool dam was highest in the summer and lowest in the monsoons season. This study shows that the necessary factors for the growth of zooplankton are calcium and free CO_2. A high value of the species abundance in the summer season, show that longer food chain than other seasons. According to Shannon index values, 0 > 1 showed that the habitat was under pollution stress; 1 < 3 showed less pollution**.** Evenness indices indicate whether all species are equally common in a sample that means uniformity of the species decreases as the zooplankton population increases. The existence of species depends on their environmental sustainability. When competition or predator decreases or food supply or adequate habitat increases, the species becomes more prevalent. When competition or predator decreases or food supply or sufficient habitat increases, the species becomes more predominant. The results of this work could be background information on the distribution and frequency of zooplankton and would be a useful tool for further ecological assessment and monitoring of ecosystems at the Harsool dam.

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References

[1] D.M. Lodge, S.R. Carpenter, J.F. Kitchell, J.R. Hodgson, P.A. Cochran, et al., Regulation primary productivity by food web structure, Ecol. 68 (1987) 1863-1876.
[2] D. Dudgeon, Riverine biodiversity in Asia: A challenge for conservation biology, Hydrobiol. 418 (2005) 1-13.
[3] W.T. Edmondson, Fresh water biology, 2nd Edn., John Wiley and Sons, I.N.C., New York, USA, 1963.
[4] S.K. Battish, Freshwater zooplankton of India, Oxford and IBH publishing co., New Delhi, India, 1992.
[5] APHA, Standard methods for the examination of water and waste waters, 21st Edn., Washington, DC, USA. 2005.
[6] J.A. Ludwik, J.F. Reynolds, Statistical ecology a primer on methods and computing, A Wiley- Inc Publication, New York, USA, 1998.
[7] C.E. Shannon, W. Weaver, The mathematical theory of communication, University of Illinois Press, Urbana, 1949.
[8] R. Devika, A. Rajendran, P. Selvapathy, Variation studies on the physico-chemical and biological characteristics at different depths in model waste stabilsation tank, Pollut. Res. 24 (2006) 771-774.
[9] S.V. Hussainy, Studies on limnology and primary production of a tropical lake, Hydrobiol. 30 (1967) 335-352.
[10] S.K. Battish, P. Kumari, Effect of physicochemical factors on the seasonal abundance of Cladocera in tropical pond at village of Raqba Ludhiana, Indian Ecol. 13 (1986) 46-151.
[11] S.E. Shinde, P.R. More, R.Y. Bhandare, T.S. Pathan, D.L. Sonawane, Seasonal variations and biodiversity indices of zooplankton and correlation with water parameter, India, Bionano. Front. 5 (2012) 109-113.
[12] S.E. Shinde, T.S. Pathan, D.L. Sonawane, Study of phytoplanktons biodiversity and correlation coefficient in Harsool-Savangi dam, Dist. Aurangabad, India, Bioinfo. Aquatic Ecosys. 1 (2011) 19-34.
[13] S.E. Shinde, T.S. Patha, D.L. Sonawane, Seasonal variations and biodiversity of zooplankton in Harsool-Savangi dam, Aurangabad, India, J. Environ. Biol. 33 (2012) 741-744.
[14] T.A. Adesalu, D.I. Nwankwo, Effect of water quality indices on phytoplankton of a sluggish tidal creek in Lagos, Nigeria, Pak. J. Biol. Sci. 11 (2008) 836-844.
[15] T.R. Shekhar, B.R. Kiran, E.T. Puttaiah, Y. Shivaraj, K.M. Mahadevan, Phytoplankton as indicator of water quality with reference to industrial pollution, J. Environ. Biol. 29 (2008) 233-236.

Table S1 Species diversity (H) and uniformity (E) of Cladocera, Rotifera, and Ostracoda in Harsool dam

Groups/Months	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
CLADOCERA												
Shannon- Weaver index (H)	0.000	1.65	1.82	1.70	1.68	1.40	1.90	1.85	1.95	1.42	1.10	0.95
Evenness (E)	0.000	0.82	0.86	0.84	0.83	0.78	0.88	0.86	0.89	0.80	0.75	0.72
Total No. of Species	1	7	8	7	7	5	8	7	8	5	6	3
COPEPODA												
Shannon- Weaver index (H)	1.10	1.45	1.52	1.40	1.48	1.35	1.30	1.25	1.38	1.42	1.46	1.28
Evenness (E)	0.72	0.78	0.80	0.76	0.79	0.75	0.74	0.73	0.77	0.78	0.79	0.74
Total No. of Species	4	5	5	4	5	5	5	5	5	5	5	4
ROTIFERA												
Shannon- Weaver index (H)	0.000	1.45	1.75	1.85	1.90	1.40	1.80	1.88	1.92	2.05	2.10	0.000
Evenness (E)	0.000	0.78	0.82	0.84	0.86	0.80	0.83	0.85	0.86	0.88	0.90	0.000
Total No. of Species	1	5	6	5	5	2	5	6	5	6	8	1
OSTRACODA												
Shannon- Weaver index (H)	0.000	0.000	0.000	0.000	0.69	0.000	0.69	0.69	0.69	0.69	1.05	0.000
Evenness (E)	0.000	0.000	0.000	0.000	1.00	0.000	1.00	1.00	1.00	1.00	0.96	0.000
Total No. of Species	0	1	1	1	2	1	2	2	2	2	3	0

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