

Diversification of Protozoans, Rotiferans, Cladocerans and Coperodans from Panchaganga river, Ichalkaranji, M.S., India

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ABSTRACT

The present paper deals with the study of Zooplankton community of Panchaganga river near Ichalkaranji, M.S. India. The qualitative and quantitative analysis of Zooplankton was done from two different sites, S₁ - Ganesh temple and S₂ - Shiradwad at regular interval of fifteenth day of every month. The different species of zooplanktons were identified. About 26 zooplankton species were recorded in five groups Protozoan, Rotifera, Cladocera, Copepode and Nematode.

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KEY WORDS : Diversity, Ichalkaranji, Panchaganga river, Zooplanktons.

Introduction

Information on species diversity, richness evenness and dominance species evolution on the Biological component of the eco-system is essential to understand detrimental changes in environment or deterioration of water quality. Species diversity is a basic measure of community structure and organization and the most important parameter to understand the health status of the ecosystem. The diversity index gives us measure of the way on which individuals in a community are distributed.

Zooplanktons serve as important aquatic organisms, occurred abundantly in all types of aquatic habitats and has vital role in energy transfer of aquatic ecosystems¹. Zooplankton community of freshwater bodies constitutes an extremely diverse assemblage of organism represented by most of the invertebrate phyla. Copepoda and Cladocera are the dominant represented groups of crustacea in fresh water habitat. Zooplankton has been used as an indicator for monitoring the water quality trophic status and pollution level. The temperature, dissolved oxygen and organic matter have influence on zooplanktons community structure. The zooplanktons, which play a role of converting phytoplankton in food, suitable for fish and aquatic animals, have acquired

importance in fishery research. The Zooplanktons also play an important role in indicating the presence and absence of certain species of fishes and in determining the population densities.

Various ecological aspects of Zooplanktons have been a subject of study in India and several workers^{2,3,15,21,22,32,34} have done enormous work in this field. Keeping this in view we have selected the Panchganga river ghat near Ichalkaranji. The present data were obtained to analyse the zooplankton diversity which gives an idea of species diversity present in the water body.

Methodology

Study area:

The study area selected was Ichalkaranji in Kolhapur district, in Maharashtra. The city of Kolhapur is the district headquarters. Total area of district is 7,685km². Ichalkaranji city is known for its export of Textile goods and textile manufacturing industry. It is located at 16.7°N 74.47°E. The city lies in the Panchganga valley about 29 km east of Kolhapur and a km north of the river.

Collection site:

Two collection sites were selected from Panchganga river *i.e.* Site 1 Ganpati mandir and Site 2

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TABLE-1 : List of Zooplankton occurring at the study **Site I** throughout the year under premonsoon, monsoon and postmonsoon seasons.

Sr. No	Name of species	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.
I	PROTOZOA (11 – Species)												
	A.CILIOPHORA	+	+	+	+	+	+	+	+	+	+	+	+
	1) <i>Epistylisolicatilis</i>	+	+	+	+	+	+	+	+	+	+	+	+
	2) <i>Metopussigmoides</i>	+	+	+	+	+	+	+	+	+	+	+	+
	3) <i>Saprodiniumdentatum</i>	+	+	+	+	+	+	+	+	+	+	+	+
	4) <i>Sapthidium spatula</i>	+	+	+	+	+	+	+	+	+	+	+	+
	5) <i>Stylonchianotophora</i>	+	+	+	+	+	+	+	+	+	+	+	+
	6) <i>Vorticella compunula</i>	+	+	+	+	+	+	+	+	+	+	+	+
	7) <i>Vorticella microstoma</i>	+	+	+	+	+	+	+	+	+	+	+	+
	8) <i>Paramecium Sp.</i>	+	+	+	+	+	+	+	+	+	+	+	+
	B) RHIZOPODA												
	9) <i>Arcella discooides</i>	+	+	+	-	-	-	-	-	+	+	-	-
	10) <i>Amoeba proteus</i>	+	+	+	+	+	+	+	+	+	+	+	+
	11) <i>Diffusia Sp.</i>	-	-	-	+	+	+	+	+	+	+	-	-
II	ROTIFERA (7-Species)												
	1) <i>Branchionus Sp.</i>	-	-	+	+	-	-	-	-	-	+	+	-
	2) <i>Colothecapelgica</i>	+	+	+	+	+	+	-	-	-	-	-	-
	3) <i>Keratella cochlearis</i>	-	-	+	+	+	-	-	-	-	-	-	-
	4) <i>Macrochaetus Sp.</i>	-	-	+	+	+	+	-	-	-	-	-	-
	5) <i>Monostyla Sp.</i>	+	+	+	-	-	+	+	+	-	-	-	-

	6) <i>Nothoica acuminata</i>	-	-	-	-	-	-	-	+	+	+	+	+	+
	7) <i>Philodina rosoela</i>	-	-	-	-	-	-	-	+	+	+	+	+	+
III	CLADOCERA(4-Species)													
	1) <i>Daphnia cornuta</i>	+	+	+	+	-	-	-	-	-	-	+	+	+
	2) <i>Cerodaphnia cornuta</i>	-	-	+	+	+	+	+	-	-	-	+	+	+
	3) <i>Moinamicrura</i>	+	+	+	-	-	-	+	+	+	+	+	+	+
	4) <i>Moinabrachiata</i>	+	+	+	+	+	+	+	-	-	-	+	+	+
IV	COPEPODA (3-Species)													
	1) <i>Nauplius</i>	+	+	+	+	+	+	-	-	-	+	+	+	+
	2) <i>Diaptomus</i>	-	-	-	+	+	+	+	+	+	+	+	+	+
	3) <i>Mesocyclops</i>	-	-	-	-	+	+	+	+	-	+	+	+	+
V	NEMATODA (1-Species)													
	1) <i>Diplogaster</i>	-	-	+	+	-	-	-	-	-	-	+	+	-

Shiradwad. Panchganga River is one of the important rivers of in Maharashtra. In English, the name translates as "Five Rivers". It is a major tributary of Krishna River, with which it joins at Narsobawadi. The Panchganga River flows through the borders of Kolhapur. The origin of river is from Prayag Sangam *i.e.* Chikhli, Taluka: Karveer, Dist:Kolhapur. The Panchganga is formed, by four streams, the Kasari, the Kumbhi, the Tulsi and the Bhogawati. Jayanti and gomati join near Kolhapur.

Sampling and analysis:

The zooplankton samples were collected from two different sites at a regular interval of fifteen days every month from Sept. 2017 to Aug. 2018 for a year. The plankton net of mesh size 30 mm was swept through subsurface and samples were transferred to 100 ml capacity plastic bottles. The samples were preserved using 4 % formalin solution. Standard key and other literature were used for identification of different species⁶.

The number of planktons per litter was determined by using Sedgwick rafter cell by taking 1 ml of approximately diluted samples and the observation represent number of zooplankton per litter. The samples were collected during day time between 4 pm to 5 p.m. A lots of cloths washing and other domestic activities go on from early in the morning till late afternoon.

Result and Discussion

The total number of zooplanktons were recorded per litter and it was noted that the total number of zooplanktons varied from 17 to 30 per litter at site S_1 , 16 to 33 per liter S_2 and 16 to 26 per litter at S_3 during Sept. 2017 to Aug. 2018. The seasonal variation of zooplanktons in order of abundance throughout the year were as follows, S_1 - Protozoans > Rotifers > Copepodes > Cladocera > Nematodes
 S_2 - Protozoans > Rotifers > Copepodes > Cladocera >

Nematodes

Protozoans:

Protozoa is a diverse group of unicellular organisms. Abundance of the species in the water body is very significant as these have a check on the bacterial growth²⁷. Protozoa are unique biological tool to understand the ecological status of an aquatic habitat²⁵.

The monthly average and total numbers of protozoan varied from 6 to 11 in no. per litter at site S₁ and S₂. In the same way, 10 species of protozoan in aquatic ecosystems were observed in the Indian desert²⁹. Similarly seven species of Protozoa belonged to Mastigophora and Ciliata from lake Jaisamand, Rajasthan²⁸ while monitoring the free living protozoans in Kerala reported a total of 19 species. 14 species belonging to eight families were recorded²⁵. Protozoans are very useful in indicating water quality particularly in pollution studies and it also helps in indicating the purity of water.

Rotifera

One of the fascinating group of zooplankton is Rotifera in the aquatic ecosystem. Rotifers are remarkable indicators of trophic status of water body. Rotifers show its ecological importance in aquatic environments.

The monthly average and total numbers of Rotifers varied from 1 to 7 per litter at sites S₁, and S₂. It was observed that there was high Rotifer population in winter due to favorable temperature and availability of food material. It was found that Rotifer Population was minimum in month of July. Similarly total of 18 species of rotifers were recorded from Phubala Irrigation canal. The population of rotifers was found to be present in the lake water throughout the study period suggesting that rotifers could tolerate organic pollution of sewage origin³⁰.

Copepodes

Freshwater copepods constitute one of the major zooplankton communities occurring in all types of water bodies¹⁴. The copepods are one of the most representatives, being the largest biomass of the plankton community.

The monthly average and total no. of copepdans varied from 1 to 3 species per litter at S₁ and S₂, Sites. Similarly 6 species were observed from perennial lake at Dharmapuri Tamil Nadu, India⁹. Workers^{11,16,31} reported six species of copepods from the Dheku reservoir of Aurangabad, (M.S) and observed the maximum number of species *i.e.* 61 species from Dandi creek west coast of India. There was high density of copepods during October. There was inverse relationship between high population of Rotifers and Cladocera and low population of Copepods during winter may be due to feeding pressure

of stocked fishes on the latter if the Copepodes are removed then there is sudden rise in the population of Rotifers and Cladocera.

Cladocerans

Cladocerans generally prefer lentic water and are therefore uncommon in lotic water bodies¹⁸. Hence less count of Cladoceran were observed in lotic water.

The monthly average and total no. of Cladocera varied from 1 to 4 per litter at Site S₁, S₂. Likewise seven species of cladoceran species were observed¹⁹ at Bhandam Cheruvu, Warangal, T.S. India. Nine species were observed²⁹ at water bodies of Ludhiana, Punjab (India). The factors like water, temperature, dissolved O₂, turbidity, transparency play an important role in controlling the diversity of Cladocera.

Nematodes

Freshwater nematodes proved to be indicators of aquatic pollution or eutrophication, both on the community and on the individual level^{6,9,10,13}.

The monthly average and total no of Nematodes varied from 0 to 1 per litter at S₁, S₂, sites. They were present in a very little amount throughout the year. Similarly 4 -12 species were found in some of the farmland ponds at Belgium.

Thus from the above studies of Zooplanktons from Panchaganga river near Ichalkaranji Dist. Kolhapur M.S. India following 26 species of zooplanktons were observed.

a. Species of protozoans :

1. Epistylis olicatilis
2. Metopus Sigmoides
3. Saprodinium dentatum
4. Saphthidium spatula
5. Stylonchia notophora
6. Vorticella Compunula
7. Vorticella microstoma
8. Paramaecium Sp.
9. Arcella discoides
10. Amoeba proteus
11. Diffusia Species.

b. Species of Rotifers :

1. Branchionous Sp.
2. Colotheca pelgica
3. Keratella cochelearis
4. Macrochaetus Sp.
5. Monostyla Sp.
6. Nothoica acuminata
7. Philodina rosoela

TABLE-2 : List of Zooplankton occurring at the study Site II throughout the year under premonsoon, monsoon and postmonsoon seasons.

Sr. No	Name of species	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.
I	PROTOZOA (10 – Species)												
	A.CILIOPHORA	+	+	+	+	+	+	+	+	+	+	+	+
	1) <i>Epistylisolicatilis</i>	+	+	+	+	+	+	+	+	+	+	+	+
	2) <i>Metopus Sigmoides</i>	+	+	+	+	+	+	+	+	+	+	+	+
	3) <i>Saprodinium dentatum</i>	+	+	+	+	+	+	+	+	+	+	+	+
	4) <i>Sapthidium spatula</i>	+	+	+	+	+	+	+	+	+	+	+	+
	5) <i>Stylonchianotophora</i>	+	+	+	+	+	+	+	+	+	+	+	+
	6) <i>Vorticella compunula</i>	+	+	+	+	+	+	+	+	+	+	+	+
	7) <i>Vorticella microstoma</i>	+	+	+	+	+	+	+	+	+	+	+	+
	8) <i>Paramecium Sp.</i>	+	+	+	+	+	+	+	+	+	+	+	+
	B) RHIZOPODA												
	9) <i>Arcella discoides</i>	+	+	+	-	-	-	-	-	+	+	-	-
	10) <i>Amoeba proteus</i>	+	+	+	+	+	+	+	+	+	+	+	+
II	ROTIFERA (9 - Species)												
	1) <i>Branchionus Sp.</i>	-	-	+	+	-	-	-	-	-	+	+	-
	2) <i>Colothecapelgica</i>	+	+	+	+	+	+	-	-	-	-	-	-
	3) <i>Keratella cochlearis</i>	-	-	+	+	+	-	-	-	-	-	-	-
	4) <i>Macrochaetus Sp.</i>	-	-	+	+	+	+	-	-	-	-	-	-
	5) <i>Monostyla Sp.</i>	+	+	+	-	-	+	+	+	-	-	-	-
	6) <i>Nothoicaacuminata</i>	-	-	-	-	-	-	+	+	+	+	+	+

	7) <i>Philodinarosoela</i>	-	-	-	-	-	-	+	+	+	+	+	+
	8) <i>Ascomorpha sp.</i>	+	+	+	+	-	-	-	-	-	-	-	-
	9) <i>Sinantheria</i>	+	+	-	-	-	-	-	-	-	-	-	-
III	CLADOCERA (4 - Species)												
	1) <i>Daphnia cornuta</i>	+	+	+	+	-	-	-	-	-	+	+	+
	2) <i>Cerodaphnia cornuta</i>	-	-	+	+	+	+	+	-	-	+	+	+
	3) <i>Moinamicrura</i>	+	+	+	-	-	-	+	+	+	+	+	+
	4) <i>Moina brachiata</i>	+	+	+	+	+	+	+	-	-	-	+	+
IV	COPEPODA (4 - Species)												
	1) <i>Nauplius</i>	+	+	+	+	+	+	-	-	-	+	+	+
	2) <i>Diatomus</i>	-	-	-	+	+	+	+	+	+	+	+	+
	3) <i>Mesocyclops</i>	-	-	-	-	+	+	+	+	-	+	+	+
	4) <i>Cyclopod</i>	+	+	+	+	-	-	-	-	-	-	-	-
V	NEMATODA (2 - Species)												
	1) <i>Diplogaster</i>	-	-	+	+	-	-	-	-	-	+	+	-
	2) <i>Heterodera</i>	+	-	-	-	-	-	-	-	-	+	+	+

c.. **Species of Cladocera:**

1. *Daphnia conuta*
2. *Cerodaphnia cornuta*
3. *Monia micrura*
4. *Monia brachiata*

d. **Species of Copepodes:**

1. *Nauplius*
2. *Diatomus*
3. *Mesocyclops*

e. **Species of Nematods :**

1. *Diploglastar*

Conclusion

The present observations are limited to the quantitative observation from the two sites, though it provides useful information on composition and ecology of plankton. The present basic information of the plankton distribution and abundance would form a useful tool for further ecological assessment and monitoring of the ecosystem Panchganga river.

References

1. Altaff KA. Manual of zooplankton: Compiled for the national workshop on zooplankton. The New College, Chennai. 2004; pp.1 –154.
2. Anita SM, Shankerappa SH, Shashikanth Majagi, Chitra J. Assessment of Zooplankton diversity of Nagara dam, Chincholli, Kalaburgi. *Research journal of Life Sciences, Bioinformatics |Pharmaceutical and Chemical Sciences*. 2019; **5** (2) : 269-281.
3. Annapurna C, Chatterjee T. The fresh Ostracodas (Crustacea, Ostracoda) Dhambad Bihar. *J. Aqua. Biol.* 1999; **14**.
4. Ansari E, Mohini G, Ujjania NC. Phytoplankton diversity and water quality assessment of ONGC pond, Hazira. *IJRES*. 2015; **1**(1): 1-1.
5. Ansari MA . Hydrobiological studies of Godavari river . *J. Aqua, Biol.* 1993; **14**.
6. APHA. Standard methods for examination of waste water American Public Health Association. 1998.
7. Arthington AH, Yeates GW, Conrick DL. Nematodes, including a new record of *Tobrilus diversi papillatus* in Australia, as potential indicators of sewage effluent pollution. *Australian Journal of Marine and Freshwater Research*. 1986; **37**: 159–166.
8. Bahura CK. Diurnal cycle of certain a biotic parameter of fresh water lake the Ganger lake Bikaner In the Thar desert of India. *J.Aqua.Biol.* 2001;**16**:**1**, **2**: 45- 46.
9. Basawarajeshwari I. Zooplankton Diversity in Freshwater Reservoir of Yadagir, District, Karnataka State *International Journal of Research in Advent Technology*. 2019; **7** (2) : 2321-9637.
10. Beier S, Traunspurger W. The meiofauna community of two small German streams as indicators of pollution. *Journal of Aquatic Ecosystem Stress and Recovery*. 2001; **8**: 387– 405.
11. Dahade DS, Chaba SG. Zooplankton Diversity around Washim region of Maharashtra. *International Journal of Advance and Innovative Research*. 2019; **6**, **2** (II) : 332-336.
12. Dhanasekaran M, Saravana P, Bhavan N, Manickam, Kalpana R. Physico-chemical characteristics and zooplankton diversity in a perennial lake at Dharmapuri (Tamil Nadu, India) *Journal of Entomology and Zoology Studies*. 2017; **5**,**1** :285-292.
13. Eyuaem A, Mees J, Coomans A. Nematode communities of Lake Tana and other inland waterbodies of Ethiopia. *Hydrobiologia*. 2001; **462**: 41–73.
14. Gunwati V, Arak Satish S. Mokashe Copepod Diversity of Tembhapury Lake Aurangabad Region, M.S, India. *International Journal of Science and Research (IJSR)*. 2014; **3**, 12.
15. Hassan MA, Bhandhopadhyay MK, Jha BC, Sharma AP, Biswas BK. Plankton and fish productivity pattern in two environmentally different oxbow lakes in West Bengal. *Journal of Inland Fisheries Sciences*. 2011; **43**(1): 70-76.
16. Kadam SS, Tiwari LR. Distribution, abundance and species diversity of copepods from Dandi creek west coast of India. *Indian Journal of Geo-Marine Science*. 2015; **44**:7, 1096-1103.
17. Mahajan *et. al*. Zooplankton as indicator for assessment of water pollution paper presented at W.H.O. Workshop. 1981.
18. Maia-Barbosa PM, Peixoto RS, Guimaraes AS. Zoo-plankton in littoral waters of a tropical lake: a revisited biodiversity. *Braz J Biol Biol*. 2008; **68**: 1069 -1078.
19. Maibam B, Singh OS, Kar D. Diversity and abundance of Rotifers in Phubala irrigation canal, Bishnupur district Manipur, North east India. *International Journal of Zoology and Research (IJZR)*. 2016; **6**: 3, 21-24.
20. Manickam N, Bhavan PS, Santhanam P, Rajgopal Bhuvneshwari, Thirunavukarasu Muraliaisankar Veeran Srinivasan, Annamalai Asaikkutti, Gopalan Rajkumar, Rajendran Udayasuriyan, Madhayan Karthik. Impact of seasonal changes in zooplankton biodiversity in Ukkadam lake, coimbatore, Tamilnadu Indian and Potential

future implications of climate change. 2018; **79** : 15.

21. Narasimha RP, Jaya Raju PB. Limnological Investigation and diversity of planktons in sewage Guntur A.P.J. *Aqua. Biol.* 2001; **16**.
22. Patra A, Santra KB, Manna CK. Limnological Studies Related to Physico - Chemical Characteristics of Water of Santragachi and Joypur Jheel, W.B., India. *Our Nature*. 2010; **8**:185 - 203.
23. Pavan M, Gowri P, Benarjee GA. Study on Zooplankton Diversity of Bhandam Cheruvu, Warangal, T.S. India *International Journal of Innovative Research in Science, Engineering and Technology India*. 2016; **5**: 9.
24. Peijler B. Taxonomi Fresh water animals of India. Oxford & IBH Publisher Delhi. 1982.
25. Radhakrishnan R, Jayaprakash V. Free living protozoans as bioindicators in Vembanad lake, Kerala, India: An important Ramsar site. *Int. J. Fish. Aqua. Stud.* 2015; **2**: 192-197.
26. Rishikanta SN, Das SK, Kumar S, Bhakta D, Behera S, Nagesh TS, Mondal. Limnology and productivity status in wetlands (Beels) of 24- South Parganas district, West Bengal. *Journal of Entomology and Zoology Studies*. 2017; **5** (2): 664 - 668.
27. Sharma M, Srivastava D. Seasonal Variations in Protozoan Diversity at Sadul branch of Sirhiind feeder Hanumangarh, Rajasthan, India. *International journal of Biological sciences*. 2016; **5** (2): 47 – 49.
28. Sharma V, Sharma MS, Lara H, Sharma R, Baghela BS. Trophic Status and Zooplankton diversity of Lake Jaisamand in relation to its physic. *In proceedings of Tall 2007: World Lake Conference*, 2008; 490-495.
29. Shrivastava VS. Physicochemical studies of river Jaharali water of Nandurbar *Indian Journal Environ. Prot.* 1993; **11**:109-112.
30. Solanki VR, Lingampally V, Mahesh L, Raja S. Zooplankton Diversity of Pandu Lake, Bodhan, Telangana, India. *International research journal of Environmental Science*. 2016; **5** (3) 71-74.
31. Sontakke, Mokashe. Diversity of Zooplankton in Dekhu reservoir from Aurangabad, Maharastra. *Journal of Applied and Natural science*. 2014; **6**: 1, 131-133.
32. Srivastava D, Saxena MM. Protozoan diversity and its ecology some village pond ecosystem in the Indian desert, *Proc, Nat. Sem. Conservation of lakes and Water Resources: Management Strategies, Udaypur*. 2010; 215 - 222.
33. Thaku A, Kaur D. Diversity and density of cladoceran population in different types of water bodies of Ludhiana, Punjab (India) *Journal of Entomology and Zoology Studies*. 2017; **5**(3): 1568-1572.
34. Tonapi GT. Fresh water animals of India. Oxford & IBH Publishing Co. New Delhi. 1980.