



ZOOPLANKTON DIVERSITY OF PARDESWADI LAKE WALUJ M. I. D. C. AURANGABAD (M. S.) INDIA

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ABSTRACT

Global human population growth rate increasing rapidly and has significant impact on natural resources. It reduces the natural water quality. Assessment of zooplankton gives valuable information about the management and restoration of aquatic ecosystem. Zooplanktons are minute aquatic animal that live all or part of their life as plankton. They play an important role in the aquatic food web by providing crucial source of food to a number of aquatic animals especially for fishes. Some of the zooplankton groups act as pollution indicator. Zooplankton communities are typically diverse and occur in almost all type of aquatic habitat. Zooplankton communities are highly sensitive

to environmental variation. Their growth and distribution depends on some biotic and abiotic factors. The present study was carried out during Feb. 2014- to Jan. 2016, for the period of 24 month to observe the percentage of zooplankton in PARDESWADI lake, waluj MIDC, Aurangabad(MS) India. Zooplankton is .the pioneer of an aquatic food chain. The zooplankton has great significance in the ecology as they provide the food for the organisms, zooplankton are the microscopic animals present in water body. The zooplankton samplings on monthly basis were carried out. Standard keys and other literature were used for identification of different species. The fresh water zooplankton form an important group in all water bodies of the world and become part of food chain on which existence of man is depend.

KEYWORDS: Zooplankton, pollution, Diversity indices; Pardeswadi lake.

INTRODUCTION

Zooplankton are integral components of aquatic food webs and contribute significantly to aquatic productivity in freshwater ecosystems. They have been studied from various inland aquatic environs of India, but a review of the limnological literature indicates limited information on their composition, ecology and role in aquatic productivity in the floodplain lakes in particular.^[1] The qualitative and quantitative studies of plankton are an important factor to assess the water quality.^[2] Zooplankton are microscopic animals that act as primary and secondary links in the food webs of all aquatic ecosystems. They feed on phytoplankton which directly provide food source for larval vertebrates and invertebrates as well as related to the growth of juvenile and larger fish.^[3] These groups occupy an intermediate position in the food web. The earliest studies on zooplankton diversity have been made by researchers like.^[4,5,6,7,8,9,10,11,12,13] In this regard, scientists have studied the planktons as an index of water quality with respect to industrial, municipal and domestic pollution.^[14,15] Major zooplankton forms vary in their relative abundance and they belong to three groups: (i) Phylum Protozoa, (ii) Phylum Rotifera and (iii) Class Crustacea which is itself composed of orders like Cladocera, Copepoda, and Ostracoda, which is the natural food of many species of fishes and also support the necessary amount of protein for the rapid growth of larval carps.^[16] Aquatic ecosystems are special because their primary organisms (i.e., phytoplankton and zooplankton) are characterized by short generation times and efficient trophic transfer.^[17] The plankton diversity responds to changes in aquatic environment. Zooplanktons are heterogeneous assemblage of minute floating animal forms found in water. They may bear some locomotory structures but are not capable of propelling against the water current. Certain species of zooplanktons are used as bio indicators of water quality. The diversity, distribution, abundance of plankton and the variation according to the abiotic factors afford information of energy turnover in the aquatic ecosystem.^[18,19] They are highly responsive against and hence serve as good biological indicators of water pollution.

MATERIALS AND METHODS

Study Area

The Pardeswadi lake is 0.5km from Ramrai (Pardeswadi) village to West, 0.5 km from Jogeswari to North, 1.0 km from Kamlapur to East, and 1.5 km from WALUJ (Aurangabad-Pune highway) to South and about 22 km from Aurangabad city.

The present study was done for the lake which is situated in WALUJ MIDC, AURANGABAD area and its geographical coordinates are 19°54' 0" North, and 79°29' 0" East.^[20]

Sampling

The water samples for zooplankton analysis were collected from the lake from four sampling stations(A, B, C, and D) were selected after survey such as NORTH, SOUTH, EAST and WEST respectively, of the lake area. the zooplankton sampling on monthly basis was carried out for a period of 24 month from FEB. 2014 to JAN. 2016 from the lake water. The samples were collected monthly in the morning between 9.00 a.m. to 11.30 a.m.

For qualitative analysis a compound microscope was used. Standard key and other literature was used for identification of different species.^[32,33] The analysis of samples was carried out in the research laboratory in Dept. of Zoology, Dr. Babasaheb Ambedkar Marathwada University Aurangabad(M.S). The Collection of zooplankton samples was made by sieving 25 litres of habitat water from approximately 10 - 12 cm below the surface level passed through a 25 µm mesh net and the collected samples were transferred to 1litre capacity plastic bottles. Then the samples which were collected, was allowed to centrifuge to concentrate and made up to 100ml after removing the surface water in the centrifuging tube. The population of zooplankton accumulated in the container were then transferred to other bottle and immediately preserved in Lugol's Iodine solution, labeled and then transferred to laboratory for further experimentation. Each sample was stirred smoothly just before microscope examination. One ml from agitated sample was transfer to a Sedge-wick Rafter counting cell with a wide mouth graduated pipette. The abundance of zooplankton was estimated by counting their presence per focus of the microscopic field. zooplankton were identified by using the keys.^[20,34,35]

RESULT AND DISCUSSION

In the present study among the group zooplanktons the rotifera were recorded maximum followed by cladosora, copepoda, ostracoda (Table-1). In summer, monsoon and winter at all stations the rotifera was maximum (42.2%) at site-A followed by cladocera copepod, ostracoda and ostreocoda is minimum (4.3%) at site-D in 2014-15,. while the copepoda are maximum(70.70%) at site-A and ostracoda are minimum (1.20%) at site-B during study year 2015-16. Zooplankton community of pardeswadi lake water comprised of 18 species belonging to rotifera (7sps), cladocera (5sps), copepod(4), ostracoda(2). The relative

abundance of zooplankton population in this lake depicted in table.^[21] In the present study it is observed that *Branchionus Falcutus*, *Branchionus forficula*; *Branchionus diversicornis*, *Asplancha priodonta* Lacane sp, *Keretella quadrata* (rotifera); *Monia Brachiate*, *Cerodaphnia* sp, *Cyclops*; (*Cladosora*); *Napulii*, *mesocyclops edax*, *Mesocyclops leukarti* (Copepoda); *cypris*, *metacypris*, *maracensis* (Ostracoda) species are found.

During summer increasing temperature enhances the rate of decomposition due to which the water becomes nutrient rich similarly due to concentration followed by evaporation in summer season the nutrient concentration increases and abundant food present in the form of phytoplankton and micro-organism to zooplankton that is why high zooplankton population density during the summer season could be related to stable hydrological factors and low water level, while low density during the monsoon season attributed to heavy flood and fresh water inflow.^[21] They were resumed again in monsoon due to dilution and high water level which has been reported by.^[22,23,24,25] Graph 1 to 8 shows the percentage composition of zooplankton species in Pardeswadi lake during the study period of 24 month from Feb. 2014 to Jan. 2016. The above data were subjected to a software program "PAST".^[26] which generates nine diversity indices namely Dominance D, Shannon H, Simpson, Evenness, Menhinick, Margalef, Equitability J, Fisher alpha and Berger-Parker. As diversity increases index value gets smaller. Dominance index is a simple measure of the numerical importance of the most abundant species. The Dominance index in the present study indicates that Pardeswadi lake at site D (0.3465) has the highest dominance and at site B (0.3281) has the least dominance of planktonic species during year 2014-15. Where as at site B (0.3270) has the highest dominance and at site D (0.3017) has the least dominance of planktonic species during year 2015-16. Shannon and Weiner index represents entropy. It is a diversity index into account the number of individuals as well as the number of taxa.^[27] This index can also determine the pollution status of a water body. Normal values range from 0 to 4. Wilham and Dorris concluded that the values of the index greater than 3 indicate clean water, values in the range of 1 to 3 are characterized by moderate pollution and values less than 1 characterized as heavily polluted.^[28] According to this index, Pardeswadi lake (1.250) moderately polluted.

The Simpson's index is often used to quantify the biodiversity of the habitats. According to Simpson's index species are not evenly distributed. The values range from a minimum of 0.6535 at site D and maximum 0.6719 at site B during year 2014-15, where as minimum of 0.6793 at site B and maximum 0.6983 at site D during year 2015-16. The Pielou's evenness

index states that species evenness is diversity index, a measure of diversity that quantifies how the distribution of the community is equally.^[29] The Evenness in Pardeswadi Lake was (0.8586) during the study year. Menhinick's and C indices measure richness of species in an ecosystem. During study period, Menhinick's index is low at site D (0.1323) and reaches a high value of 0.1402 at site A, where as Margalef's index is low (0.400) at site D and reaches a high value of 0.4476 at site B in Pardeswadi Lake. The Equitability index is a measure of the evenness with which individuals are divided among the taxa present. Equitability takes the values between 0 and 1, with 1 being complete evenness. The index when applied to the present study indicates that Pardeswadi Lake has 0.9019. Fisher's alpha index is a mathematical calculation for determining diversity within a population.^[30] It represented the first attempt to describe mathematically the relationship between the number of species and the number of individuals of those species. The index is very low in Pardeswadi Lake (0.5020) at site C and is highest 0.5476 at site B during the study period. This indicates the abundance of species in the lake. Berger-Parker dominance index is the number of individuals in the dominant taxon divided by number of individuals (n).^[31] The values are high in Pardeswadi lake (0.4862) at site D and is low (0.4651) at site A during study year 2014-15. Where as high (0.3935) at site B and low(0.3304) at site D during study year 2015-16.

Table 1: Seasonal variation of Zooplankton (organism/lit.) during Feb 2014- Jan 2016.

		2014-	2015					2015-	2016							
Site	Order/Season	Summer	Monsoon	Winter	Total	Average	%Age	Summer	Monsoon	Winter	Total	Avg.	%Age			Average
	ROTIFERA	181	35	170	386	128	38.6	132	34	115	281	93.6	9.36	9	281	
A	CLADOCERA	89	40	66	195	65	19.5	88	48	95	231	77	7.7		231	
	COPEPODA	57	34	111	202	67.3	20.2	104	77	141	322	107.3	70.7		322	
	OSTRACODA	12	11	24	47	15.6	4.7	18	12	14	44	14.6	1.46		44	
	PERCENAGE															
	ROTIFERA	187	27	165	379	126	37.9	135	35	121	291	97	9.7		291	
B	CLADOCERA	97	21	61	179	59.6	17.9	87	46	78	211	70.3	7.03		211	
	COPEPODA	70	20	105	195	65	19.5	97	77	175	349	116.3	11.63		349	
	OSTRACODA	25	9	27	61	20.3	6.1	12	10	14	36	12	1.2		36	
	PERCENAGE															
	ROTIFERA	187	40	195	422	140.6	42.2	128	25	129	282	94	9.4		282	
C	CLADOCERA	97	25	89	211	70.33	21.1	87	36	84	207	69	6.9		207	
	COPEPODA	83	41	94	218	72.66	21.8	102	72	163	337	112.3	11.23		337	
	OSTRACODA	11	8	26	45	15	4.5	18	11	16	45	15	1.5		45	
	PERCENAGE															
	ROTIFERA	171	42	191	404	134.6	40.4	151	35	116	302	100.6	10.06		302	
D	CLADOCERA	104	25	79	208	69.33	20.8	102	57	101	260	86.6	8.66		260	
	COPEPODA	55	23	98	176	58.66	17.6	81	74	146	301	100.6	10.06		301	
	OSTRACODA	8	10	25	43	14.33	4.3	15	24	12	51	17	5.1		51	
	PERCENAGE															

Table 2: Total Number and Percentage of Zooplankton(Organism/ litter) of Pardeswadi lake.

Stations	year	2014-2015		2015-2016	
	Order	Total Zooplankton	Percentage %	Total Zooplankton	Percentage%
A	Rotifera	825	38.60	878	9.36
	Cladocera		19.50		7.70
	Copepoda		20.20		70.70
	Ostracoda		4.70		1.46
B	Rotifera	814	37.90	887	9.70
	Cladocera		17.90		7.03
	Copepoda		19.50		11.63
	Ostracoda		6.10		1.20
C	Rotifera	896	42.20	871	9.40
	Cladocera		21.10		6.90
	Copepoda		21.80		11.23
	Ostracoda		4.50		1.50
D	Rotifera	831	40.40	914	10.06
	Cladocera		20.80		8.66
	Copepoda		17.60		10.06
	Ostracoda		4.30		1.7

Table 3: Diversity Indises of Pardeswadi Lake.

Year	2014-15				2015-16			
Index/ site	A	B	C	D	A	B	C	D
Texa-sp.	4	4	4	4	4	4	4	4
Individuals	830	814	896	831	878	887	871	914
Dominance-d	0.3339	0.3281	0.3390	0.3465	0.3087	0.3270	0.3137	0.3017
Simpson-1-d	0.6661	0.6719	0.6610	0.6535	0.6913	0.6793	0.6863	0.6983
Shannon-h	1.203	1.225	1.189	1.179	1.234	1.204	1.227	1.250
Evenness-e ^h	0.8324	0.8514	0.8212	0.8130	0.8556	0.8336	0.5228	0.8729
Menhinick	0.1388	0.1402	0.1336	0.1388	0.1350	0.1343	0.1355	0.1323
Margalef	0.4463	0.4476	0.4413	0.4463	0.4426	0.4420	0.4432	0.4400
Equitability	0.8677	0.8840	0.8579	0.8507	0.8900	0.8687	0.8852	0.9019
Fisher_alpha	0.5459	0.5476	0.5394	0.5458	0.5411	0.502	0.5418	0.5377
Berger-parker	0.4651	0.4656	0.4710	0.4862	0.3667	0.3935	0.3869	0.3304

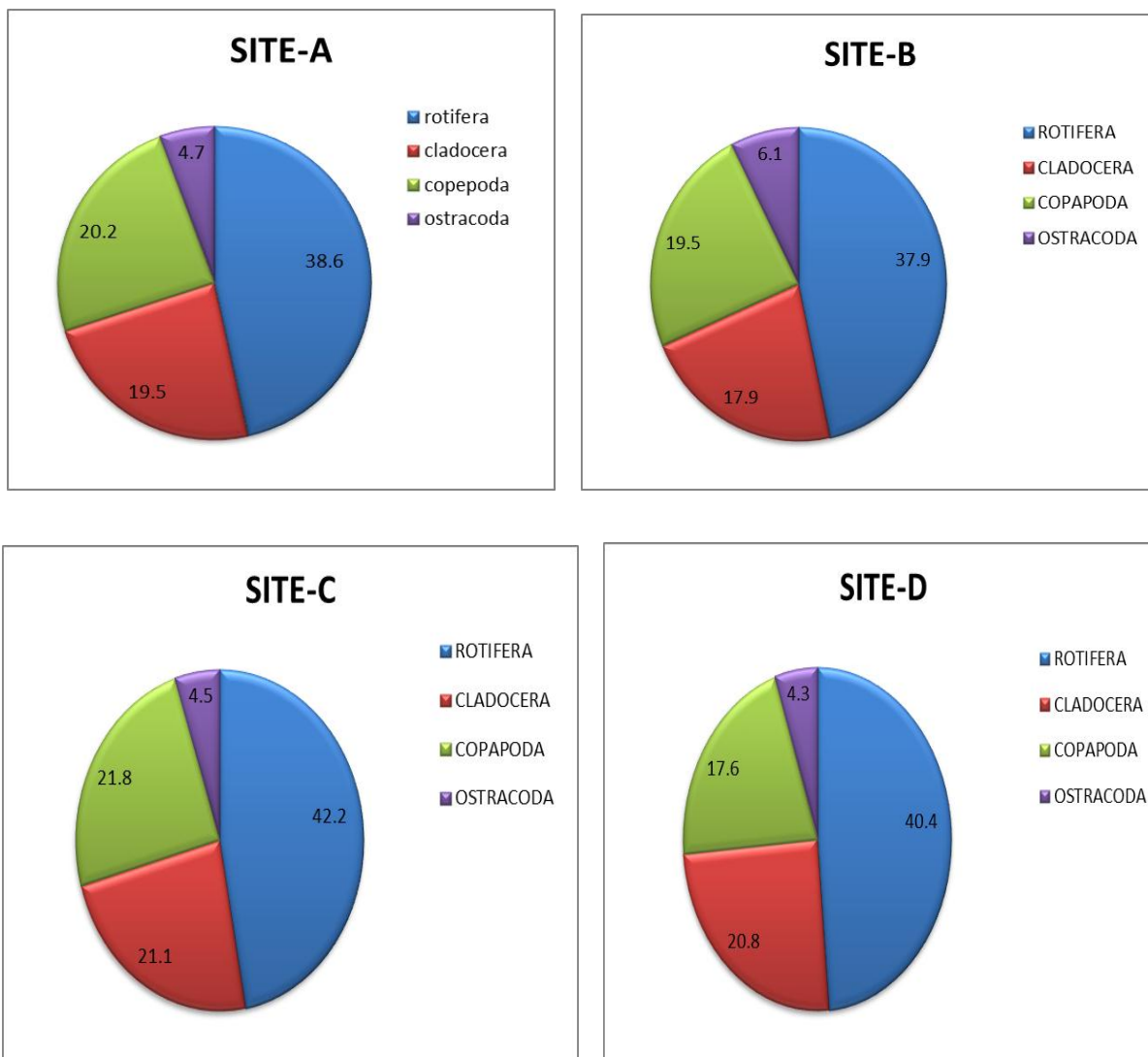
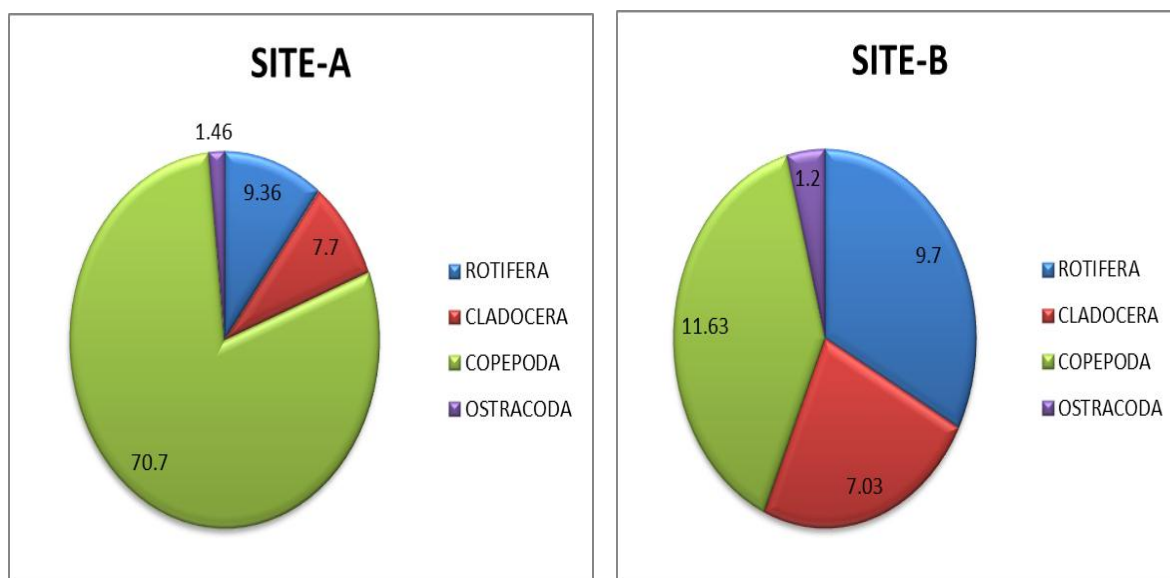


FIG.1 PI chart shows percentage of Zooplankton at Pardeswadi lake during Feb 14 – Jan 15.



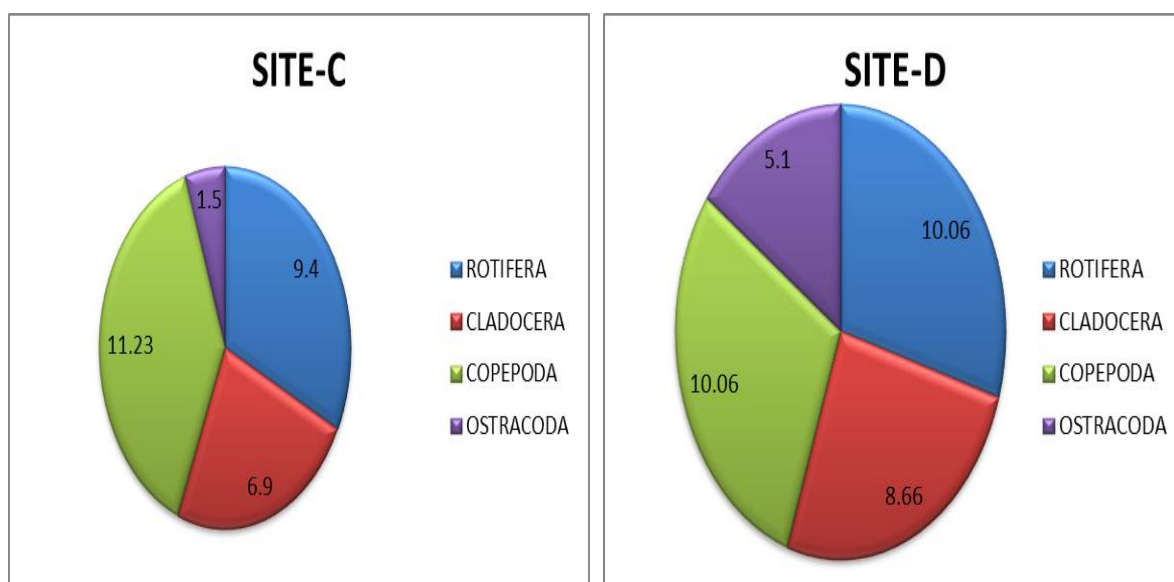


FIG.2 PI chart shows percentage of Zooplankton at Pardeswadi lake during Feb 15 – Jan 16.

CONCLUSION

In the present study Rotifera, Cladocera and Copepoda formed the zooplankton population of Pardeswadi Lake. The Rotifera dominated the zooplankton population. The quantity of zooplanktons was found to be more during winter season. The cladocerans were comparatively in low profile in annual cycle.

The role of Zooplankton species and their assemblage as bio-indicators reflected the pollution status of the study lake. The pollution indicator species are present in the Pardeswadi lake. Hence environmental monitoring makes use of the fact that polluted or stressed communities are characterized by a change in the species abundance.

The values of Shannon Weiner index for zooplankton were mostly above two indicating that there was very low or no impact of pollution in Pardeswadi lake.

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