



## Diversity of zooplankton in Lower Manair reservoir, Karimnagar, AP, India

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### Abstract

Diversity of zooplankton in the lower Manair reservoir was studied September 2010 to August 2011. Samples were collected monthly using plankton net (mesh size 50 $\mu$ m) at four different stations. A total of 34 species of zooplankton belonging to 16 species of rotifera, 8 species of cladocera, 6 species of copepoda, 2 species of ostrocoada and 2 species of protozoa were identified. Species diversity (H), evenness (E) and species richness (S) for different months were calculated.

**Keywords:** Zooplankton diversity, species diversity (H), evenness (E) and species richness (S) and lower manair reservoir.

### Introduction

Zooplankton are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of mater<sup>1</sup>. They play an important role in the conservation of energy from primary to secondary level<sup>2</sup>. The biomass abundance and species diversity of zooplankton are used to determine the conditions of aquatic environment<sup>3</sup>. Zooplankton diversity and density refers to variety within community<sup>4</sup> and their diversity is one of the most important ecological parameters as these are the intermediate link between phytoplankton and fish<sup>5</sup>. They are also useful indicator of future fisheries health because they are a food source of organism at higher trophic levels<sup>6</sup>.

The distribution of Zooplankton community depends on a complex of factors such as change of climatic conditions physical and chemical parameters and vegetation cover<sup>7</sup>. Zooplankton plays an integral role and may serve as bio-indicator and it is well suited food for understanding water pollution status<sup>6,8</sup>. The main objective of the paper was to determine the diversity and abundance of zooplankton in the Lower Manair reservoir water.

### Material and Methods

**Study Area:** To evaluate the diversity of zooplankton in Lower Manair Reservoir, Karimnagar District, and Andhra Pradesh, India. It lies between North latitude 18°38' and East longitude 79°12'. The total area of the reservoir is about 8,103 hectare and maximum depth is 21.9m. The climatic condition of the study area was hot summer and cool winter. In the present study period temperature range a minimum 29°C and a maximum of 38°C. The region gets much rainfall from south west monsoon. The place gets most of its rainfall from June to September during the monsoon. In October and November also increased rainfall from the north east monsoon. The average rainfall of this study area is 100.9 mm. The water of this Reservoir is used for drinking, agriculture and supports fish culture.

**Collection of zooplankton sample:** Zooplankton were collected monthly from four different station of the Lower Manair reservoir from September 2010 to August, 2011; figure-1. Samplings were made between 9.00 am to 11.30 am. Each sample was collected by filtering 20 liters of water through plankton net. Filtrate was stored in 20 ml plastic bottles and 5% formalin was added for sample preservation. These samples were then brought to laboratory for further studies. One ml of sample was transferred to Sedgwick-Rafter cell with a pipette; identification and enumeration were done by a Wildsterio microscope. All the zooplankton present in cell were counted the mean of five estimates was then calculated for each component occurring in the total count. The systematic identification of plankton was made by using standard keys of Adoni A.D.<sup>9</sup>, Michael R.G. and Sharma B.K.<sup>10</sup>, Edmondson W.T.<sup>11</sup>, Pennak R.W.<sup>12</sup>, Dhanapathi M.V.<sup>13</sup>, Altaff K.<sup>14</sup>.

The qualitative and quantitative analysis of planktonic organisms was carried out. Species Shannon-Wiener index [ $H = -\sum P_i \log P_i$ ], Evenness index [ $J = H/H_{max}$ ] and Species richness [ $D = \frac{S-1}{\log N}$ ] were worked out.

**Shannon-Weiner index:**  $H = -\sum P_i \log P_i$ ; Where, H = Shannon – Weiner index,  $P_i = n_i / N$ ,  $\sum =$  Sum,  $n_i =$  Number of individuals of each species in the sample, N = Total number of individuals of all species in the sample.

**Evenness:**  $J = H/H_{max}$ ; Where, J = Evenness index, 'H' is the Shannon – Weiner index,  $H_{max} = \log S$ , 'S' is the number of species.

Species richness:  $D = \frac{S-1}{\log N}$

D= is the index of species richness, S= total number of species, N= total number of individuals.

### Results and Discussion

In the present investigation 34 species of zooplankton belonging to 25 genera, 15 families and 5 groups were recorded in Lower

Manair reservoir. Out of 34 species 16 species of Rotifera, 8 species of Cladocera, 6 species of Copepoda, 2 species of Ostracoda and 2 species of Protozoa; table-1. During September 2010 to August 2011 the percentage of zooplankton groups are presented in figure-2, Rotifera 36%, Cladocera 28%, Copepoda 25%, Ostracoda 10% and Protozoa 1%.

Monthly percentages of different groups of zooplankton are presented in figure-3, during September 2010 to August 2011. The maximum percentage (48.85%) of rotifera recorded in January 2011 and minimum percentage (8.08%) recorded in August 2011. The cladocera recorded high percentage (62.71%) in September 2010 and low percentage (9.55%) in month of April 2011. In case of copepoda high percentage (43.94%) recorded in April 2011 and low percentage (9.45%) in October 2010, not recorded any copepods in September 2010. Ostracoda recorded high percentage (23.72%) in September 2010 and low percentage (5.34%) in month of January 2011. In protozoa maximum percentage (2.12%) of species recorded in June 2011 and minimum percentage (0.60%) recorded in November 2010, not recorded any protozoa in July 2011.

**Shannon Weiner diversity index (H):** Zooplankton Shannon-Weiner diversity index presented in table-2. Shannon-Weiner index (H) of rotifera ranged from 1.53 to 2.51128. The highest diversity was recorded in October 2010 the lowest in June 2010. The Cladocera diversity index (H) ranged from 1.1981 to 1.9735. The highest diversity was recorded in October 2010 and lowest in August 2010. The Copepoda diversity index (H) ranged from 1.2696 to 1.6941 during September 2010 to August 2011. The highest diversity was recorded in January 2011 and lowest in October 2010. The Ostracoda diversity index (H) ranged from 0.3924 to 0.6821 during September 2010 to August 2011. The highest diversity was recorded in January 2010 and lowest in April 2011. The Protozoa diversity index (H) ranged from 0 to 0.6729 during the September 2010 to August 2011. The highest diversity was recorded in March 2010 and lowest in November 2010, April 2011, June 2011 and no species found in September 2010, July 2011 during the study period.

**Evenness diversity index (E):** Zooplankton evenness diversity index (E) presented in table-2. The rotifera diversity index (E) ranged from 1.0326 to 1.7499 during September 2010 to August 2011. The highest diversity was recorded in March 2011 and lowest in September 2010. The Cladocera diversity index (E) ranged from 0.5098 to 1.7096 during September 2010 to August 2011. The highest diversity was recorded in April 2011 and lowest in December 2010. The Copepoda diversity index (E) ranged from 0 to 1.4042 during September 2010 to August 2011. The highest diversity was recorded in August 2011 and lowest in October 2010 and no species found in September during the study period. The Ostracoda diversity index (E) ranged from 0.26804 to 0.7217 during September 2010 to August 2011. The highest diversity was recorded in May 2010. The lowest Ostracoda diversity was recorded in March 2011. The Protozoa diversity (E) ranged from 0.38 to 0.9996 during September 2010 to August 2011. The highest diversity was recorded in December 2010 and lowest in April 2011, June

2011 and no species found in September 2010, May 2011 and July 2011 during the study period.

**Zooplankton richness:** Zooplankton richness presented in table-2. During September 2010 to August 2011 richness of rotifera ranged from 1.9236 to 3.5934. It was highest in October 2010 and lowest in August 2011. During September 2010 to August 2011 richness of Cladocera ranged from 1.6616 to 2.3773. It was highest in March 2011 and lowest in September 2010. During September 2010 to August 2011 richness of Copepoda ranged from 1.0771 to 1.8204. It was highest in June 2011 and lowest in December 2010. During September 2010 to August 2011 richness of Ostracoda ranged from 0.3146 to 0.5581. It was highest in May 2011 and lowest in April 2011. The richness of Protozoa ranged from 0.4472 to 1.4427 during September 2010 to August 2011. It was highest in May 2011 and lowest in October 2010, January 2011, February 2011 and August 2011.

During the present investigation rotifera were the most dominant forms in all stations of the Reservoir. They were found in maximum numbers during the winter season and minimum number during the monsoon. *K. tropica* and *Brachionus calyciflorus* were the dominant forms of rotifera and was represented throughout the study period<sup>15</sup>. Goel P.K. and Charan V.R.<sup>16</sup> has reported occurrence of *K. tropica* in polluted freshwater lake at Kolhapur. According to Goel P.K. and Charan V.R.<sup>16</sup> the species of *K. tropica* and *Brachionus calyciflorus* are the pollution tolerant species and indicate accumulation of organic matter. However, the Lower Manair Reservoir water is not polluted but *K. tropica* and *Brachionus* species rotifers were observed during the study period indicated the presence of organic matter. The abundance of rotifera may be attributed to its dependence on phytoplankton and retrieval matter as food<sup>17</sup>. Dominance of rotifera among zooplankton as observed in the present study is in accordance with the finding of Pandey B.N., Jha A.K. and Pandey K.<sup>18</sup>.

The Cladocera species like *Alona intermedia*, *Alona pulchella* and *Daphnia pulex* observed high number during the study period. Similar observations have been reported by Okogwu I.O.<sup>19</sup>. Copepods were found in maximum number during summer months and minimum number monsoon months. Similar observation was made by Chauhan R.<sup>20</sup>. Ostracoda observed maximum population in summer months and minimum in monsoon months. Similar results were reported by Mahor R.K.<sup>21</sup>. Protozoa maximum recorded in summer and winter months and minimum in monsoon months. Similar observation made by Mahor R.K.<sup>21</sup>, Krishnamoorthi A. and Selvakumar S.<sup>22</sup>.

Presence of maximum zooplankton population observed in winter and summer might due to the presence of higher population of bacteria and dead and decayed organisms. Vegetation and shallowness of the reservoir water might have also supported the increases the zooplankton density. Similar findings were observed by Soruba R.<sup>23</sup>. The low number of zooplankton in monsoon might be due to the fall in temperature,

low light penetration and heavy water flow wash off the surface zooplankton were the reasons. The unsettled and disturbed water Colum was resulting from the rain water and heavy out flow and inflow retard the zooplankton population. As a result of this study, we found that diversity indices were close and highly resemble to each others. The values of the indices indicate that the water environment is stable for survival of rotifera, cladocera and copepoda.

## Conclusion

Huge diversity of zooplankton in Lower Manair reservoir indicates there is not pollution and plays a vital role in aquatic ecology and water is a suitable source for the supply of water for drinking, irrigation and fish culture.

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## Reference

1. Sinha B. and Islam M.R., Seasonal variation in zooplankton population of two lentic bodies and Assam State Zoo cum Botanical garden, Guwahati, Assam, *Eco. Environ. Cons.*, **8**, 273-278 (2002)
2. Kadam S.S. and Tiwari L.R., Zooplankton Composition in Dahanu Creek-West Coast of India, *Research Journal of Recent Sciences.*, **1(5)**, 62-65 (2012)
3. Marine Biology Organisation (MBO), (2007): Zooplankton Retrieved Sept. 29. (2006) Retrieved from: <http://www.marinebiocom/oceans/zooplankton.asp.62k>.
4. Jalilzadeh A.K.K., Yamakanamardi S.M. and Altaff K., Abundance of zooplankton in three contrasting lake of Mysore city, Karnataka state, India, Sengupta M. and Dalwan R (eds.) Proceedings of Taal 2007: The 12 th World lake Conference: 464-469 (2008)
5. Goswami A.P. and Mankodi P.C., Study on Zooplankton of Fresh Water Reservoir Nyari-II Rajkot district, Gujarat, India, *ISC Journal of Biological Sciences*, **1(1)**, 30-34 (2012)
6. Davies, O.A., Tawari C.C. and Abowei J.F.N., Zooplankton of Elechi Creek, Niger Delta Nigeria, *Environ. Ecol.*, **26(4c)**, 2441-2346 (2008)
7. Neves I.F., Recha O., Roche K.F. and Pinto A.A., Zooplankton community structure of two marginal lakes of the river Cuiaba (Mato Grosso, Brazil) with analysis of Rotifera and Cladocera diversity, *Braz. J. Biol.*, **63**, 1-20 (2003)
8. Contreas J.J., Sarma S.S.S., Merino M., Ibarra and S. Nandini, Seasonal changes in the rotifer (Rotifera) diversity from a tropical high altitude reservoir (Valle de Bravo, Maxico), *J. Environ. Biol.*, **30**, 191-195 (2009)
9. Adoni A.D., Work book on limnology. Pratibha Publishers C-10 Gour Nagar, Sagar-470 003, India, 216 (1985)
10. Michael R.G. and Sharma B.K., Fauna of India. Indian Cladocera (Crustacea: Brachinous: Cladocera), The Technical and General Press, India, 262 (1998)
11. Edmondson W.T., Freshwater biology 2<sup>nd</sup> Ed. USA. John Wiley and Sons, Ins New York (1963)
12. Pennak R.W., Field and experimental limnology of three Colorado maintain lakes, *Ecology*, **19(3)**, 505-520 (1968)
13. Dhanapathi M.V. S.S.S., Taxonomic notes on the rotifers from India, *IAAB*, Hyderabad, 1-78 (2000)
14. Altaff K., A manual of Zooplankton University Grants commission, New Delhi (2004)
15. Somani Vaishali, Quadros Goldin and Pejaver Madhuri.K., Occurrence of Rotifers and its Relation to the water Quality during the Bioremediation process in Lake Kacharali, Thane, MS, India, *ISCA Journal of Biological Science*, **1(3)**, 54-58 (2012)
16. Goel P.K. and Charan V.R., Studies on the liminology of polluted fresh water tank, InB.Gopan, and V. Asthana (Eds) Aquatic Sciences in India (pp 51-64), Indian Association for liminology and Oceanography, (1991)
17. Bazmi Shaukat Hussain Md, Shahabuddin Md. Alam Mumtaz and Sayeed Akhtar S.M., Seasonal fluctuation of zooplankton community in relation to certain physico-chemical parameters of river Bagmati of Darbhanga, Bihar, *Environ. Ecol.* **29(2A0)**, 922-925 (2011)
18. Pandey B.N., Jha A.K. and Pandey K., Zooplankton community in relation to certain physico-chemical factors of Kosi, Purnes, Bihar, *Environ. Ecol.*, **12**, 563-567 (1994)
19. Okogwu I.O., Seasonal variations of species composition and abundance of zooplankton in Eboma Lake, Floodplain Lake in Nigeria, *Rev. Biol. Trop.*, **58(1)**, 171-182 (2010)
20. Chauhan R., Seasonal fluctuation of zooplanktons in Renuka lake Himachala Pradesh, *Utter Pradesh J. Zool.*, **113(1)**, 17-20 (1993)
21. Mahor R.K., Diversity and seasonal fluctuation of zooplankton in fresh water reservoir Tighra Gwalior (M.P), *International Reseach Journal*, **2(19)**, 24-25 (2011)
22. Krishnamoorthi A. and Selvakumar S., Seasonal fluctuation of zooplankton community in relation to certain physico-chemical parameters of Veeranam lake in Cuddalore district, Tamil Nadu, *Iner. J. Resea. Enviro. Scie. Tech.*, **2(2)**, 22-26 (2012)
23. Soruba R., Ecology of water bodies formed by limestone mining in and around Ariyalure, Ph.D., Thesis, Bharathidasan University, (2002)

**Table-1**  
**Diversity of zooplankton groups recorded in Lower Manair Reservoir during study period**

Groups	Family	Species
Rotifera	Brachionidae	<i>Brachionus angularis</i> (Gosse,1851)
		<i>Brachionus calyciflorus</i> (Pallas, 1766)
		<i>Brachionus caudatus aculeatus</i> (Haner, 1937)
		<i>Brachionus diersicornis</i> (Daday, 1883)
		<i>Brachionus quadridentata</i> (Hermann, 1783)
		<i>Keratella cochlearis</i> (Gosse,1851)
		<i>Keratella tropica</i> (Apstein, 1907)
	Lecanidae	<i>Lecane lunaris</i> (Ehrenberg,1982)
		<i>Lacane monostyla</i> (Daday, 1897)
	Gastropodidae	<i>Gastropus minor</i> (Rousselet 1892)
		Asplanchnidae
	Synchaetidae	<i>Synchaeta</i> sp
Philodinidae		<i>Philodina citrine</i> (Ehrenberg)
	Testudinellidae	<i>Filinia longiseta</i> (Ehrenberg)
Cladocera	Daphnidae	<i>Daphania pulex</i>
		<i>Daphania carinata</i>
		<i>Monia micrura</i> (Kurz)
		<i>Monia brachiata</i>
	Bosminidae	<i>Bosmina</i> . Sp
	Chydoridae	<i>Alona pulchella</i> (King)
		<i>Alona intermedia</i> (Sars)
		<i>Alonella</i> . sp
Copepoda	Diaptomidae	<i>Cyclopoid copepodite</i>
		<i>Diaptomus pallidus</i>
		<i>Neodiaptomus</i> sp
	Cyclopidae	<i>Cyclops</i> sp
		<i>Mesocyclops</i> sp
		<i>Nauplius larva</i>
Ostracoda	Cyprididae	<i>Cypris</i> sp
		<i>Stenocypris</i> sp
Protozoa	Parameciidae	<i>Paramecium caudatum</i>
	Vorticellidae	<i>Vorticella campanula</i>

**Table-2**  
**Diversity indices of Zooplankton in Lower Manair Reservoir (September 2010 to August 2011)**

Month	Rotifera			Cladocera			Copepoda			Ostracoda			Protozoa		
	H	E	S	H	E	S	H	E	S	H	E	S	H	E	S
Sep-10	1.54	1.03	2.05	1.39	0.95	1.66	0	0	0	0.65	0.35	0.37	0	0	0
Oct	2.51	1.56	3.59	1.97	1.16	1.78	1.26	0.43	1.51	0.63	0.34	0.36	0.67	0.80	0.44
Nov	2.22	1.38	3.29	1.70	0.71	1.68	1.28	0.50	1.20	0.54	0.28	0.32	0.63	0.39	0.91
Dec	2.42	1.53	3.51	1.36	0.50	1.68	1.39	0.71	1.07	0.63	0.39	0.40	0.69	0.99	0.72
Jan-11	2.36	1.24	2.88	1.91	1.08	1.71	1.69	0.77	1.22	0.68	0.35	0.37	0.67	0.80	0.44
Feb	2.36	1.67	2.90	1.94	1.47	1.93	1.53	0.91	1.29	0.65	0.35	0.37	0.67	0.80	0.44
Mar	2.46	1.74	3.22	1.93	1.51	2.37	1.67	0.78	1.23	0.56	0.26	0.31	0.71	0.76	0.55
Apr	2.33	1.74	3.46	1.84	1.70	2.21	1.66	0.71	1.18	0.39	0.43	0.36	0.63	0.38	0.91
May	2.18	1.47	3.00	1.71	0.98	1.87	1.34	0.83	1.17	0.63	0.72	0.55	0.69	0	1.44
June	1.53	1.58	3.39	1.69	1.25	2.17	1.52	1.29	1.82	0.56	0.62	0.48	0.63	0.38	0.91
July	2.18	1.69	3.17	1.73	0.92	2.00	1.58	0.95	1.48	0.52	0.58	0.45	0	0	0
Aug	1.55	1.49	1.92	1.19	0.84	1.78	1.62	1.40	1.55	0.59	0.36	0.37	0.67	0.80	0.44

H=Shannon-Weiner diversity index, E=Evenness diversity index, S= Species richness

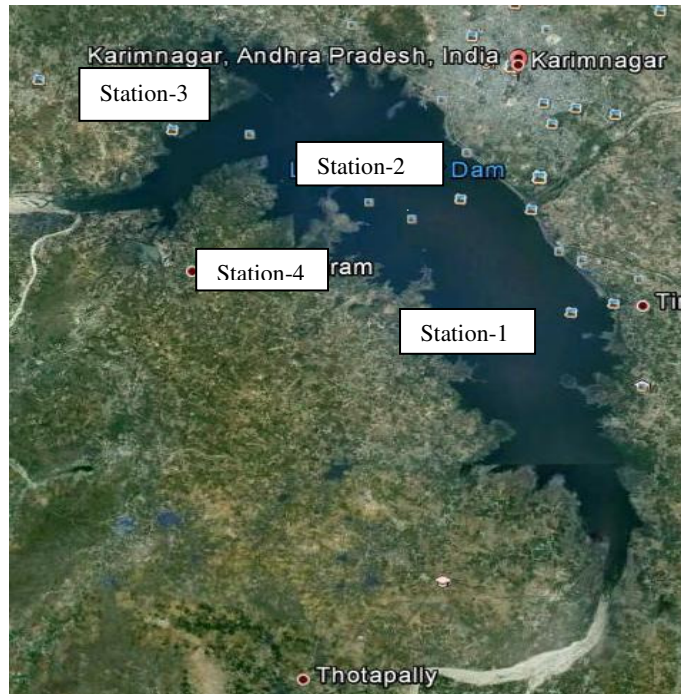


Figure-1

Map of the study area showing the different sampling stations

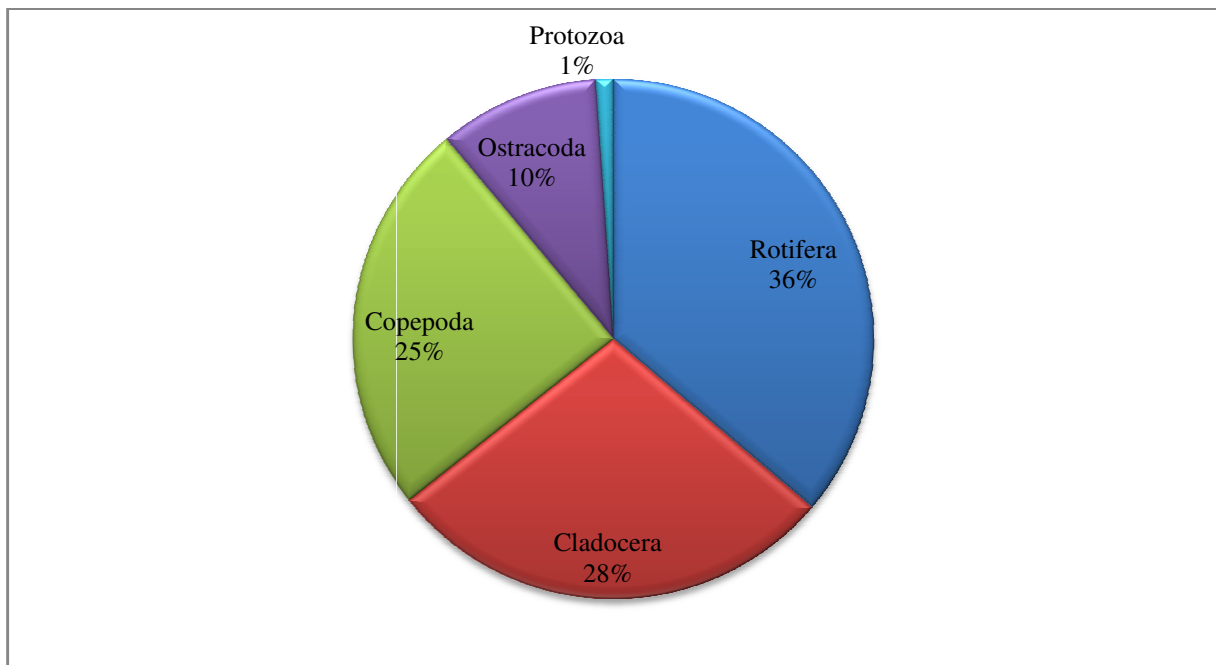
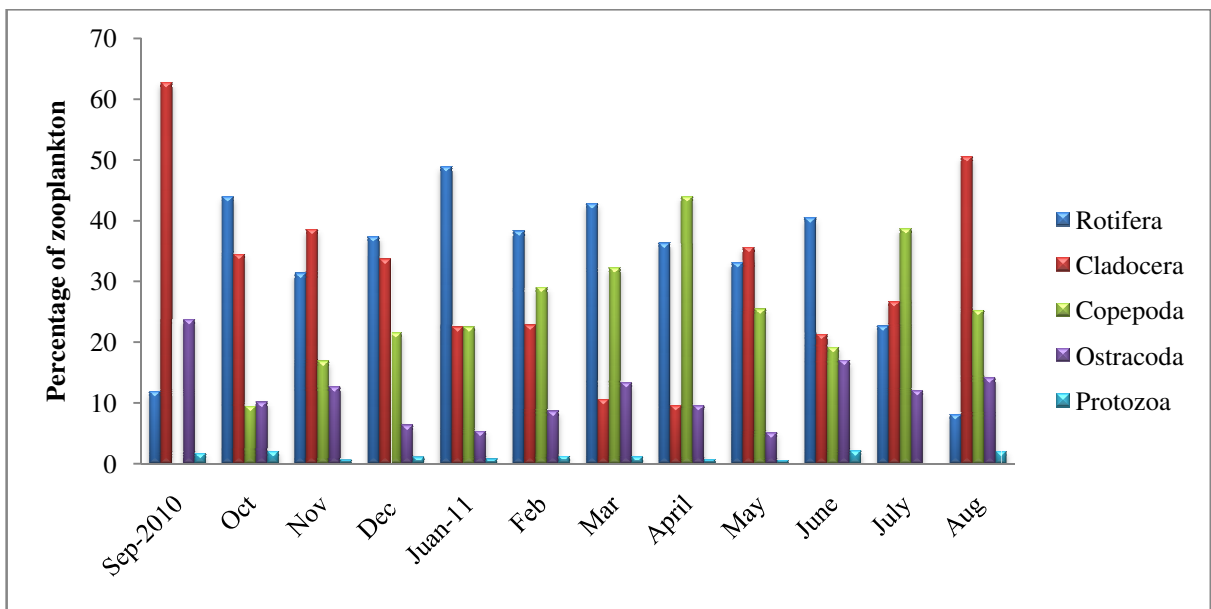


Figure-2

Species composition of zooplankton and relative percentage of each group (September 2010 to August 2011)



**Figure-3**  
Monthly percentage of different groups of zooplankton (September-2010 to August-2011)