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Study of Zooplankton Diversity and Seasonal Variations in Raviryala Pedda Cheruvu, Ranga Reddy District, Telangana State

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ABSTRACT: Zooplankton are indeed tiny, microscopic aquatic animals that play a crucial role in freshwater ecosystems as a vital link in the food web and contribute significantly to the overall productivity of these environments. They are performing at second trophic level in energy flow and switch over to conversion of detritus matter into edible animal food. The present study deal with the study of Zooplankton diversity and seasonal variation in Raviryala Pedda Cheruvu was conducted to check the status in the area and provide new insights into its ecology. The study was carried out during the period of two years *i.e.* June- 2022 to May- 2024. A total of 40 species were found in this reservoir. Among these, rotifers comprise of 20 species, Cladocera 07, Copepods 07, Ostracoda 2 and Protozoa 2. The season wise zooplankton analysis showed that the number of population was highest during winter (post monsoon), followed by summer (pre-monsoon) and lowest during rainy season (monsoon).

Keywords: Raviryala Pedda Cheruvu, Zooplanktons, seasonal diversity.

INTRODUCTION

Zooplankton is crucial to aquatic ecosystems as primary consumers, linking higher trophic levels, including fish and other aquatic species, to primary producers such as phytoplankton (Dhanasekaran *et al.*, 2017). As primary consumers, Zooplankton regulates the populations of phytoplankton by grazing, thereby preventing algal blooms and maintaining ecological balance. Zooplankton also plays a role in nutrient cycling as it recycles organic substances through feeding and excretion, thereby influencing the total productivity of freshwater systems (Butts *et al.*, 2022).

Zooplanktons are very sensitive to the influences of their environment and react to changes in water chemistry, temperature, and other hydrographic parameters in very obvious ways. Samples of zooplankton were taken by choosing three localities having varied environmental features. The order followed Rotifera (54.73%), and after the order came Copepoda, with a difference of 13.1, followed by Cladocera at 20.59, and then Ostracoda was 8.9%.

The Rotifera dominated the zooplankton community, which was greatly influenced by seasonal fluctuations. Transparency, pH, conductivity, biological oxygen demand (BOD), and dissolved oxygen were important influencing factors. Ecologically 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 matter

MATERIAL AND METHODS

Study Area:

SAMPLE COLLECTION SITES: Sites: 1, 2, 3 and 4

Methodology

Zooplanktons are collected bimonthly from RAVIRYALA PEDDA CHERUVU from June 2022 to May 2024.

• Samples were collected around 7.00 am to 9.30 am.
• Each sample was collected by filtering 20 litres of water through plankton net.
• Filtrate was stored in 20 ml plastic bottles and 4 per cent formalin was added for sample preservation.
• The concentrated samples were fixed with 4 per cent neutralized formalin and a few drops of glycerine, allowed to settle for overnight.
• Finally the quantitative analysis was done by using a Sedgwick-rafter cell method (Bhuiyan and Nessa 1991).
• One ml sample was transferred to Sedgwick-Rafter cell with a pipette,
• Identification and enumeration were done by a Compound microscope and enumeration of plankton by help of sedgewick-rafter chamber
• The systematic identification of plankton was made by using standard keys of Adoni (1985); Michael and Sharma (1998); Dhanapathi (2000); Altaff (2004).

Zooplanktons:

1. Zooplankton monthly population from June-2022 to May-2023 (Organisms/mL.).

Months	Rotifers	Cladocera	Copepods	Ostracods	Protozoa	Total
Jun-2022	54	43	35	27	20	179
Jul-2022	48	39	32	26	23	168
Aug-2022	51	43	34	25	21	174
Sept-2022	50	36	31	18	22	157
Oct-2022	94	87	49	31	36	297
Nov-2022	127	102	60	38	37	364
Dec-2022	130	110	56	37	35	368
Jan-2023	132	112	59	30	39	372
Feb-2023	90	68	70	40	22	290
Mar-2023	79	59	89	60	21	308
Apr-2023	76	54	90	55	25	300
May-2023	71	48	96	60	32	307
Total	**1002**	**801**	**701**	**447**	**333**	**3284**

2. Seasonal diversity of Zooplankton from June-2022 to May-2023 (Organisms/mL.).

Zooplanktons	Monsoon	Post-Monsoon	Pre-monsoon	Total
Rotifers	203	483	316	1002
Cladocera	161	411	229	801
Copepods	132	224	345	701
Ostracods	96	136	215	447
Protozoa	86	147	100	333
Total	**678**	**1401**	**1205**	**3284**

3. Zooplankton monthly population from June-2023 to May-2024 (Organisms/mL).

Months	Rotifers	Cladocera	Copepods	Ostracods	Protozoa	Total
Jun-2023	57	46	38	30	24	195
Jul-2023	50	40	35	31	26	182
Aug-2023	52	42	37	28	22	181
Sept-2023	50	39	34	21	23	167
Oct-2023	100	87	50	35	39	311
Nov-2023	128	109	65	41	40	383
Dec-2023	137	112	60	43	38	390
Jan-2024	135	117	58	38	43	391
Feb-2024	94	73	75	48	28	318
Mar-2024	83	63	93	64	29	332
Apr-2024	81	60	98	61	30	330
May-2024	77	53	104	68	32	334
Total	**1044**	**841**	**747**	**508**	**374**	**3514**

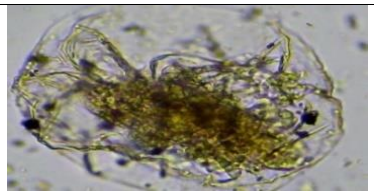
4. Seasonal diversity of Zooplankton from june-2023 to May-2024 (Organisms/mL.).

Zooplanktons	Monsoon	Post-Monsoon	Pre-monsoon	Total
Rotifers	209	500	335	1044
Cladocera	167	425	249	841
Copepods	144	233	370	747
Ostracods	110	157	241	508
Protozoa	95	160	119	374
Total	**725**	**1475**	**1314**	**3514**

Monsoon = June-September, Post-monsoon = October-January Pre-monsoon= February-May

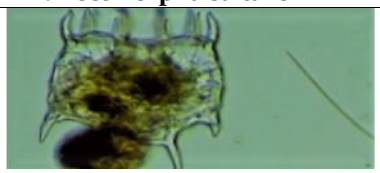
Zooplankton Species Copmposition: Study on zooplankton species composition at Raviryala Pedda cheruvu for a period of two years (2022-23 & 2023-24). Total 30 species of zooplanktons were identified belonging to 5 groups, among them 17 species were observed during year 2022-2023 and 13 species of zooplanktons were recorded during the 2023-2024 year.Total 30 species of zooplanktons were identified during the study period 2022-2024 out of which **16** species of Rotifers, 04-cladocera, 05-copepods, 02-ostracods and 03 were protozoans.

Rotifers:

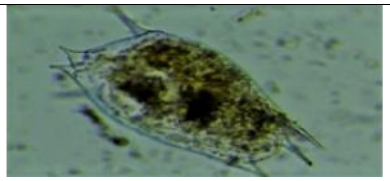


1. Ascomorpha saltans

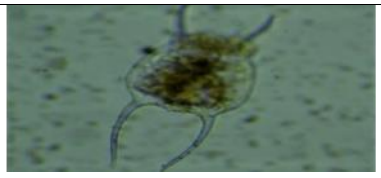
2. Keratella cochleari



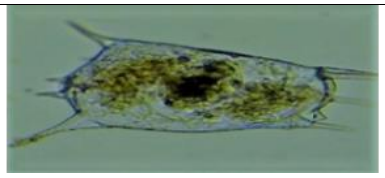
3. *Brachionus bidentate*



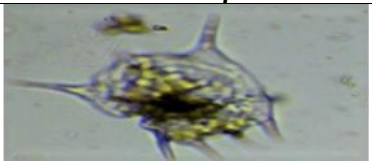
4. *Brachinous diversicornis*



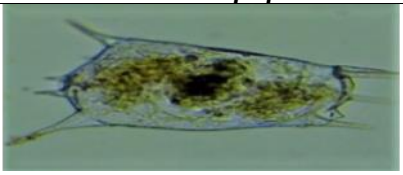
5. *Brachinous falcatus*



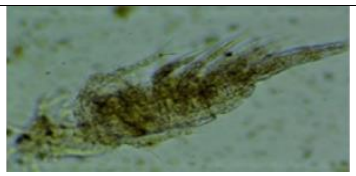
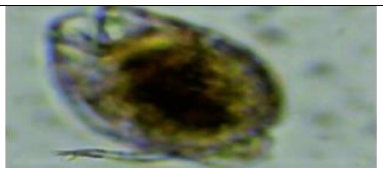
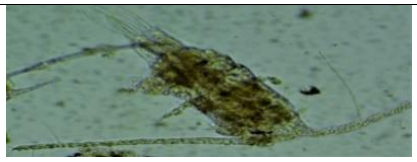
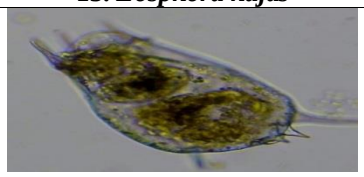
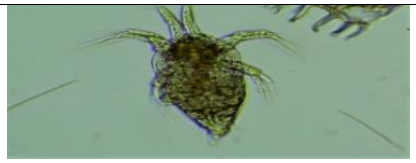
6. *Brachionus forficula*

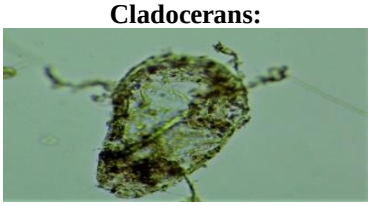
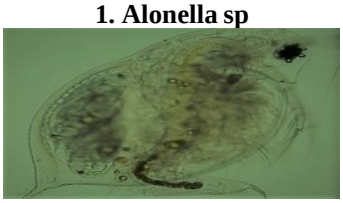
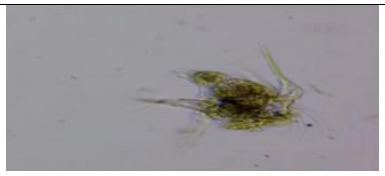


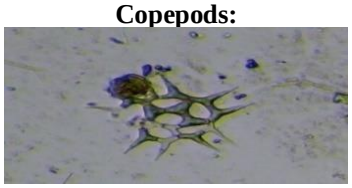
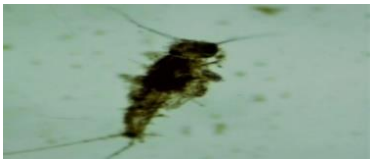
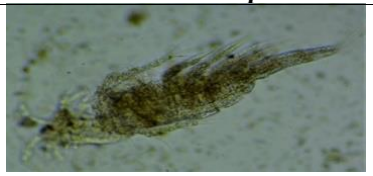
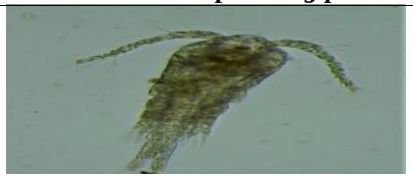
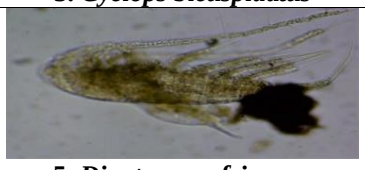
7. *Brachionus calyciflorus*



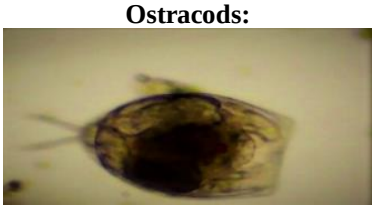
8. *Brachionus quadridentatus*

 **9. *Cephalodella forficula***	 **10. *Colourella* sp**
 **11. Philodina sp**	 **12. *Dicranophorus forcipatus***
 **13. *Eosphora najas***	 **14. *Filinia longiseta***
 **15. *Keratella quardata***	 **16. *Keratella trophica***

Cladocerans:  **1. Alonella sp**  **3. Daphnia parvula**	 **2. Moina micrura**  **4. Daphnia dubia**

Copepods:  **1. *Barnacle Nauplius***	 **2. *Canthocamptus longipe***
 **3. *Cyclops bicuspidatus***	 **4. *Dicyclops thomasi***
 **5. *Diaptomus africanus***	

Ostracods:



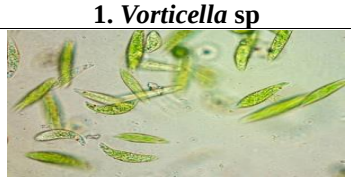
1. *Steno cypris*

2. *Cypris*

Protozoans:

1. *Vorticella* sp

2. *Paramecium caudatum*



3. Euglena

The quality of zooplanktons:

Group	Family	Genus	Species
			Brachionus calyciflorus Pallas, 1776
Rotifers (16)	Brachionidae	Brachionus	Brachionus forficula
	(Ehrenberg, 1838)	Pallas, 1776	Brachionus diversicornis Daday, 1883
			Brachionus falcatus Zacharias, 1898
			Brachionus quadridentatus Hermann, 1783
	Notommatidae Trichoceridae Dicranophoridae (O.F Muller) 1773	Eosphora ,Cephalodella Bory de St.Vincent 1826 Trichocera Dicranophorus	Brachionus bidentate Keratella quardata, Keratella Keratella cochlearis. Cephalodella forficula, Eosphora najas (Ehrenberg, 1830) Trichocera Dicranophorus forcipatus
	Philodinidae (Scopoli,1777	Philodina,Rotaria	
Cladocerans (04)			Philodina,
		Alonella Alona	Alonella, (W.Baird, 1843)
			Daphnia dubia (Herrick 1883), Daphnia parvula (Fordyce 1901)
	Dapniidae (Stratus, 1850)		
		Daphnia	
Copepoda(05)	Moinidae (Goulden, 1968	Moina Baird, 1850	Moina micrura Kurz 1874
		Cyclops	Cyclops bicuspidatus(Claus, 1857), Diacyclops thomasi(S.AForbes,1882)
	Cyclopoidae	Mesocyclops Claus, 1893	Mesocyclops (G.O. Sars 1914)
	(Dana, 1853)		
		Cypris Muller, 1776	Cypris protubera Muller, 1776
	Cyprididae		
Ostracods_02			
		Stenocypris Claus, 1892	Stenoocypris dentatomarginatus Baird, 1859
Protozoans (03)	Paramecidae (Ehrenberg 1831)	Paramecium Vorticella	Paramecium caudatum Euglena Vorticella campanula

Overall population Rotifers during 2022-2023 were, 1002 organisms/mL, cladocera-801 organisms/mL, Copepods 701 organisms/mL, Ostracods 441 organisms/mL and protozoans were 333 organisms/ mL. During 2023-2024 Rotifers were 1044 organisms/mL, cladocerans 841 organisms/mL, copepods 747 organisms/mL, Ostracods 508 organisms/mL and protozoans 374 organisms/mL. Seasonal deviations of zooplanktons recorded as 678 organisms/mL (monsoon), 1401 organisms/mL (post-monsoon and 1205 organisms/mL (pre-monsoon) during 2022-2023 year. Similarity in 2023-2024 were 725 organisms/mL(monsoon), 1475 organisms /mL (post-monsoon) and 1314 organisms /mL (pre-monsoon).

RESULTS AND DISCUSSION

The present investigation of zooplanktons includes five groups were found *i.e.* rotifers, cladocerans, copepods, ostracods and protozoa and the total number of species 30 belongs to five groups of zooplankton were identified. The monthly variation of zooplankton during the 2022-2023, 2023-2024 is depicted in table numbers: 6, 7,9 and10 The highest number of rotifers in month of January (132 organisms /mL), lowest number were in month of July (48 organisms/mL, cladocerans were highest in January (112 organisms/mL, lowest number in September (36 organisms /mL), copepods were high number in may (96 organisms/mL), lower in September (31 organisms/Ml), ostracods were high in may (60 organisms/mL), lower number in September (18 organisms/mL) and highest number of protozoans in January(39 organisms/mL), lowest number in June, august (20 organisms /mL during 2022-2023.

The highest number of rotifers in month of December (137 organisms/mL), lowest number were in month of July and September (50 organisms/mL, cladocerans were highest in January (117 organisms/mL, lowest number in September (39 organisms/mL), copepods were high number in may (104 organisms/mL), lower in September (34 organisms/mL, ostracods were high in may (68 organisms/mL), lower number in September (21 organisms/mL) and highest number of protozoans in January (43 organisms/mL), lowest number in august (22 organisms/mL during 2023-2024. The present revealed 40 species of zooplanktons in Raviryala Pedda Cheruvu.

The percentage of zooplankton groups in seasonal wise during June-2022 to May-2023 was highest percentage during winter (post-monsoon) 42.66%, next 36.6% in summer (pre-monsoon) and low in rainy (monsoon) was 20.64%. The low number of zooplankton in monsoon due to the fall in temperature, low light penetration and heavy water flow wash off the surface. The percentage of different zooplanktons classes noted during June-2023 to May-2024 were Rotifers 29.7%, Cladocera 23.93%, copepods 21.25%, ostracods 14.45% and protozoa 10.6 percent respectively during this period. The percentage of zooplankton groups in seasonal wise during June-2023 to May-2024 was highest percentage during winter (post-monsoon) 41.97%, next 37.39% in summer (pre-monsoon) and low in rainy (monsoon) was 20.63%.

Dominate number of rotifers, copepods were mainly because of small size, with short life cycles and wide tolerance to a variety of environmental factors. Overall population of Rotifers during 2022-2023 were, 1002 organisms/mL, cladocera-801 organisms/mL, Copepods 701 organisms/mL, Ostracods 447 organisms/mL and protozoans were 333 organisms/mL. During 2023-2024 Rotifers were 1044 organisms/mL, cladocerans 841 organisms/mL, copepods 747 organisms/mL, Ostracods 508 organisms/mL and protozoans 374 organisms/mL. The seasonal deviations of zooplanktons recorded as 678 organisms/mL (monsoon), 1401 organisms/mL (post-monsoon 0 and 1205 organisms/mLb(pre-monsoon) during 2022-2023 year. Similarity in 2023-2024 were 725 organisms/mL (monsoon), 1475 organisms/mL (post-monsoon) and 1314 organisms/mL (pre-monsoon).

CONCLUSIONS

Zooplankton diversity and abundance of this lake showed significant seasonal variations, with influenced by environmental factors like temperature, rainfall, and food availability. In this lake zooplankton populations were more diverse and abundant during post-monsoon, due to more favorable for growth and reproduction, and less diverse during rainy seasons due to dilution and other factors**.** Different zooplankton groups, above mentioned such as rotifers, cladocerans, and copepods, may exhibit varying responses to seasonal changes. Rotifers, were often abundant in eutrophic (nutrient-rich) waters and it showed that water quality indicaters. Monitoring zooplankton diversity and abundance of this lake clearly provided valuable insights into the impacts of climate change and other environmental factors on aquatic ecosystems.

Scope of this study: The scope of zooplankton diversity in a lake ecosystem is broad and reflects the complex interplay between various biotic and abiotic factors. Understanding this diversity is essential for assessing the health of the lake and managing its resources sustainably.

Ecosystem Management: Understanding zooplankton diversity helps in managing water quality, controlling harmful algal blooms, and maintaining a healthy aquatic ecosystem.

Conservation Efforts: Knowing which species are present and how they respond to environmental changes is essential for developing targeted conservation strategies.

Resource Management: By monitoring zooplankton, we can gain insights into the overall health of the lake and manage its resources sustainably.

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