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A Study of Zooplanktonic Diversity with Special Reference to Rajsamand Lake

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Abstract - The present study focuses on the zooplanktonic diversity of Rajsamand Lake. Zooplankton are small aquatic animals that are free-floating in the water. They are an important component of the lake ecosystem, and play a key role in the food chain. The study of zooplanktonic diversity provides valuable information about the health of the lake ecosystem. The analysis of water variables such as , temperature(from thermometer) ,pH(electronic handy digital pH meter) ,depth of visibility (from sachhi disc), TDS(from digital TDS meter) Dissolved oxygen (digital dissolved oxygen meter) at the station of the study as well as winklers methods in the lab . Alkalinity (through titration) ,hardness(through titration) , sulphate by accordance to IS:3025 APHA 20TH EDITION an d EPA-600/4-79-020USEPA method 375.4,phosphate,nitrogen-nitrate,sulphate by spectrophotometer titration were measured in the laboratory within the period of 24 hrs of sample collection. Studies of zooplankton diversity were conducted at five different locations on Rajsamand Lake (S, I, S, S, and S, V). During the first year of the study (2019-2020), a total of 39 species were recorded; these belonged to four different taxonomic groups.

Keyword - Rajsamand Lake, Zooplankton

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INTRODUCTION

Rajsamand Lake is a freshwater lake located in the state of Rajasthan, India. It is a natural lake that has been recognized as one of the largest lakes in the region. The lake is known for its scenic beauty and is an important source of water for the surrounding areas. The zooplanktonic diversity of Rajsamand Lake was found to be quite rich. A total of 29 species belonging to five different phyla were identified. The phylum Arthropoda was found to be the most dominant, with 19 species, followed by Rotifera (5 species), Protozoa (3 species), Annelida (1 species), and Mollusca (1 species). The most abundant zooplanktonic species found in the lake was Daphnia carinata, followed by Ceriodaphnia reticulata, Bosmina longirostris, and Moina micrura. The presence of these species indicates that the water quality of the lake is good and suitable for the survival of these organisms. mThe study also revealed that the zooplanktonic diversity of the lake varies at different sites. The highest diversity was found at site 3, followed by site 4, site 5, site 2, and site 1. This variation in diversity may be due to differences in water depth, temperature, dissolved oxygen, and nutrient availability at different sites.

Living organisms need fresh water as one of their most essential constituents. There has been an increase in the demand for water in the nation as a result of rapid population expansion, urbanization, and industrialization. Earth's seas hold 97% of all water on Earth; glaciers and ice sheets hold only 2%; lakes/ponds and rivers hold just 0.099%; groundwater holds the rest. A mere 0.1% of the freshwater on Earth is used by living beings. Quality control and conservation are necessary because of this. Water is a need for human survival, health, and well-being. Our consumption is expected to rise by 40% over the next two decades. Since most of these water sources have already been seized, there is little left for future generations to benefit from (Edwin, 1997). As long as there is a water supply, we have no choice but to save and save it. The management of water resources has had a significant influence in human development.(Bhandarkar, W.R., Bhandarkar, S.V., Murkute, V.B., (2008)) Today, water is seen as a finite and restricted resource, and its usage is viewed as a major issue. As a result of population increase and urbanization, industrialization, and agricultural advancements during the last century or so, things have changed dramatically. Water shortage is currently an issue in many developing nations, but it is especially acute in those countries. In the absence of water, life as we know it would be impossible on our planet.

According to international norms, a country can be categorized as 'water stressed' when water availability is less than 1700 m^3 per capita per year

whereas classified as 'water scarce' if it is less than 1000 m^3 per capita per year. In India, the availability of surface water in the years 1991 and 2001 were 2309m^3 and 1902 m^3. The Per capita water availability in the year 2010 was 1588 m^3 against 5200 m^3 of the year 1951 in the country.

Zooplanktons play a vital role in aquatic food web because they are food for fish and invertebrates predators & they graze heavily on algae, bacteria, protozoans and other invertebrates. water quality will be assessed through the following parameters during the course o study-1-Temperaturein air 2-Temperature in water(24^{O}C) 3-pH(ISI,1991)(6.5-8.5) 4-condactivity (WHO,1984) 5-Total dissolved solids (ICMR,1975,wicox,1955) 500mg/L 6-Transparency 7-Alkalinity 8-Choloride 9-Hardness 10-Dissolved oxygen 11-Free carbon di oxide 12- ortho-Phosphate 13-Sulphate 14- Nitrite-Nitrate 15- Silicate.

LITERATURE REVIEW

R.J. Chavan, et al. (2004), is threatening the potable quality of water and reducing the quantity available in ponds and reservoirs due to sewage disposal, industrial water, excessive fertilisation of lands, and the use of pesticides, but with a few exceptions all other parameters are within the permissible limits as stated by WHO and ISI. Drinking water is safe to ingest after filter unit treatment. The criterion for irrigation should not include factors like conductivity and dissolved oxygen (DO).

Ingole, S.B.et al. (2009), the chemical and meteorological qualities of the water in any aquatic system greatly influence its physical properties. There are a number of important physical factors, including as light and heat, that have a significant impact on the quality of the water and the plankton, micro and macro organisms in the water, as well as the quality of the water itself. **Dhere, R.M. et al,** conducted a study of the Karpara reservoir in Parbhani, Maharashtra, and found that pH, temperature, and dissolved oxygen (DO) all changed over time (2006).

Naveen, Neha Atwal, K.K. Sharma (2015) Two perennial ponds in the Jammu region (Lakh Pond and dilli Pond) were studied to determine the zooplankton and macrobenthic invertebrates of each. In total, 29 zooplankton species were identified from dilli Pond and 25 from Lakh Pond, including protozoan,rotifers, cladocerans, Copepods, and ostracod species. Dilli pond has 23 macrobenthic invertebrates, whereas Lakh Pond had 13 species. Reports on the pollution state of the Perennial Lake of Budha Pushkar in Ajmer Rajasthan were made by Chouhan and Sharma in 2007.

At Shivaji University, Patil et al. (2012) researched the physical and chemical features of lakes in Kohlapur city and their influence on phytoplankton populations.

Sreenivasa Salla and Suparna Ghosh (2014) Comparative limnological studies of Bhopal's lower lake23, including Kali Mandir and Neelam Park, are part of the 2012 limnological studies of Bhopal's lower lake23, which comprise monthly surface and subsurface water quality measurements in 2012. The quality of the lower lake water has to be properly monitored, according to limnological parameters.

Ecological study by Neelima Nair, Dhavan Saini, and Gopal S.Maheecha (2015, in press) Limnological research has certain holes. Research about Udaipur, the city of lakes- Throughout history, freshwater habitats have been important to the survival of life and the development of civilization. There is a growing danger to freshwater lakes across the globe as a result of new stressors and the interactions between these new and existing stressors. It is imperative that limn logical experts review their own state-of-the-art in light of the continually changing environment. An investigation of ecological modelling, lake restoration and invasive species development was the subject of this research, which examined the effects of land use on aquatic and terrestrial habitats. applicable data and predictive models, which are crucial for the effective management of fresh water lakes, may be generated by this study's research

Accompanied by: Admnesh. Zenebe Tadesse and Alois Herzr, Christian D. Jersabek, and others Lake Ziway planktonic rotifers and crustaceans abundance, species comparison, and spatial distribution (Rift vally, Ethiopia) Rotifers and crustaceans zooplanktons were researched in Lake Ziway from the end of April to the beginning of July 2004 to determine their species composition, abundance, and regional distribution. It was discovered that there are a total of 49 different species of rotifers, with the most common being Anuraeopsis fissa and the least common being Brachionus angularis. There was a wide range of abundance, from two to more than a thousand individuals per liter. When it came to the distribution of rotifer species, there was no substantial difference between the inshore and offshore zones. In the open water, only five cladoceran and three copepod species were found in the Creutaceae family.

METHODOLOGY

The analysis of water variables such as , temperature(from thermometer) ,pH(electronic handy digital pH meter) ,depth of visibility (from sachhi disc), TDS(from digital TDS meter) Dissolved oxygen (digital dissolved oxygen meter) at the station of the study as well as winklers methods in the lab . Alkalinity (through titration) ,hardness(through titration) , sulphate by accordance to IS:3025 APHA 20TH EDITION an d EPA-600/4-79-020USEPA method 375.4,phosphate,nitrogen-nitrate,sulphate by spectrophotometer titration were measured in the laboratory within the period of 24 hrs of sample collection. the standard method (APHA,1985) were

used for the analysis of parameters . Silicates by predicted fluxes and measured fluxes. For zooplankton study, 100 liters of surface water were filtered with bolting silk NO. 25 during the morning hours and filtrate was preserved in 4% formalin at the experimental site. The preserved samples were transferred to the Limnology Laboratory S.D.govt college Beawar, for further analysis for quantitative analysis of plankton, one ml preserved sample was taken in Sedgwick Rafter plankton Counting cell (SRPCC) with the help of a plankton pipette and observed under CZ inverted microscope. The total number ofplankton was counted for each sub – sample for up to species level and data obtained were used to compute the number of plankton per litre (No.1 $^{-1}$) The quantitantive and qualitative analyses of Zooplankton were performed using standard methods

SAMPLE COLLECTION

Samples were taken from five locations on the surface of the water. Surface water samples in five-liter plastic canes were collected every month from October 2019 to September 2021 early in the morning (6-8 am) from each location for the examination of physico-chemical parameters. The water quality examination of the lakes reveals the specific type and source of any contaminants, if any, that could be present. A lake's productivity is determined by its physical properties, such as temperature, conductivity, and turbidity. The quality of lake water is determined by the concentrations of many chemical factors, such as pH, dissolved minerals, dissolved gases, and nutrients.

DATA ANALYSIS

Diversity of Zooplankton Groups

Studies of zooplankton diversity were conducted at five different locations on Rajsamand Lake (S, I, S, S, and S, V). During the first year of the study (2019-2020), a total of 39 species were recorded; these belonged to four different taxonomic groups: Rotifera (15), Cladocera (14), Cyclopoida (3), and Ostracoda (7). During the second year, a total of 42 species were recorded, including 17 Rotifera (17), 15 Cladocera (15), 3 Cyclopoida (3), and 7 Ostracoda (7).

1. Diversity of Rotifera [ORGANISMS/L]

The group of rotifers known as the Monogononta was sampled, and it yielded members of two orders (Pliomida and Floscullariacea). There were a total of 17 different Rotifer species found in this research, spread throughout 4 different families and 5 different genera. In the summer, Rotifera were most numerous at site V, whereas in the winter and spring, they were most numerous at site I. There were 13 species (2 genera) of Brachionidae, 2 species (1 genus) of Filinidae, 1 species (1 genus) of Lecanidae, and 1 species (1 genus) of Testudinillidae (Table 3.1). Ten species belonged to the genus Brachionus, three to the genus Keratella, two to the genus Filiinia, one to the genus Lacana, and so on. The genera Brachionus, Keratella, Filinia, Lacana, and Testudinella are home to the majority of these 17 species. The following are the known taxonomic characteristics of Rotifera:

Table 1: Month-wise population density of Rotifers (Org. /L) at Site – I in the Rajsamand Lake, (October 2019 - September 2021).

SI. No	Rotifer species	2019			2020											2021									Range	Mean ±SD	Total
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S			
1	*B. angularis*	-	-	-	-	29	11	14	9	8	4	9	-	-	-	-	10	9	11	14	9	50	65	70	-	2-70	18±22	304
2	*B . forficula*	4	37	16	14	-	-	-	-	12	9	8	40	37	18	14	52	40	25	65	75	12	10	8	4-75	26±21	498
3	*B. diversicornis*	12	15	22	28	25	32	35	5	4	2	2	5	12	15	22	34	30	45	70	65	40	25	40	22	2-70	25±18	607
4	*B. plicatilis*	15	14	13	16	18	22	32	3	-	-	-	-	15	14	13	16	18	22	32	30	15	16	8	5	3-32	17±8	337
5	*B. calyciflorus*	12	45	55	47	65	79	125	78	57	24	33	35	60	45	75	85	90	120	140	200	180	115	85	40	12-200	79±48	1890
6	*B. quadridentatus*	18	12	5	13	-	-	-	12	2	13	15	18	12	10	13	5	4	4	6	12	10	13	15		2-18	11±5	212
7	*B. bidentata*	3	6	4	9	11	9	5	25	12	6	6	-	30	60	40	60	90	85	8	-	-	-	-	-	3-90	26±29	469
8	*B.caudatus*	-	-	-	-	-	-	-	-	-	-	-	15	13	8	3	6	7	5	3	-	-	-			3-15	8±5	60
9	*B. rubens*	2	15	-	-	-	-	22	2	6	6	4	2	25	32	40	50	60	65	70	13	15	8	20	12	2-70	23±22	469
10	*B. falcatus*	15	12	2	-	-	-	12	9	2	8	-	-	32	22	15	12	13	30	40	32	22	15	-	-	2-40	17±10	293
11	*K. tropica*	8	4	35	3	45	9	75	65	5	11	9	2	80	40	75	70	90	100	140	95	85	70	40	30	2-140	49±39	1186
12	*K.quadrata*	4	35	25	45	4	9	13	2	6	4	2	2	50	75	50	75	70	80	95	85	65	40	20	20	2-95	37±31	876
13	*K. cochlearis*	25	13	9	12	8	14	14	23	-	-	-	-	25	13	9	12	8	14	14	23	15	8	12	9	8-25	14±6	280
14	*F. longiseta*	-	-	-	-	-	-	-	-	-	-	-	-	4	2	5	3	-	-	-	-	-	-	2	5	2-5	4±1.3	21
15	*F. terminalis*	2	15	12	9	-	-	-	-	-	6	9	20	15	12	9	-	-	-	-	12	8	35	28		2-35	14±9	192
16	*Lacana papuana*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	*Testudinella mucronata*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

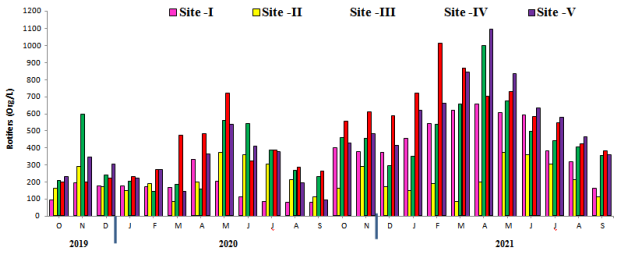

Figure 1: Monthly variations in Rotifera (Org/L) diversity of species belonging to Brachionidae (Brachionus angularis. B. forficula, B. diversicornis, B. plicatilis, B. calyciflorus, B. quadridentatus, B. bidentata, B. caudatus, B. rubens, B. falcatus, Keratella tropica Keratella quadrata, Keratella cochlearis, Filinia longiseta, Filinia terminalis in surface waters of Rajsamand Lake.

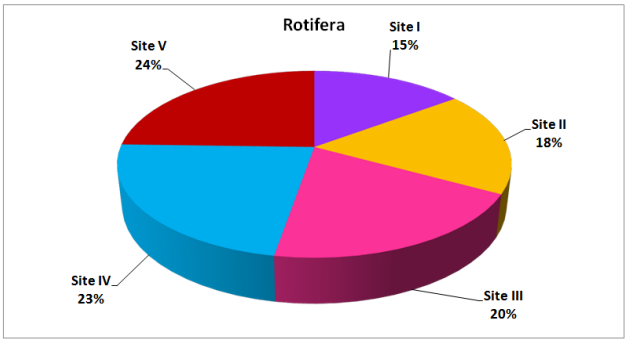

Figure 2: Percentage contribution of Rotifers (Org/L) in Rajsamand Lake

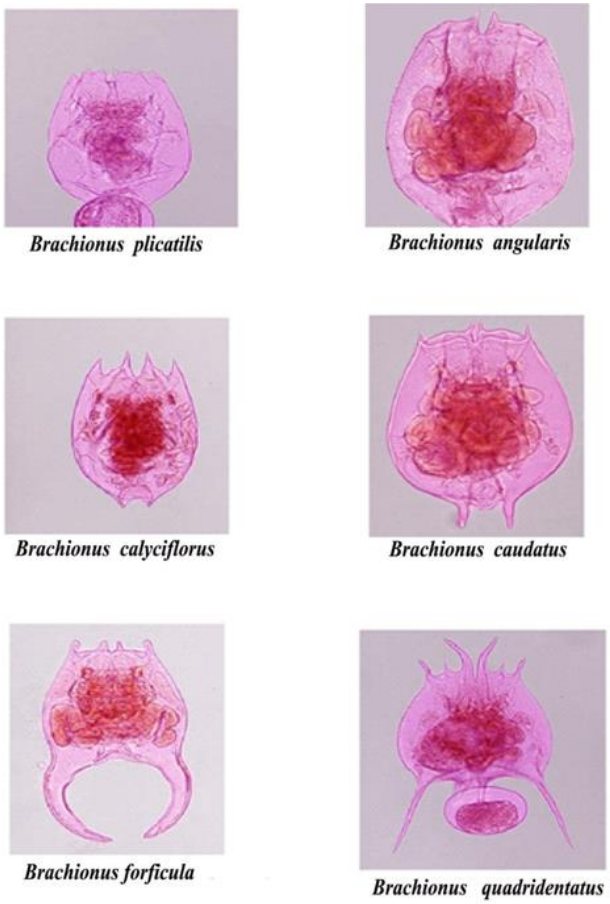

Plate 1: Some representatives Rotifers in the surface waters of rajasmand Lake

Diversity of Cladocera [ORGANISMS/L]

This species is distinguished by a small roundish rectangular head with sloping dorsal side, eye occupies almost the whole area of the head and different forms and sizes, usually conical or rectangular. Antennules small in size, not reaching hind edge of carapace Swimming antennae are long and strong Altaff (2004). Cladocerans vary in size from 0.2 to 6.0 mm long and their identification is only possible with the help of a microscope. The head has a single median compound eye, and a carapace covering the apparently un-segmented thorax and abdomen. In most species, the body is not segmented, but it is covered by a secreted shell.

CONCLUSION

In conclusion, the study of zooplanktonic diversity in Rajsamand Lake indicates that the lake is a healthy ecosystem. However, periodic monitoring and conservation efforts are required to maintain the diversity and health of the lake ecosystem. Result indicates that forty two (42) species of zooplankton belonging to four (4) different taxonomic groups (Rotifers, Cladocerans, Cyclopoids and Ostracods) were recorded. Out of the forty two species recorded in the present study, seventeen (17) species belonging to Rotifers, fifteen (15) to Cladocerans, three (3) to Cyclopoids and seven (7) to Ostracods,

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