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Zooplankton of Kagzipura and Mombatta Lakes, Aurangabad (Maharashtra)

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Abstract: Two freshwater bodies, Mombatta and Kagzipura lakes were surveyed for their zooplankton during the year 2016-17. The water was sampled for zooplankton species likIe Rotifera, Cladocera, Copepoda, Ostracoda and Protozoa every month using standard plankton Net. Twelve species of Cladocera, 8 from Copepoda, 7 from Ostracoda, 16 from Rotifera and 4 from Protozoa were observed from the samples collected from both the lakes. The results exhibit a good diversity of all zooplankton groups, that are normally found in a freshwater body. The study points to the importance of studying such kind of habitats, and thus their conservation.

Keywords: Zooplankton, Aurangabad, Kagzipura lake and Mombatta lake.

I. INTRODUCTION

Biodiversity is the variety of life on Earth, that includes the 8 million plant and animal species on the planet, the ecosystems that house them, and also the genetic diversity in them. Without animal and plant biodiversity there is no future for all of us. Biodiversity is a complex and interdependent system, where every member plays an important role contributing in as many ways possible. The food we eat, the air we breathe, the water we drink and the weather that makes our planet habitable is all possible due to these important interactions. Biodiversity loss is now becoming a more pressing issue than climate change itself. Biodiversity works at different levels, first genes, then individual species and then the communities of creatures and finally entire ecosystems (freshwater, marine etc). Here, the biological component interplays with the physical environment. These complex interactions have made earth habitable for these many years up till now.

Zooplankton are important as bioindicators and are known to predict the physico-chemical condition of any water body. Their presence-absence, diversity and abundance are important parameters to understand the water quality as well. They can indicate the eutrophic levels, type of pollutants, temperature, pH etc of any aquatic ecosystem.

They also play an important role in the maintaining ecology of the freshwater habitats. They are also important economically, as they are at the lower end of the food chain and are protein-rich source for fishes and crustaceans, which we eat. These fishes and crustaceans are important in aquaculture practices. Zooplankton include microscopic free-floating organism like Rotifers, Cladocerans, Copepods, Ostracoda and Protozoans[1,2]

Zooplankton of Mombatta and Kagzipura lakes were surveyed during the year 2016-17. The water was sampled for zooplankton including Rotifera, Cladocera, Copepoda, Ostracoda and Protozoa. Twelve species of Cladocerans, 8 Copepods, 7 Ostracods, 16 Rotifers and 4 Protozoa were observed from the samples taken from both the waterbodies. The results exhibit a good diversity of all zooplankton groups, that are normally found in a freshwater body.

II. MATERIAL AND METHODS

Zooplanktons were sampled every month from February 2016- January 2017. Sampling for zooplankton was done between 9-10 am every time a visit was done at the collection sites.The two sites selected for collection for the yearlong study wereMombatta lake and Kagzipura lake, Aurangabad.

The ***Mombatta lake*** is located (latitude 19° 57’ 42” N and longitude 75° 13’ 24” E) near Daulatabad village, Aurangabad about 15 km from the main Aurangabad city. It is on an average approximately 8 meters deep. The ***Kagzipura lake*** is situated in Daulatabad valley and is used for aquaculture practices **[3-6]**. The water body is located (latitude 19° 57’ N and longitude 75° 15’ E) near Kagzipura village, Aurangabad, about 17 km from the Aurangabad city. It is approximately 8-9 meters deep and is used for fishing and irrigation **[3-6]**.

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A. Zooplankton collection methodology:

Samples were normally taken between 9 am -10 am every time, every month from the both the collection sites. Zooplanktons like rotifers, cladocerans, copepods, ostracods were collected with filtering 100 liter of water through a fine mesh Plankton Net. A 100 ml container was attached to the bottom end of the plankton net (Number 25). Approximately100 litres of water were taken from each of both the lakes and put into the plankton net. The material and zooplankton bigger than the mesh size of the plankton net remained in the net and got collected in the 100 ml container. This concentrated sample containing the zooplankton was then preserved and fixed using 4-5% formaldehyde solution immediately. The sample was transferred to sterile and clean 100 ml plastic containers which were then properly labelled with the details such as collector name, sample station number, collection date, collection time, original sample quantity and other observable parameters like temperature, pH etc[7-8]. The collection bottles were then immediately put in a dark place and taken to the laboratory for further analysis like zooplankton identification.

B. Zooplankton Identification Methodology:

The collected zooplanktons were then taken to the laboratory for further analysis and identification under a compound microscope fitted with a digital camera. Zooplankton like rotifers, cladocerans, copepods and ostracods were identified using available literature like thesis, research papers, monographs etc [9-12].

III. RESULTS AND DISCUSSION

The studies done at both the lakes revealed 12 species of Cladocerans, 8 Copepods, 7 Ostracods, 16 Rotifers and 4 Protozoa were observed from the samples taken from both the waterbodies. Total 47 Zooplankton were revealed from the studies done over a period of one year.Kagzipura Lake was inhabited with 11 species of Cladocerans, 6 Copepods, 6 Ostracods, 13 Rotifers and 2 species of Protozoa. Sampling of Mombatta Lake revealed 7 species of Cladocerans, 8 Copepods, 5 Ostracods, 15 Rotifers and 3 species of Protozoa. Thus, both Kagzipura Lake and Mombatta Lake revealed 38 zooplankton species each. The study results co-insides with most of the studies that have taken place in the collection region[3-6,13,14]

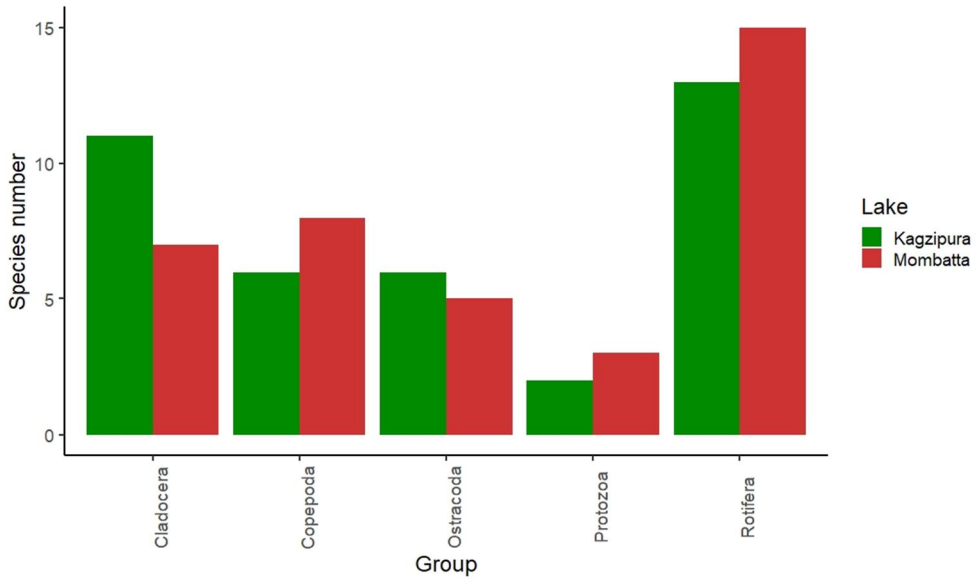

Figure 1: Species richness of all the five groups for both the lakes

The overall species richness was the same for both the lakes with 38 species/lake (Table 1). The distribution of species of the five groups varied between the lakes with more species of rotifers and copepods observed in Mombatta lake (Rotifers= 15; Copepods= 8) while cladocerans, ostracods and protozoans were more in number in Kagzipura (Cladocera= 11; Ostracoda=6; Protozoa=2) (Figure 1). The Phylum Rotifera was the most dominant group in most of the collections done and overall as well. Rotifers are known to be dominant in most of the stagnant waterbodies[1,11]

Maximum species were observed in the month of February (late winter) and then steadily decreased until September (end of Monsoon season) after which the numbers did not follow any specific pattern (Table 1).

Species data in both the lakes

Collection months	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Kagzipura Lake												
1. Cladocera												
Ceriodaphnia cornuta	0	0	0	1	0	0	1	0	0	0	0	1
Ceriodaphnia reticulata	0	1	0	1	0	1	0	0	0	0	1	0
Chydorus reticulatus	0	0	0	1	0	1	0	1	1	0	0	0
Chydorus sphaericus	1	0	1	0	0	1	0	1	1	0	0	0
Daphnia longiramus	0	0	1	1	0	1	0	0	0	0	1	0
Diaphanosoma orientalis	0	0	1	1	1	0	0	1	1	1	0	0
Diaphanosomasarsi	1	1	0	0	0	0	0	0	0	1	0	0
Leydigia acanthocercoides	0	0	1	1	1	0	0	1	1	0	0	0
Macrothrix rosea	1	1	0	0	0	0	1	0	0	0	1	0
Moina macrocopa	1	1	0	0	1	1	0	1	1	0	0	1
Moina micrura	1	1	0	0	0	0	1	0	1	1	0	1
2. Copepoda												
Heliodiaptomus viduus	1	1	0	0	0	0	1	1	1	1	1	0
Mesocyclops hylanus	0	0	1	1	0	0	0	1	1	1	0	1
Nauplius larvae	1	0	1	0	1	0	0	0	0	1	1	1
Paracyclops fermbrialis	0	0	1	1	1	1	0	0	1	0	1	1
Rhinodiaptomus indicus	1	0	0	1	0	0	1	1	1	1	1	0
Tropocyclops parasinus	1	1	0	0	1	0	1	0	0	1	1	1
3. Ostracoda												
Candona suburbana	0	1	1	0	0	0	0	1	0	0	0	1
Cypraea reticulatus	0	1	0	1	1	0	0	0	0	0	0	0
Cyprinus nudues	0	1	1	0	1	0	0	1	0	0	1	0
Cypriochonca alba	0	1	0	0	1	0	0	0	0	0	0	0
Cypriodapsis halvetica	1	0	1	1	0	0	0	0	0	0	0	0
Hemicypris fossiculata	0	0	1	1	0	1	1	1	0	1	0	0
4. Protozoa												
Euplotes sp.	1	1	1	1	0	0	0	0	1	0	1	1
Stentor sp.	1	1	1	1	0	0	0	0	1	1	0	1
5. Rotifera												
Asplanchna priodonta	1	1	1	1	1	1	1	0	1	0	1	0
Brachionus bidentata	1	1	1	1	1	1	1	0	1	1	0	0
Brachionus caudatus	0	1	1	1	0	1	1	0	1	1	0	0
Brachionus diversicornis	1	1	1	0	1	1	1	0	1	0	0	1
Brachionus forficula	1	0	1	1	0	0	1	0	0	0	1	1
Brachionus quadridentatus	1	1	1	0	1	1	1	1	1	0	0	1
Euchlanis dilatata	1	1	1	1	1	0	0	0	1	0	0	1
Filinia terminalis	1	1	1	1	0	0	1	1	0	0	0	1
Keratella tropica valga	1	1	1	1	1	1	1	1	1	1	1	0
Lecane luna	1	1	1	1	0	1	1	1	0	0	0	1
Phillodina sp.	1	1	1	1	1	0	1	0	1	0	1	0
Polyathra major	0	1	1	0	1	1	0	0	1	0	0	0
Trichopria tetractis	0	1	0	1	0	0	0	1	0	0	1	1
Mombatta Lake												
Cladocera												

Ceriodaphnia cornuta	0	0	0	1	1	0	0	0	1	0	1	0
Ceriodaphnia reticulata	1	0	0	0	1	0	0	0	0	0	1	0
Chydorus sphaericus	0	0	1	0	1	0	1	0	1	0	1	0
Daphnia longinus	1	0	0	1	1	0	0	0	1	1	0	0
Diaphanosoma sarsi	1	1	0	0	0	0	0	1	0	0	0	1
Macrothrix rosea	0	0	1	0	0	0	1	0	0	1	0	1
Moina macrocopa	1	0	0	0	0	1	0	0	0	0	1	0
Copepoda												
Eodiaptomus sp.	1	1	0	1	0	0	0	1	0	1	1	1
Heliodiaptomus viduus	1	1	1	0	1	0	0	0	1	0	1	0
Mesocyclops hyalinus	1	1	0	1	0	0	0	1	1	0	0	0
Mesocyclops leuckarti	0	1	1	1	0	0	0	0	1	1	1	0
Nauplius larvae	1	1	1	1	0	0	0	0	1	1	0	0
Paracyclops familiales	0	1	1	1	0	0	0	0	1	0	0	0
Rhinediaptomus indicus	1	0	0	1	0	0	1	0	1	1	0	0
Tropocyclops parasinus	1	1	0	0	1	0	1	1	0	0	1	0
Ostracoda												
Candona suburbana	0	0	0	0	0	0	0	0	0	1	0	0
Cypraea reticulatus	0	0	0	0	0	0	0	0	0	1	0	0
Cypridopsis helvetica	1	0	0	0	1	0	0	0	0	0	0	1
Cyprinus nudues	0	0	0	0	0	0	1	0	0	0	0	0
Hemicypris fossiculata	1	0	0	0	0	0	0	1	0	0	1	0
Protozoa												
Phacus sp.	1	1	1	1	0	0	0	0	1	0	1	1
Euplotes sp.	1	1	1	1	0	0	0	0	1	1	0	1
Paramecium sp.	1	0	1	1	0	0	0	0	0	1	1	1
Rotifera												
Asplanchna priodonta	1	1	1	1	1	1	1	0	1	1	1	0
Brachionus angularis	1	1	1	1	0	1	1	0	0	1	1	1
Brachionus bidentata	1	1	1	1	0	1	0	1	1	1	1	0
Brachionus calyciflorus	1	1	1	1	1	1	0	0	0	1	1	0
Brachionus caudatus	1	1	0	1	1	1	0	0	1	1	1	0
Brachionus diversicornis	1	1	1	0	1	1	0	0	1	1	1	0
Brachionus forficula	1	1	1	1	0	0	1	1	0	0	1	0
Brachionus quadridentatus	1	1	1	1	1	0	1	0	1	1	1	0
Euchlanis dilatata	1	1	0	1	0	0	1	0	0	1	1	0
Filinia terminalis	1	1	1	1	1	0	1	0	1	1	1	0
Keratellatropica	1	1	1	0	0	1	0	1	0	0	1	0
Lecane luna	1	1	1	1	1	0	0	1	1	0	0	1
Phillodina sp.	0	1	1	0	1	1	0	0	0	0	1	0
Polyathra major	1	0	0	1	1	0	0	1	1	1	1	0
Trichopria tetractis	1	0	1	1	1	1	0	0	1	1	1	1
Grand Total (Both Lakes)	51	48	46	47	34	25	28	26	41	34	40	27

Table 1: The species data of both the lakes for one year (starting from February to January) along with total occurrences as Grand Total. (Month names abbreviated to first three alphabets; 1 – represents presence of species and 0 – represents absence)

A. Protozoa

Protozoan organisms are one celled, heterotrophic (using organic carbon as a source of energy), belonging to kingdom Protista. Protozoa are unicellular organisms and 16 phyla of protists contain free-living freshwater protozoan species. They are one of the most commonly found zooplankton. They live in a variety of moist habitats including freshwater, marine environments, and the soil. Protists (*Euglena*) produce energy by photosynthesis and form the base of food chain and webs. They are the most important grazers of microbes in freshwater habitats and the only grazers found in anoxic conditions. They are highly dominant in sediments. Benthic ciliate biomass accounts for upto 10% of total benthic invertebrate biomass. Protozoans like *Amoeba*, *Paramecium* are non-photosynthetic and are heterotrophs. In the present study 4 species of Protozoans were found viz. *Euplotes, Paramecium, Phacus*and *Stentor. Two species of Protozoa, Euplotes* sp. and *Stentor* sp. were observed in Kagzipura Lake whereas, 3 species *Phacus* sp., *Euplotes* sp., *Paramecium* sp. were seen in Mombatta Lake.

Euplotes sp. were the most commonly seen species while *Phacus* sp. was the rarest with 4 occurrences. Mombatta lake showed a greater number of species every month for most of the sampled months. There were no protozoans observed for the monsoon period (June-Sept) in both the lakes. Only a single species of protozoan was observed in Kagzipura in the winter months of November and December (Figure 2).

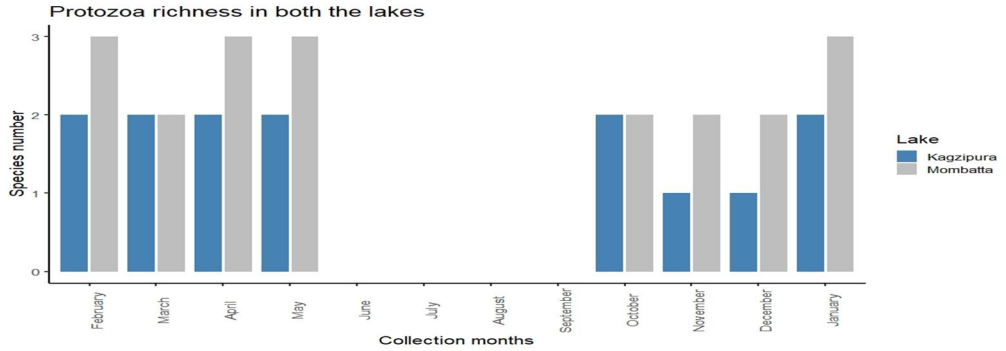

Figure 2: Monthly species richness of Protozoa in both the lakes

B. Ostracods

Ostracods are a class of small crustaceans with about 8000 species. They are commonly known as seed shrimp due to their small size. Their carapace, the upper shell of crustaceans, is bivalved like molluscan mussels. They can be found in lakes, wetlands, seasonal pools, groundwater, streams and mosses.

A total of 7 species were found in the collections with *Hemicyprisfossiculata* being the most commonly seen and *Cypriochonca alba* the most rarely seen species respectively. Five species were found in Mombatta Lake viz. *Candonasuburbana, Cypraeareticulatus, Cypridopsis Helvetica, Cyprinus nudues* and *Hemicyprisfossiculata. Six species of Ostracods Candonasuburbana, Cypraeareticulatus, Cyprinus nudues, Cypriochonca alba, Cypriodapsishalvetica* and *Hemicyprisfossiculata were found in* Kagzipura Lake (Figure 3).

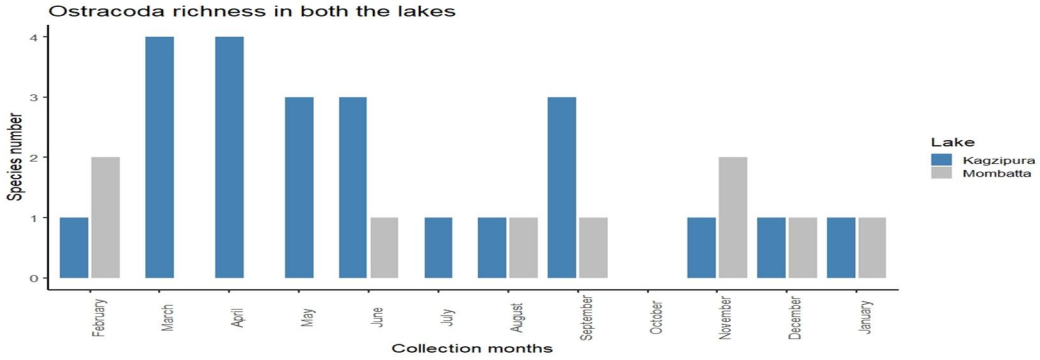

Figure 3: Monthly species richness of Ostracoda in both the lakes

Ostracods were relatively rare in Mombatta lake with richness never exceeding two species and no species recorded for some months. No species were observed for the month of October for both the lakes A maximum of 4 species were observed in Kagzipura lake.

C. Cladocera

Cladocerans are aquatic crustaceans, belonging to the phylum Arthropoda. Cladocerans swim using their second antenna. They normally feed on zooplankton and phytoplankton. They are found abundantly in both temporary and permanent stagnant waters. More than 620 species are known, but the real number of species might be 2–4 times higher.

A total of 12 species were found in both the lakes of which *Chydorussphaericus* and *Moinamacrocopa* were the most common species while *Daphnia longiramus* was rare with only 4 occurrences. Eleven species of cladoceran were found in Kagzipura Lake, whereas 7 were documented from Mombatta Lake (Figure 4).

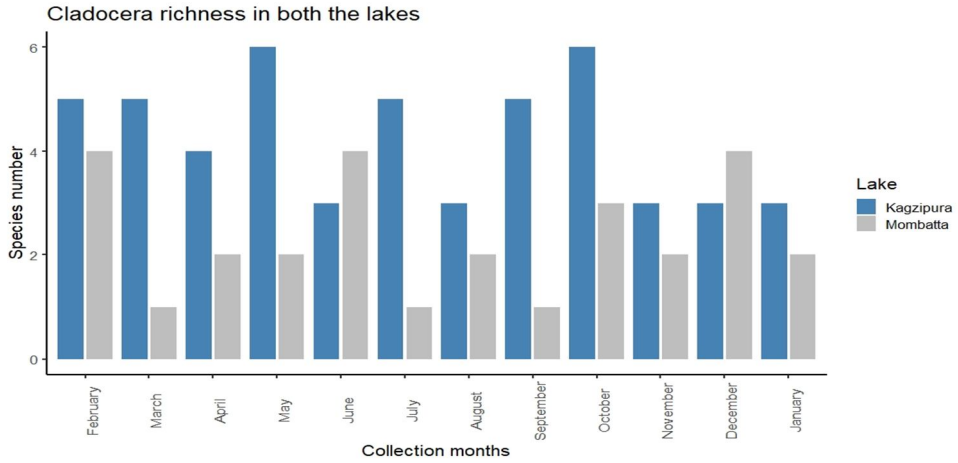

Figure 4: Monthly species richness of Cladocera in both the lakes

Kagzipura lake had more species than Mombatta lake for most of the collection months. There was a very high difference (more than 2 times) of species number between the lakes in certain months. Single species were reported in Mombatta for a few months and this trend was not observed in Kagzipura lake.

D. Copepoda

Eight species of copepods were observed along with napuliar stages which could not be identified until genus/species levels. The most common species observed were*Heliodiaptomusviduus, Rhinediaptomus indicus* and *Mesocyclopshyalinus. Paracyclopsfamiliales* was the rarest species with only 4 occurrences. Seven species in Mombatta lake and 5 species in Kagzipura lake were observed with some unidentified naupliar stages.

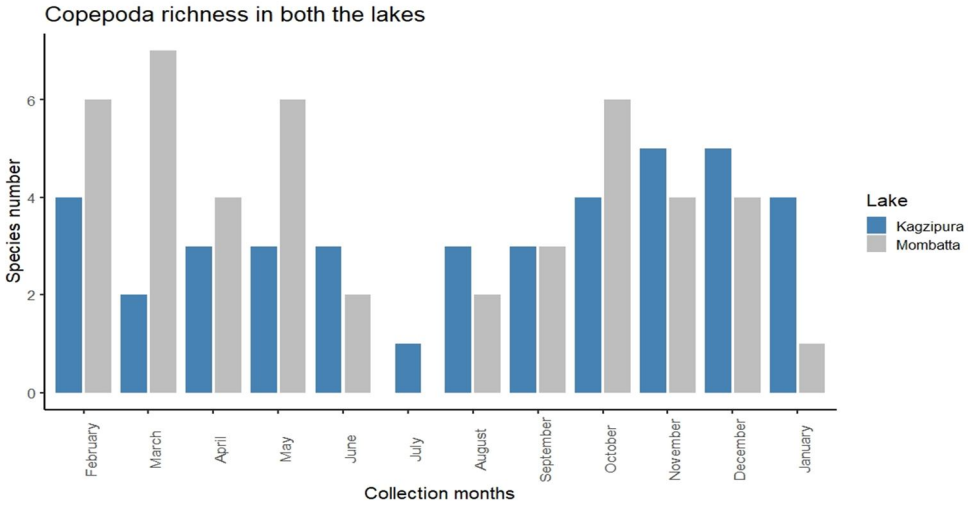

Figure 5: Monthly species richness of Copepoda in both the lakes

There was a succession in the species numbers seen for both the lakes. Mombatta lake had higher species than Kagzipura until June with no species seen in the month of July while Kagzipura lake showed increasing number of species from July till January (Figure 5).

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E. Rotifera

Sixteen species were seen in total from both the lakes. The predatory *Asplanchnapri odonta* was the most commonly occurring species while *Keratella tropica* was the rarest with less than 7 occurrences (in total). Thirteen species of rotifers in Kagzipura Lake and 15 species in Mombatta lake were documented during the study.

Monthly variation varied between the 2 lakes with Mombatta lake showing more species number than Kagzipura for most of the months. More species were seen in Kagzipura for only 2 months viz. August and January. Least number of species (<5) were seen in November in Kagzipura and December in Mombatta lake (Figure 6).

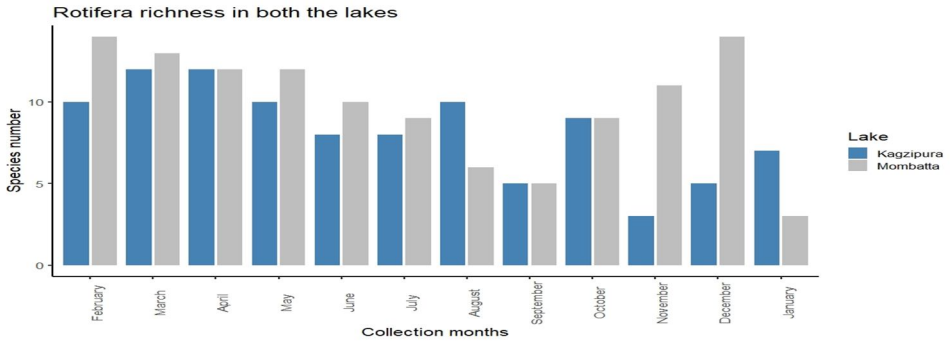

Figure 6: Monthly species richness of Rotifera in both the lakes

Monthly variation varied between the 2 lakes with Mombatta lake showing more species number than Kagzipura for most of the months. More species were seen in Kagzipura for only 2 months viz. August and January. Least number of species (<5) were seen in November in Kagzipura and December in Mombatta lake.

Total occurrences of species (both lakes combined)

Group	Species	Total occurrences
Cladocera	*Ceriodaphnia cornuta*	7
	Ceriodaphnia reticulata	7
	Chydorus reticulatus	4
	Chydorus sphaericus	10
	Daphnia longiramus	9
	Diaphanosoma orientalis	6
	Diaphanosoma sarsi	7
	Leydigia acanthocercoides	5
	Macrothrix rosea	8
	Moina macrocopa	10
	Moina micrura	6
Copepoda	*Eodiaptomus sp.*	7
	Heliodiaptomus viduus	13
	Mesocyclops hyalinus	11
	Mesocyclops leuckarti	6
	Nauplius larvae	12
	Paracyclops familiales	4
	Paracyclops fermbrialis	7
	Rhinediaptomus indicus	12
	Tropo cyclopsparasinus	13
Ostracoda	*Candonasuburbana*	5
	Cypraea reticulates	4
	Cypridopsis helvetica	3
	Cyprinus nudues	6
	Cypriochonca alba	2
	Cypriodapsis halvetica	3
	Hemicypris fossiculata	9
Protozoa	*Euplotes*	14
	Paramecium	7
	Phacus	6
	Stentor	7

Rotifera	*Asplanchna priodonta*	19
	Brachionus angularis	9
	Brachionus bidentata	18
	Brachionus calyciflorus	8
	Brachionus caudatus	15
	Brachionus diversicornis	16
	Brachionus forficula	13
	Brachionus quadridentatus	18
	Euchlanis dilatata	13
	Filinia terminalis	16
	Keratellatropica	6
	Keratella tropica valga	11
	Lecane luna	16
	Phillodina sp.	13
	Polyathra major	12
	Trichopria tetractis	14

Table 2: Total occurrences considering both lakes for each species from every group

The rotifer, *Brachionus bidentata*(18) was the most frequently occurring zooplankton in the overall collections, followed by *Filinia terminalis* (16) another rotifer. The Ostracods, *Cypriochonca alba* and *Cypriodapsis halvetica* were the least seen zooplankton in overall collections.

IV. CONCLUSION

The overall diversity of the studied lakes showed a good diversity of Zooplankton. Sixteen rotifers, 12Cladocerans, 8 Copepods, 7 Ostracods, and 4 Protozoa were observed from the collected samples. The results exhibit a good diversity of the zooplankton groups, especially Rotifera and Cladocera. This is always the case in most of the Zooplankton collections. Rotifers are dominant in terms of their numbers and diversity as well. This is due to their ability to survive in all types of habitats.

V. ACKNOWLEDGMENTS

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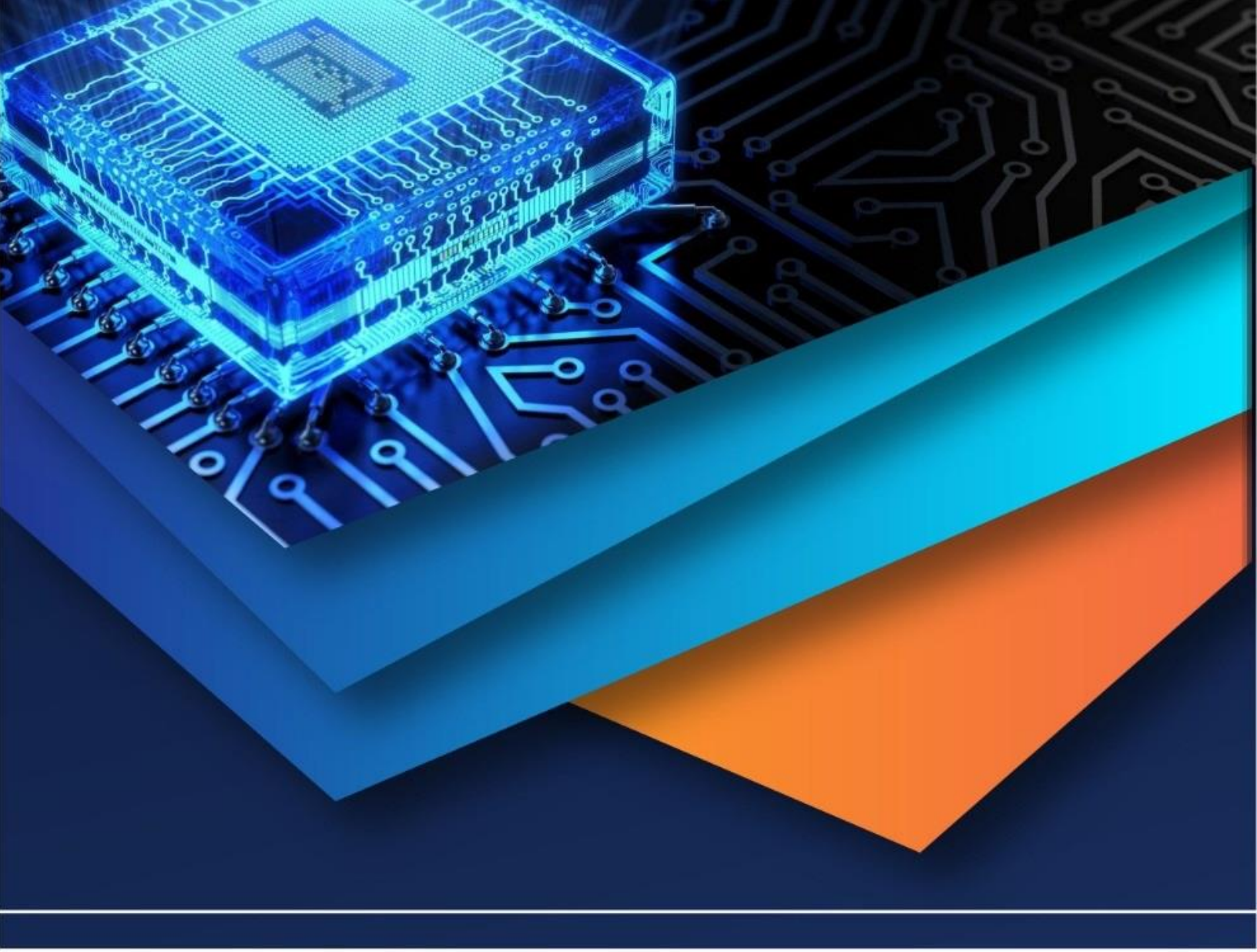

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