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Diversity, Distribution and Abundance of Macrozoobenthos of Upper Lake Bhopal (Madhya Pradesh)

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Abstract

The present study was aimed to assess the diversity, distribution and abundance of macrozoobenthos in Upper Lake Bhopal (Madhya Pradesh). During the present investigation, 5 sampling stations were selected to collect the samples. Shannon diversity index and Margalef's richness index was used on benthic data obtained during the survey. A total of 28 taxa of macrobenthic fauna were recorded from different sampling stations of Parbati River. The phylum Arthropoda was found dominant followed by mollusca and annelida. The maximum diversity and richness were recorded at station 1 while minimum diversity was recorded station 4.

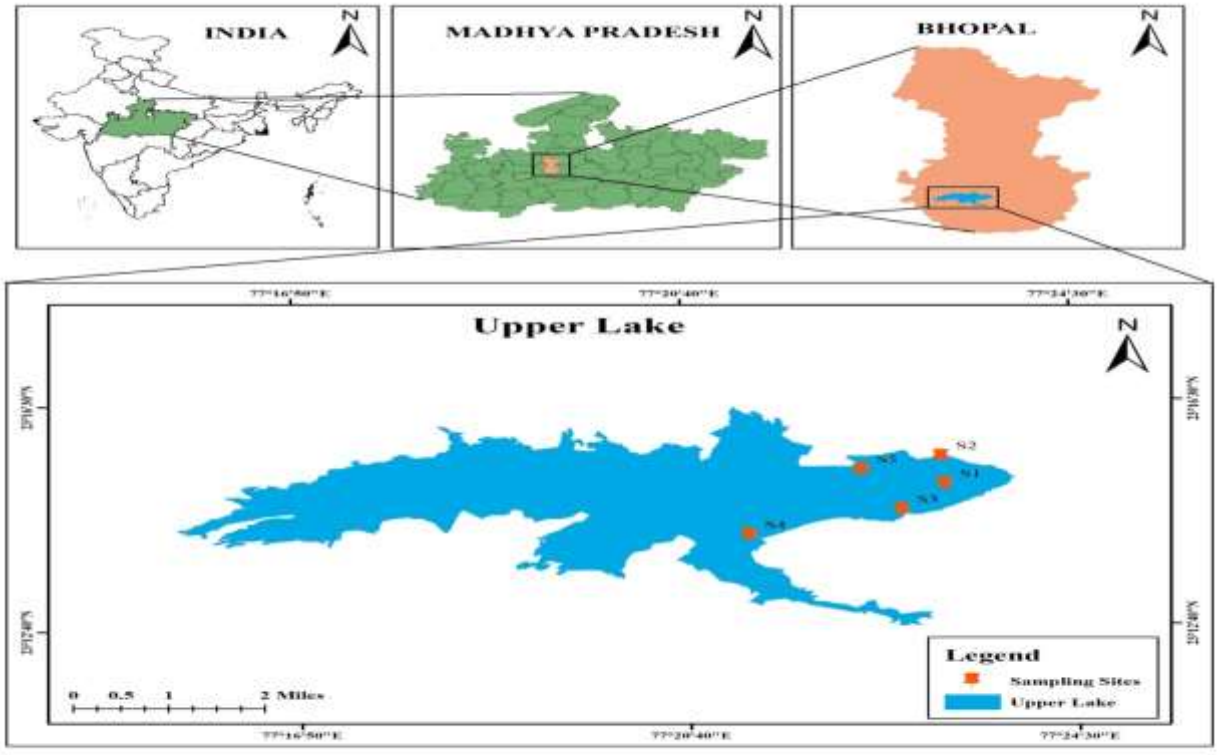
Keywords: Macrozoobenthos, diversity index, upper Lake Bhopal.

INTRODUCTION

Macrozoobenthos are aquatic organisms that inhabit the bottom of any body of water. Their ability to adapt to changes in their surroundings makes them valuable for determining the surface water quality (Hallawell, 1986). Macroinvertebrates have a crucial role in ecological systems because, in addition to providing food for fish and functioning as a vector of viruses that can infect people and other animals, their existence or absence indicates the characteristics of freshwater bodies (Foil, 1998). The degradation of river water quality due to the release of hazardous materials and urban growth activities alters the community structure of benthic macroinvertebrates (Dar *et al.*, 2022).Measuring the physicochemical properties of water gives estimation of its quality but cannot exactly represent the actual state of the reasons for polluted waters. To overcome this, biological evaluation along with other monitoring methods are used to provide a comprehensive picture of ecological quality of the waters (Sciortino & Ravikumar, 1999). Biological monitoring using macroinvertebrates has been found accurate and advantageous compared with other organisms because macroinvertebrates are extremely sensitive to organic pollutants, widely distributed, easy and economical to sample (Setiawan, 2009). So, macroinvertebrate diversity is one of the most effective and inexpensive way to determine the ecological status in aquatic ecosystems.

MATERIAL AND METHODS:-

The present study was conducted on Upper Lake Bhopal, the picturesque capital of the state of MP. It is also known as "city of lakes" on the account of large numbers of water bodies present in and around Bhopal. The latitude location of lake is between 23º10' – 23º – 20'N and longitude 77º 15' – 77º25'E with catchment area of 361 km and having maximum depth of 13 m and minimum depth 0.34m.Five sampling stations were selected, based on the depth profile, habitat and nutrient supply to the lake One location was selected at central point of the urban zone with 4 m depth (S1) it is the central point of the water body with no pollution interference.location second was selected at Hamidea with 4.5 m depth (S2) it is the offshore point of the water body with frequent bathing and washing of cloths. It also receives sewage from hospital and other drains. Site third was selected at Boat club with 1.5 m depth (S3).Mazar this site also receives organic as well as inorganic waste from its catchment area and also receives sediment from the Van Vihar during rainfall (S4). Site five was selected from koifiza designated as (S5).It receives water from sewage treatment plant. For biological analysis ,sediments were collected from all the five sampling stations(between 9am- 5:30pm) with the help of Petersons grebe mud sampler and the collection was sieved with the help of 0.5mm sieve(Ankar and Elmgreen 1976).Similarly samples were collected from stones and Macrophytes by laying down50 x 50 cm^2 quadrant .Stones were hand- picked and attached Macrobenthos were collected by using brush and poured into the 70 percent ethanol for fixing Macrophytes present in the quadrant are uprooted with the help of a hook and collected in a white finished tray . The substrate collected is washed and punched against the floor of tray. The water retained in tray is sieved through 0.5mm sieve .Filtrate is sorted out with the help of forceps and brush and then collected in plastic bottle, containing 70 percent alcohol as preservative(Adoni 1985)and subsequently shifted to laboratory for identification. Macrofaunal were identified under the Metzer light microscope and highly magnified hand lens with the help of standard keys and manuals, Needham and Needham (1962), Mike *et al.* (2005), Pennak (1989),Subba Rao, (1989) and Chandra (1991).



Map-1: Showing the different sampling stations of Upper Lake Bhopal

RESULT AND DISCUSSION

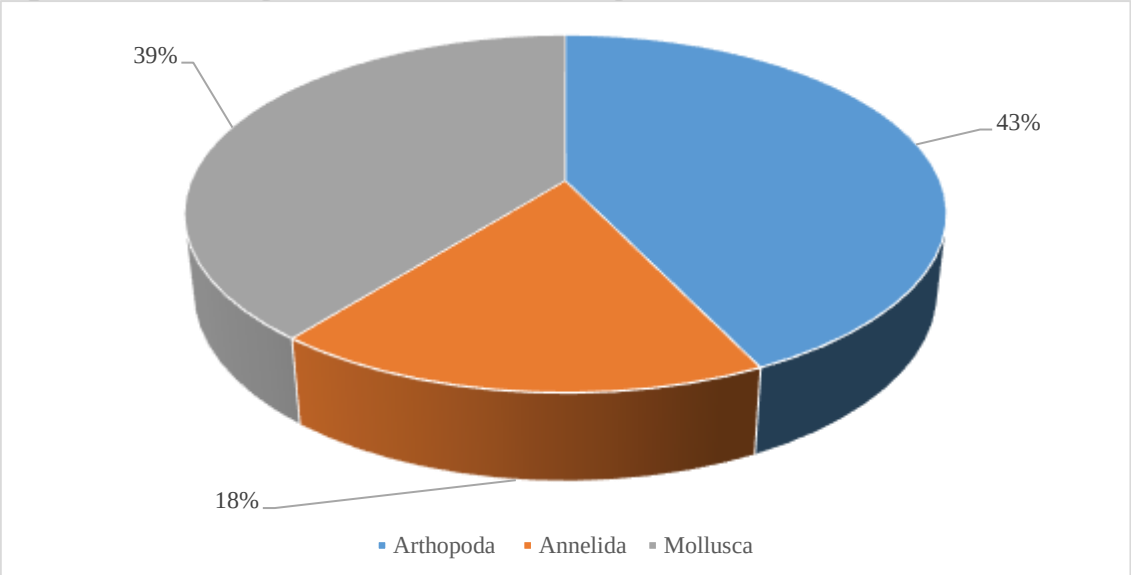
A total of 28 macrobenthic species were recorded during the present study from Upper Lake Bhopal belonging to three phylum's viz., Mollusca, Arthopoda and Annelida. During the present study the maximum number of species were recorded from phylum Arthopoda (12 species), followed by Mollusca (11 species) and Annelida (5 species) (Table-1). Phyllum arthropoda was dominant followed by mollusca and annelida (Fig-1). Similar results were revealed for (Dar *et al.,* 2022) they found 30 species of class insect, 16 of mollsaca and 4 of Annelida. The dominance of Arthopoda was attributed due to favorable habitat conditions and food availability.(Sharma *et al.,* 2013 and Ishaq and Khan, 2013) are also of the opinion that favorable habitat conditions and food availability results in the dominance of arthropoda diversity. At Class level Insecta (Arthropoda) and class Gastropoda (Mollusca) were main representatives of macrozoobenthos from the Parbati river. Similar observations were recorded from Ganjal River (Sharma *et al.,* 2013), Ken River (Nautiyal and Mishra, 2013) and Streams of Yedigoller National Park (Turkmen and Kazanci, 2010).

Table 1: Showing diversity of macrozoobenthos in Upper Lake Bhopal

Species S.No.	Family S.No.	PHYLUM ARTHOPODA	S1	S2	S3	S4	S5
	1	**Family – Atydae**					
1		*Atydae sp*	-	-	-	+	+
	2	**Family- Chironomidae**					
2		*Chironomous sp*	+	+	+	+	+
3		*. Spaniotoma sp.*	+	+	+	+	-
	3	**Family- Caenidae**					
4		*. Caenidae sp.*	+	+	-	+	-
	4	**Family- Gomphidae**					
5		*Gomphous vulgatissinus*	-	+	-	-	-
	5	**Family- Gammeridae**					
6		*Gammarus pulex*	-	+	-	-	-
	6	**Family- Hydropsychadae**					
7		*Namamyia plutonia*	-	-	+	-	+
	7	**Family- Hydrophilidae**					
8		*Sternolophus rufipes*	-	-	+	+	-
	8	**Family- Hydrometidae**					
9		*Hydrometra latreille*	-	+	-	-	+
	9	**Family - Polycentropidae**					
10		*Polycentropus flavomaculatus*	-	-	+	-	-
	10	**Family- Psephenidae**					
11		*Psephenus herricki*	+	-	-	+	-
	11	**Family- Psychomyiidae**					
12		*Tinodes waenesi*	-	-	+	-	+
		PHYLUM- ANNELIDA					
	12	**Family- Glassiphonidae**					
13		*Glassiphonia complanata*	-	-	+	-	-
15	13	***Hemiclepsis viridis***					
14		*Batracobdella hardingi*	+	-	-	-	-
	14	**Family- Hirudidae**					
15		*Poecilobdella granulose*	+	-	+	-	-

	15	**Family- Lumbricullidae**					
16		*Lumbriculus sp.*	+	-	-	+	+
	16	**Family-Tubificidae**					
17		Tubifix tubifix	+	+	+	+	+
	17	**Family – Bithyniidae**					
18		*Digoniostoma pulchella*	-	-	+	-	-
	18	**Family – Lymnaeidae**					
19		*Lymnaea luteola*	+	-	-	-	-
20		*L. biacuminata*	+	-	-	-	-
21		*L acuminate*	+	+	-	-	-
	19	**Family – Planorbidae**					
22		*Gyraulus rotula*	-	+	-	-	-
23		*Planorbis velifer*	-	+	-	-	-
	20	**Family – Thiaridae**					
24		*Thiara pyramis*	+	+	-	-	-
25		*T. crebra*	+	-	-	-	-
26		Paludomous andersoniana	+	-	-	-	-
	21	**Family- Vivparidae**					
27		*Bellamya bengalensis*	+	+	+	-	-
28		*B. crassa*	-	+	-	-	-

Fig.-1 : Percent Composition of Taxonomic Group of macrozoobenthos

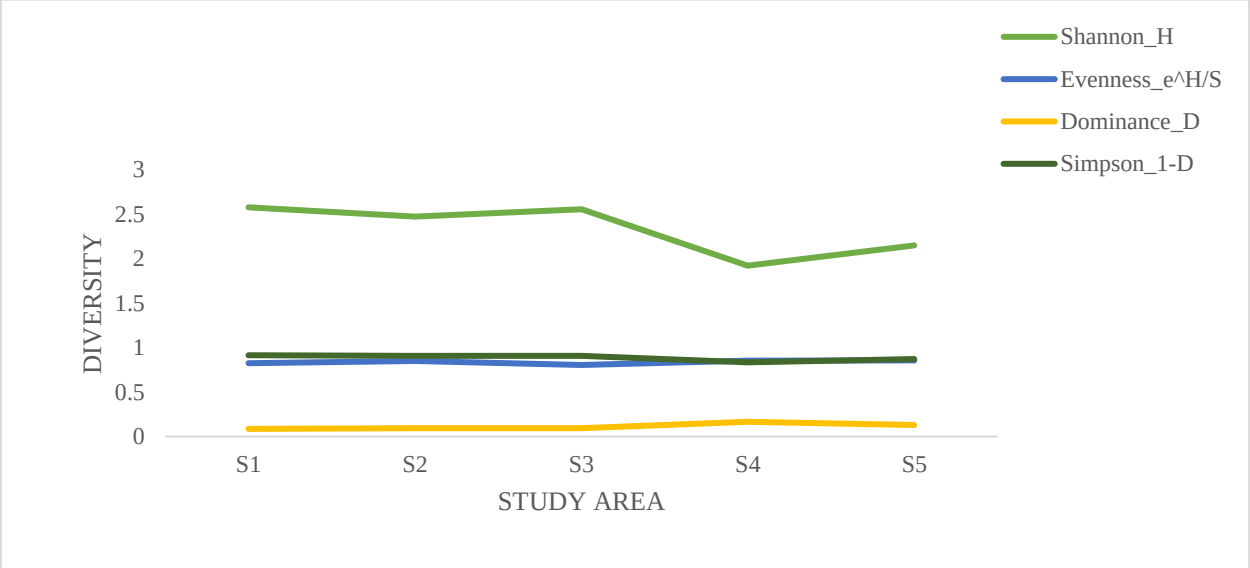


In the present study, maximum taxa richness and diversity were recorded at site 2 and3 (Table 2 and Fig-2) due to good riparian vegetation, found on the banks of the river which provide high nutrient sources for macroinvertebrates (Legendre, 1998) while as the minimum richness and diversity which were recorded at S5 and Site S4 (Table 2 and Fig-2) due to intense human activities (bathing, washing, urban location and highway road connectivity) which produces the high pollution load. Dominance of Chironomus sp. at site S4 and S5 indicates the increase of nutrients enrichment such as nitrates, and phosphate, because under such conditions, only certain types of organism like Chironomus sp. can survive because of their ability to tolerate the high organic contamination (Dar *et al.*, 2022). Further During our study sensitive species like Ephemeroptera was limited only in the reference site (Table-2) but Plecoptera and Trichoptera were totally absent in all of the sites These results are in agreement with the findings of (Sultana & Seshi Kala 2012).

Table-2:- Showing Diversity indies of sampling stations.

Stations	**S1**	**S2**	**S3**	**S4**	**S5**
Shannon_H	2.578	2.475	2.555	1.922	2.148
Evenness_e^H/S	0.8236	0.849	0.8047	0.8547	0.8564
Dominance_D	0.08571	0.09446	0.09326	0.1657	0.1302
Simpson_1-D	0.9143	0.9055	0.9067	0.8343	0.8698

Fig-2: Graphical presentation of Diversity index of sampling sites



CONCLUSION

This study provides information about diversity, distribution and abundance of macrozoobenthos of upper lake (Madhya Pradesh). The maximum taxa richness and diversity were recorded at site S1 and S3 throughout the study period which was mainly due to good riparian vegetation whereas the minimum richness and diversity were recorded at site S4 and S5 which is due to intense human activities as these sites producing high pollution load. The upper lake Bhopal is rich in benthic diversity and measure should be taken to prevent anthropogenic pressure nearby river.

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