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Study of macrobenthic fauna in two aquatic resources of Rampur Naikin District Sidhi (Madhya Pradesh)

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Abstract
The bottom muds of the lakes appear to be similar but are habitats for high biodiversity. Physical, chemical, and biological processes create significant horizontal and vertical heterogeneities in the substrata that provide a physical template for distinct niches. The diversity of benthic fauna acts as sensitive indicators of lake health. Physical-chemical limnology revealed that the sacred lakes were shallow with turbid, alkaline, hard, slightly saline and well oxygenated water. The result show the dominancy of Nematoda (20 genera) > Rotifera (7 genera) > Oligochaeta (6 genera) and Cladocera (6 genera) > Protozoa (6 genera) and Copepoda (5 genera) > Porifera (4 genera) > Bryozoa (3 genera) and Ostracoda (3 genera) > Hydrozoa (1 genera) and Polychaeta. It shows that Nematoda were most dominantly found during the study period.

Keywords: Benthic macro invertebrates, physical-chemical limnology, diversity, population

Introduction

The benthic community is complex. It includes a wide range of organisms from bacteria to plants (phytobenthos) and animals (zoobenthos) and from the different levels of the food web. They are generally classified according to their size *viz.* microbenthos < 0.063 mm, meiobenthos 0.063-1.0 (or 0.5) mm, macrobenthos > 1.0 (or 0.5) mm and, sometimes, megabenthos > 10.0 mm (Tagliapietra and Sigovini, 2010) [26]. Macro benthic invertebrates form an integral part of aquatic environment and are of great ecological and economic importance as they maintain various levels of interaction between the community and the environment (Sharma and Chowdhary, 2014) [19]. Aquatic macro-invertebrates have been identified as excellent tool for bio-monitoring studies as they respond rapidly to the environmental changes. Some Benthic forms are often considered to be best indicators of organic pollution because of their constant present, relatively long life span, sedentary habits, and different tolerance to stress habitat (Webber *et al.*, 1989) [29] benthic population is an essential part of lake ecosystems, exerting a considerable impact upon their functioning. The diversity of benthic fauna acts as sensitive indicators of lake health. The benthic population consumes organic matter that sinks from surface production. These benthic invertebrates become food for the other aquatic invertebrates and vertebrates, hence play a critical role in the natural flow of energy and nutrients in the ecosystem more over they play a vital role in purifying water bodies since they are saprophytic but some may be harmful as some gastropods are intermediate hosts of infectious trematodes and other parasites of animals and human beings. Biological monitoring is considered to provide an integrated approach to assess water and overall environmental quality (Hynes, 1960) [11]. Additionally, snails are ideal bioindicators not only for paleoenvironments and water quality (Harman, 1974; Clarke, 1979) [10, 5], but for lotic and lentic aquatic ecosystems as well (Choubisa, 1992) [4]. Usually various physicochemical methods are used to detect the effect of pollution on the water quality changes. Such alterations in water quality are also very well reflected in the structure and composition of biotic community as shown by occurrence, diversity and abundance pattern of species (Kumar *et al.*, 2006) [13].

The present communication deals with the year round study on diversity and population turnover of macrobenthic invertebrates and their ecological aspects in the two aquatic resources of Rampur Naikin district Sidhi namely Dashaudha Lake and Ghunghuta ghat of Son River from March, 2020 to Feb., 2022.

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The data on population density are viewed upon to adjudge the sensitivity of species to environmental conditions.

Study area

Rampur Naikin is a town and Nagar panchayat (a settlement in transition from rural to urban) in the Sidhi district of the Indian state of Madhya Pradesh. The latitude 24.34 and longitude 81.47 are the geocoordinate of the Rampur Naikin.

Dashaudh Lake is situated in Rampur Naikin, behind the police station and about 500 meters from the main road. This lake is very deep. This lake is famous since the time of Rampur Kothi. Fish farming is also done in this lake and almost different type of Macrobenthic fauna's bioindicator.

Ghunghuta Ghat (Ghunghuta village) is located in Rampur Naikin tehsil of Sidhi district in Madhya Pradesh, India. It is situated 6km away from sub-district headquarter Rampur Naikin and 50km away from district headquarter Sidhi. As per 2009 stats, Ghughunta is the gram panchayat of Ghunghuta village.

Materials and Methods

Both water and sediment samples were collected from the two aquatic resources (Dashaudh Lake and Ghunghuta Ghat Son River).

Water was examined for major ecological variables including temperature, pH, electrical conductance, total dissolved solids, dissolved gases (oxygen, carbon dioxide), alkalinity and hardness. A quadrate was used to collect the samples of sandy sediment. The sediment samples were examined for pH, electrical conductance, total dissolved solids and organic matter. Benthic forms were collected by sieving the mud samples. The results are expressed in the No. /m^2. The analysis was made following APHA-AWWA-WPCF (1981) [1]. For parameters like temperature, pH, electrical conductance and total dissolved solids, respective meters were used. Benthic fauna were identified following Daglish (1952) [7], Borrer & Delong (1957) [2], Baid (1958) [30], Vazirani (1964) [28], Edmondson (1966) [8], Needham & Needham (1978) [17], Tonapi (1980) [27], Mc Cafferty (1981) [15] and Subbarao (1989) [25]. Population turnover was calculated as Maximum population / Minimum population recorded.

Results and Discussions

Physical-chemical limnology revealed that the lakes were shallow with turbid, alkaline, hard, slightly saline and well oxygenated water. No much difference was found in the physical-chemical parameters. The average values of important abiotic variables of water were observed as Temperature 23.70 - 23.30 ℃, Transparency 47.13 - 52.77 cm, pH 7.97 - 8.65, EC 268.13 - 180.06 µmhos/cm, DO 6.84 - 7.57 mg/l, Free CO_2 1.56 - 0.60 mg/l, TDS 97.26-75.11 mg/l, Hardness 154.55-91.11 mg/l and Total Alkalinity 122.53-69.98 mg/l. Sediment analysis revealed the average

values as pH 9.46-9.34, EC 0.42 - 0.35 mmho/cm, TDS 364 - 372 mg/g and Organic matter 53.25 - 46.44 mg/g in the Dashaudha lake and Ghunghuta ghat Son river (Table 1). The high value of hardness during summer can be attributed to a decrease in water volume and an increase in the rate of evaporation of water (Kashyap, 2016, Shukla & Shukla, 2022, Mishra & Singh, 2022b and Shukla & Singh, 2023a & b) [12, 22, 16, 20, 21].

The benthic fauna displayed a diversity of 09 groups belonging to Nematoda, Rotifera, Oligochaeta, Cladocera, Protozoa, Copepoda, Porifera, Bryozoa, Ostracoda, Hydrozoa and Polychaeta. Considerable number of Annelids was recorded only when the water temperature was above the average value (>26 °C). The pattern of the population turnover and the periodicity of occurrence were similar in both aquatic resources yet the average population density was high in Ghunghuta ghat Son River.

During the study total 60 genera were found among the benthic faunal communities belong to the group of Protozoa (6 genera), Porifera (4 genera), Nematoda (20 genera), Rotifera (7 genera), Bryozoa (3 genera), Oligochaeta (6 genera), Cladocera (6 genera), Copepoda (5 genera) Ostracoda (3 genera), Hydrozoa (1 genus) and Polychaeta in the sediment at two aquatic resources of Rampur Naikin district Sidhi. The result show the dominancy of Nematoda (20 genera) > Rotifera (7 genera) > Oligochaeta (6 genera) and Cladocera (6 genera) > Protozoa (6 genera) and Copepoda (5 genera) > Porifera (4 genera) > Bryozoa (3 genera) and Ostracoda (3 genera) > Hydrozoa (1 genera) and Polychaeta. It shows that Nematoda were most dominantly found during the study period.

The greater population turnover of a species suggests the greater sensitivity of it to the available environmental conditions of existence. However, this should be viewed upon with the incorporation of data on the periodicity of occurrence of the individual species. Thus, a species may, however be having a poor population turnover, if displays poor periodicity, is obviously highly sensitive to the available environmental conditions during most part of the year. This is important to note that species in highly stressed condition such as desert (Dashaudha) develop locally adapted population as also observed by Singh and Saxena (2002) [24] and Singh et al. (2006) [23].

The availability and distribution of chironomids on intra lake level have been attributed to be relative to many factors (Bowman, 1976) [3]. Chironomus larvae have also been used as pollution indicators by number of workers Gaufin (1957) [9] and Curry (1962) [6]. Thus, the abundance of chironomids in the benthic population is due to impact of altered nature of substrate due to organic pollution. The presence of *Tubifex* and *Lymnaea acuminate* in the lakes also corroborates with the work of Mason (1981) [14] and Sarang & Sharma (2009) [18]. However, the physicochemical parameters were well within the threshold limit in these water bodies.

Table 1: Physical-chemical variables at the Dashaudha lake and Ghunghuta ghat of Son river from March, 2020 to Feb., 2022 Values are averages of two years and are expressed in mg/l in water and mg/g in sediment, except otherwise mentioned

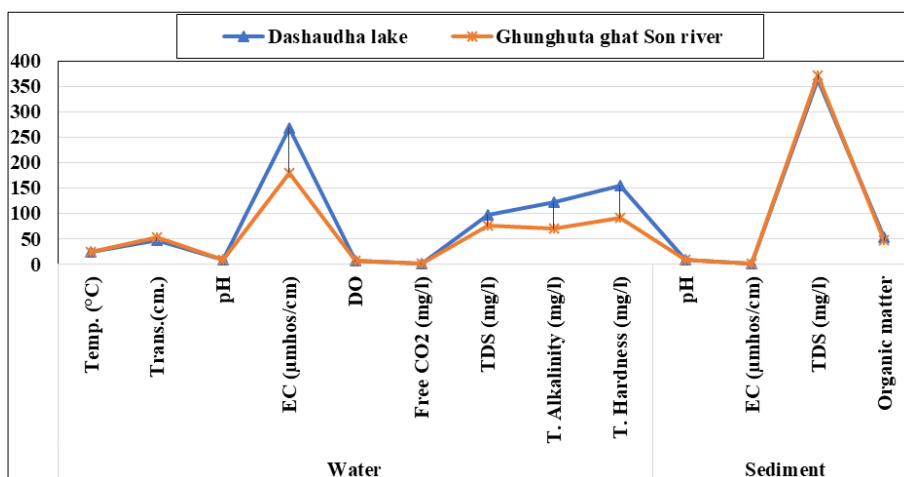| Variables		Dashaudha lake			Ghunghuta ghat Son river		
		Max.	Min.	Avg.	Max.	Min.	Avg.
Water	Temp. (°C)	29.30	17.15	23.70	29.24	16.03	23.30
	Transparency (cm.)	92.23	17.32	47.13	103.18	12.14	52.77
	pH	8.57	7.24	7.97	9.11	8.36	8.65
	EC (µmhos/cm)	391.03	120.77	268.13	269.86	130.21	180.06
	DO	8.07	5.46	6.84	9.29	5.82	7.57
	Free CO_2 (mg/l)	3.96	0.02	1.56	4.03	0.01	0.60
	TDS (mg/l)	123.16	55.25	97.26	103.21	52.12	75.11
	Total Alkalinity (mg/l)	155.19	87.83	122.53	90.62	50.82	69.98
	Total Hardness (mg/l)	210.20	93.81	154.55	117.80	63.51	91.11
Sediment	pH	10.6	9.8	9.46	10.4	8.2	9.34
	EC (µmhos/cm)	0.50	0.12	0.42	0.48	0.22	0.35
	TDS (mg/l)	482	110	364	460	265	372
	Organic matter	68.96	22.64	53.25	70.22	22.26	46.44

Fig 1: Graph analysis of Physical-chemical variables at the Dashaudha lake and Ghunghuta ghat of Son river from March, 2020 to Feb., 2022 Values are averages.

Table 2: Number and percentage composition of genera and species under various microbenthic faunas of two aquatic resources of Rampur Naikin from March 2020 to Feb. 2021 and March 2021 to Feb. 2022.

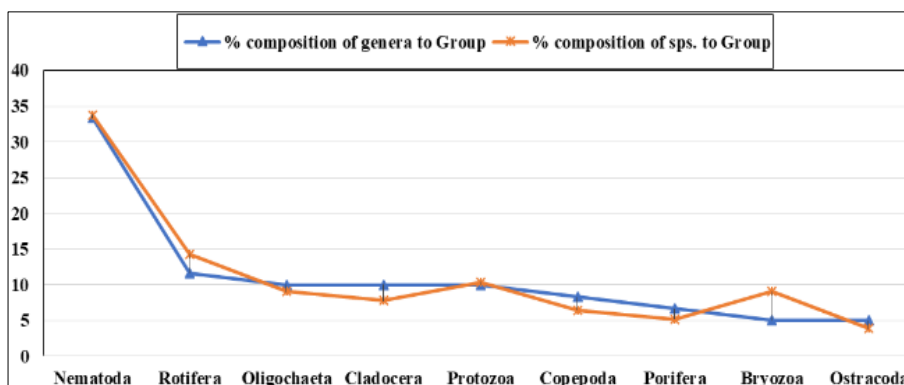| S. No.	Group	Genera	% composition of genera to Group	Species	% composition of sps. to Group
1.	Nematoda	20	33.33	26	33.77
2.	Rotifera	7	11.67	11	14.29
3.	Oligochaeta	6	10.00	7	9.09
4.	Cladocera	6	10.00	6	7.79
5.	Protozoa	6	10.00	8	10.39
6.	Copepoda	5	8.33	5	6.49
7.	Porifera	4	6.67	4	5.19
8.	Bryozoa	3	5.00	7	9.09
9.	Ostracoda	3	5.00	3	3.90
	Total	60	100.00	77	100.00

Fig 2: Graph analysis of percentage composition of genera and species under various microbenthic faunas of two aquatic resources of Rampur Naikin from March 2020 to Feb. 2021 and March 2021 to Feb. 2022.

During the observation it has been found that the Group Nematoda contributed the 33.77% of whole community in two aquatic resources of Rampur Naikin district Sidhi (Table 2).

Conclusion
This preliminary investigation enabled a comprehensive monthly analysis of the Physical-chemical fluctuations and macrobenthic faunal diversity of the water bodies and the data generated might help in planning better conservation measures and management of these religiously and biologically important perennial. In spite of certain climatic challenges and intermittent availability of species and lesser population density the lake of Dashaudha was equally kaleidoscopic to the Son river of Ghunghuta ghat as far as macrobenthic invertebrates are concerned. The diversity index can be used as a measure of water pollution in the lentic ecosystem and when studied in combination with physico-chemical parameters, it provides more realistic assessment of the quality of water.

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