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Original Research Article

Macrozoobenthos Diversity of Bhagda Taal, A Wetland of Balrampur, U.P. (India)

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ABSTRACT:
Wetlands are one of the richest habitats of biodiversity, provide food and shelter to organisms that thrive in. During the present investigation 22 genera of macrozoobenthos were recorded. Out of 22, 8 genera belong to phylum annelid, 8 to mollusca, and 6 to arthropod. The mean density shows that molluscan dominates and constituted 36.66% of the total macrozoobenthos population was followed by annelids (34.66%) and arthropods (28.66%). Among the benthic population was chiefly constituted by *Tubifex* sp followed by *Gammarus* sp., *Chironomus* sp., *Lymnaea* sp., *Pila* sp., *Branchiura* sp., *Lumbriculus* sp. Erpobdella sp. and *Lamellidens* sp.

Keywords: Macrozoobenthos, Bhagda Taal, Wetland

INTRODUCTION

Wetlands are defined as lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitsch and Gosselink, 1986).

Wetlands exhibit varied characteristics function as vital life and environmental supporting systems, they are extremely important for wildlife not only in terms of the sheer number of individuals but also for enormous diversity of species they support. Wetlands are among the world's most productive environments. They support high concentrations of birds, mammals, reptiles, amphibians, fish and invertebrate species. They are cradles of biological diversity, providing the water and primary productivity upon which countless species of plants and animals depend for survival (Prakash, 2020).

The economic importance of wetlands is attributed to this abundance and diversity of flora and fauna inhibiting them. However, overexploitations of its resources, urbanization and other developmental anthropogenic activities have been threatening the wetlands and are making the wetlands among the most threatened ecosystems. Wetlands form an important resource for humans and its conservation is essential in maintaining the environmental security. It is now essential that man recognizes the importance of wetlands, protect and conserve them.

With the growth of human population, the anthropogenic activities increase in and around the waterbodies, leading to the

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deterioration of soil and water qualities. Large quantities of nutrients are added through sewage, industrial effluents and agricultural runoff. When this occurs for a long time, most of aquatic organisms perish or replaced by those organisms, which are able to tolerate such altered conditions. Since the water body is a complete ecosystem, any change in physical or chemical conditions of soil and water also affects the biodiversity of aquatic organisms.

Macrozoobenthos being diverse in nature, react strongly and often predictably to human influences in aquatic ecosystem. They act as a viable tool for biological monitoring of freshwater ecosystems as they have wide range of sensitivities to change in both water quality and habitats (Thoker *et al*., 2015).

Macrozoobenthos form the basis of the trophic level and any negative effect caused by pollution in the community structure can in turn affect trophic relationships. Macrobenthic invertebrates act as food for many aquatic birds and fishes. Different species comprises distinct functional groups that provide ecological integrity. In some cases, these functional groups may be represented by only a few species, so that any loss of species diversity could be detrimental to continued ecosystem functioning. Thus, it is increasingly becoming important to protect macrozoobenthic communities owing to their immense importance in their natural habitats.

The macrozoobenthos of freshwater wetlands provide significant support to the aquatic food web and contribute to ecosystem stability through sustenance of cultivatable fish, aquatic birds and other aquatic life. Their composition, abundance and distribution pattern acts as an ecosystem index, thereby indicating trophic structure, water quality and eutrophication level of the waterbodies (Mehdi *et al*., 2005). Benthic diversity of wetlands were studied by many ecologists in India (Siraj *et al*., 2010; Verma and Prakash, 2018; Singh *et al*., 2019; Prakash, 2020) but no such information is available in fresh water body of Tarai region of eastern U.P. Keeping this mind an attempt has been made to document macrozoobenthic diversiy of Bhagda Taal and their composition as well as to know the variation of the macrozoobenthic diversity with depth.

STUDY AREA

Bhagda Taal is a large shallow lentic waterbody. The total catchment area of wetland is about 10 ha. It is situated in Gurhra (Kushmor) villages, of Shriduttganj Block of Utraula Tahasil of district Balrampur.

But in summer season its water spread area becomes reduced up to 7.0 ha. It is situated between the latitude 27^{0} $25^{/}$ $48^{//}$N to 27^{0} $43^{/}08^{//}$ N, altitude and $82^{0}18^{/}48^{//}$ E to $82^{0}30^{/}18^{//}$ E longitude. The climatic change influences to its vast openness, landscape ecology and biodiversity. The Taal is enriched with several type of vegetation such as *Nymphaea, Nelumbo* and Nymphya as well as aquatic birds like Duck, Saras and Bagula.

The water of Taal is used for agriculture and fish culture. The abundant food attracts hundreds of resident and migratory birds including Siberian crane during winter season. As an important resort for the native faunal diversity and a beautiful habitat for the phytodiversity, it has never been a subject of scientific or geological study. Therefore, the present study was undertaken to evaluate the Bhagda Taal, a wetland of Balrampur, U.P. in terms of its macrozoobenthos diversity as well as ecological significance for the area.

Figure 1: Satellite map off Bhagda Tall, Utraula, Balrampur District, U.P.

MATERIALS AND METHODS

The sediment samples were collected monthly and dried to constant weight in an oven at 105⁰-110⁰C. The sand, silt and clay were determined by pipette method (Piper, 1966). The soil organic carbon and available phosphorus were estimated by Trivedy *et al*. (1987). The available nitrogen was determined by alkaline permanganate method (Subbiah and Asija, 1956). The pH was determined in 1:5 soil water suspensions by pH meter.

The sediment sample were collected monthly from the bottom at three station during morning time by using Peterson Grabe mud sampler, collected samples were sieved through 0.5 mm sieve (Ankar and Elmgreen,1976) the material which retained on sieve were collected and from it benthic organisms were stored out with the help of forceps and brush and were collected in narrow mouthed plastic bottle, containing 4% formalin and 70% alcohol as preservative depending upon the type of organisms to be preserved. The soft-bodied organisms were preserved in 70% alcohol while the shelled organisms like mollusks in 4% formalin (Borror *et al.,* 1976). All macro fauna of bottle were identified with the help of available key and manuals Neetham and Needham (1962), Borror *et al.* (1976) and Pennak (1989) under the light microscope. The population of organisms was counted and number of individuals of a species per sample and was expressed as number/m^2.

RESULTS AND DISCUSSION

Physico-chemical Properties of Soil (Table1): Results of the physico-chemical properties of soil of Bhagda Taal have been presented in Table1.

Table 1: Physico-chemical Properties of Soil of Bhagda Taal, Balrampur

Parameters	January to April,2021		
	Site-1	Site-2	Site-3
Sand%	17.79	17.39	16.97
Silt%	27.69	25.85	27.31
Clay%	56.92	56.76	55.72
pH	7.77	7.75	7.81
Organic carbon %	1.35	1.38	1.29
Available Phosphorus (ppm)	10.12	11.05	11.63
Available Nitrogen (ppm)	212.45	239.25	209.00

Texture of Soil: The soil of taal under study is clay in texture (55.72-56.92%) suitable to support microphytic and macrophytic vegetation, and also good for aquatic life because neither it is very sandy to allow leaching nor too clayey for the absorption of nutrients.

pH of Soil: The soil was alkaline in all three seasons, with a narrow range of pH 7.75-7.81 which is suitable for aquatic animals. An almost similar range of pH has also been reported by Prakash (2000). Thus the soil pH of this wetland is conducive to high production.

Organic content: The organic carbon contents will affect the life of aquatic animals and nitrogen fixation. In the present study organic carbon of the soil was varied between 1.28-1.65%, which is optimum for aquatic animals.

Phosphorus: The availability of phosphorus is the most important to aquatic productivity owing to the fact that phosphorus ion in soil from insoluble compound with iron and alumina under acidic condition and with calcium under alkaline condition. Available phosphorus of the soil was in the range of 8.63 to 12.05 ppm which is in almost similar range of available phosphorus observed by Prakash (2000).

Nitrogen: Nitrogen is present mostly in organic forms which are broken down through bacterial action into simpler inorganic molecules. Available nitrogen fluctuated in a narrow range of 209.00 to 239.25 ppm which is good for growth and development of aquatic animals.

Population dynamics of macrozoobenthos (Table 2)

Macrozoobenthos are good indicators of long term habitat quality rather than instantaneous conditions. In the present study the benthic population of the wetland was estimated to be 450 nos/m^2 during four month study period in monthly sampling. Benthic population of all the three sites is given in Table2. During the present study, total 22 genera of benthos were identified which belonged to 3 phylum and 8 classes. Among the macrozoobenthos collected from three sites of wetland, phylum mollusca was dominant (36.66%) and followed by annelid (34.66%) and arthropoda (28.66%). The collected benthos including their classes, zoological names and their annual mean density are shown in the table 2.

In normal condition the distribution of macrozoobenthos fauna has been reported to be dependent on the availability and distribution of preferably food items. In fact, their capacity to exploit areas with optimum food supply might be explained by their abundance (Zahoor *et al*, 2010). Vyas and Bhat (2010), Shrivastava (1997) and Prakash (2020) reported 1782 nos/m^2, 845nos/m^2 and 454 nos/m^2, respectively in different fresh water bodies of India.

Table 2: Macrozoobenthos recorded in the Bhagda Taal during Jan. to April, 2021.

S.N.	Class/Genera of Macrozoobenthos	Mean Density of Macrozoobenthos (Number/m^2) in different sampling stations			Mean Density of Macrozoobenthos (Number/m^2) in Bhagda Taal
		S1	S2	S3	
Phylum- Annelida (34.66%)					
	Class 1:Oligochaeta				
1	*Branchiura* sp.	12	9	7	9.33
2	*Limnodrilus* sp.	7	1	3	3.66
3	*Lumbriculus* sp.	9	8	10	9.00
4	*Tubifex* sp.	25	22	15	20.66
5	*Nais* sp.	2	0	0	0.66
	Class 2: Hirudinidae				
6	*Glassiphonia* sp	4	0	2	2.00
7	*Erpobdella* sp.	11	9	6	8.66
8	*Pentopdella* sp.	6	0	0	2.00
Total Density/ Mean Density		**76**	**39**	**41**	**156/ 52**
Phylum- Arthropoda (28.66%)					
	Class 1: Insecta				
9	*Caenis* sp.	8	11	2	7.00
10	*Chironomus* sp.	16	12	9	12.33
11	*Hydrophilus* sp.	6	0	4	3.33
	Class 2: Crustacaea				
12	*Gammarus* sp.	22	15	12	16.33
	Class 3: Arachnida				
13	*Dolomedes* sp.	5	0	4	3.00
14	*Acari* sp.(Water mites)	2	1	0	1.00
Total Density/ Mean Density		**59**	**39**	**31**	**129/43**
Phylum- Mollusca (36.66%)					
	Class 1: Gastropoda				
15	*Lymnaea* sp.	12	9	10	13.00
16	*Pila* sp.	14	11	12	12.33
17	*Thiara* sp.	8	5	10	7.66
18	*Tarebia* sp.	7	3	8	6.00
	Class 2: Pelecypoda				
19	*Corbicula* sp.	8	6	7	7.00
20	*Planorbula* sp.	3	2	3	2.66
21	*Promentus* sp.	1	1	0	0.66
	Class 3: Bivalvia				
22	*Lamellidens* sp.	10	8	7	8.33
Total Density/ Mean Density		**63**	**45**	**57**	**165/55**
Mean Density of Macrozoobenthos		**198**	**123**	**129**	**450**

In the present investigation 22 genera were identified throughout the study period. Out of 22, 8 species belonged to annelids, 6 belonged to arthropods and 8 belonged to molluscans. The pattern of dominance of various macrozoobenthic forms in terms of their mean density at Bhagda Taal was as follows:

Mean density of annelids was *Tubifex* sp. (20.66 nos/m^2) followed by *Branchiura* sp. (9.33 nos/m^2), *Lumbriculus* sp. (9.00 nos/m^2), *Erpobdella* sp. (8.66 nos/m^2), *Limnodrilus* sp. (3.66 nos/m^2), *Glassiphonia* sp. (2.00 nos/m^2), *Petopdella* (2.00 nos/m^2) and *Nais* sp. (0.66 nos/m^2).

Mean density of arthropods was *Gammarus* sp. (16.33 nos/m^2), *Chironomus* sp. (12.33 nos/m^2), *Caenis* sp. (7.00 nos/m^2), *Hydrophilus* sp. (3.33

nos/m²), *Dolomedes* sp. (3.00 nos/m²), *Acari* sp. (1.00 nos/m²).

Mean density of molluscan was *Lymnaea* sp. (13.00 nos/m²) *Pila* sp. (12.33 nos/m²), *Lamellidens* sp. (8.33 nos/m²), *Thiara* sp. (7.66 nos/m²), *Corbicula* sp. (7.00 nos/m²), *Tarebia* sp. (6.00 nos/m²), *Planorbula* sp. (2.66 nos/m²) and *Promentus* sp. (0.66 nos/m²).

Among the benthic population was chiefly constituted by *Tubifex* sp followed by *Gammarus* sp., *Chironomus* sp., *Lymnaea* sp., *Pila* sp., *Branchiura* sp., *Lumbriculus* sp. Erpobdella sp. and *Lamellidens* sp. These were found in all three sampling sites.

The macrozoobenthic communities of three study sites belonged to more or less similar taxonomic groups, although the number of individuals within each group varied considerably. The maximum density (198 nos/m²) and diversity (22 genera)of macrozoobenthos were found at site S1, moderate density (129 nos/m²) and diversity (18genera) at site S2 and minimum density (123 nos/m²) and diversity (17 genera) at site S3. The mean population density at different stations varies between 108 -198 individuals/m². This variability in the diversity and density of benthos at different sites might be due to the substrate type, velocity, depth and anthropogenic activities (Thoker *et al*, 2015). Presence of pollution tolerant *Tubifex* sp and *Chironomus* sp. in all the stations is directly related to the high quantity of organic matter in the water (Dar *et al*., 2010). Relatively high species density and species composition of macrozoobenthos at Site S1 seems to be correlated with macrophytic species richness because they spent much of their life cycle on host plants (Prakash, 2020).

CONCLUSION

Thus from the present study, it can be concluded that-

- Due to low depth, transparency increases which helps in penetration of sunlight to the bottom layer by which process of decomposition get accelerated resulting increase in benthic diversity.
- The present wetland is suitable for growth and development of macrozoobenthos due to optimum soil condition, rich in macrophytes and solid organic wastes.
- Benthic forms are an important component of food webs and form the trophic relationships include those that feed on them directly or indirectly.
- They are the best indicators of the stress in the aquatic ecosystem, so it is utmost important to document the benthic diversity.

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