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## **Studies on ecology of three urban lakes of Nagpur Maharashtra (I) with special reference to macrozoobenthic diversity**

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### **Abstract**

The present study was carried at three urban lakes of Nagpur City in Central India from September 2012 to August 2014 confirmed macrozoobenthic diversity of 30 species belonging to 4 different phylum, viz Platyhelminths, Annelida, Arthropoda, Mollusca. The most abundant species are observed in Phylum Arthropoda, Class Insecta as larvae, nymph and naids of the aquatic insects. The presence of species belonging to Phylum Mollusca are also more in number with the occurrence of Gastropoda and Pelecypoda. The occurrence of Phylum Annelida is prominent with class Oligochaeta and Hirudinea. The species belonging to Phylum Platyhelminths of class Turbellaria are least in study. The study suggests that the rich benthic fauna is due to the organic rich habitat in the three urban lakes of city.

**Keywords:** Macrozoobenthic diversity, Urban lakes, Nagpur city

### **Introduction**

The term benthos includes all bottom dwelling organisms. Among the animals are representative of most of the phylum. Study of the macro benthos has received considerable attention due to their significance as biological indicators of environmental change in aquatic ecosystem and also as source of fish food organisms. These organisms inhabiting in the lentic or lotic water bodies, come across influence of human civilization and urbanization ultimately resulting into considerable variation in their community structure (Wilhm J and Dorris T. C., 1968) [22] the presence of macro benthos in an aquatic ecosystem has close relationship with its environment and is regarded as an indicator organism in discussing the conditions of nature and characteristics of that ecology (Ganesh T and A.V. Raman, 2007) [4].

Benthic organisms play an important role in the aquatic ecosystem because of their importance in food chain. These act as potential elements in fishery and sustaining biodiversity of vegetation. Benthic macro fauna is inhibited by the various degree of disturbances such as bottom activity of biogeochemical process in the sediment structure, rocks, zonation's (Pearson T.H. and Rosenberg R., 1978) [16]. The presence of species and the species specific study evaluates the scenario of benthic environment. The factors affecting aquatic ecosystem as pollution, organic enrichment and physical disturbances are sensitized by benthic communities. These are termed as indicator species sensitive to multiple stressors. Such species are having different tolerance levels in community structure.

### **Study Area**

The present study was carried out in the Nagpur city [21° 09'N. & 79° 09'E] in the Maharashtra state of Central India. The city has an average elevation between 274.50 to 350 meters above sea level. The city is endowed with natural water bodies, rivers and man-made lakes. Since the period of urbanization these getting deteriorated to phase of extinction. The study was carried out to estimate the macrozoobenthic fauna in three lakes namely Futala, Ambazari and Gandhisagar of the city.

### **Futala Lake**

The futala lake [21° 08' 44''N and 79°03'48''E] is a closed water body. This lake is located in west Nagpur. The initial purpose for irrigating nearby agricultural land was prominent amongst utilization of lake. The water is unpotable and now-a-days used for commercial fisheries. It does not have self-cleansing capacity.

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Hence the continuous addition of nutrients through many polluting sources is leading. The watershed of Futala Lake is a part of nag river watershed. Four streams are prominent within the catchment.

#### Ambazari Lake

The ambazari lake [21°07'43"N and 79°02'26"E] is having its water supply from storm run-off and streams. To the north-west side hill top on the city is a small plateau from where originates the main streams of Nag river adding water to ambazari reservoir. The overflow point is responsible for shedding water during heavy rains. The lake water is sustained due to bund wall, built with the purpose to provide potable water to city. Due to rapid urbanization and industrial growth, the purpose merely exists up to commercial uptake of water, fishery and recreational purpose.

#### Gandhisagar lake

The Gandhisagar Lake [21° 08'48"N and 79°05'55"E] this lake is situated in the central part of the Nagpur city towards East. It is closed water bodies at all proximities. This lake is fed by storm water drains. This lake has several temples on its

bank which unknowingly contaminate water by dried flowers, garlands polythene bags and garbage.

#### Materials and Methods

Study on macro benthos was conducted between September 2012 to August 2014 at selectively four locations of each lakes. Sediment along with benthic fauna was collected with the help of Ekman dredge having size 6" x 6" x 6". The collected sample was further sieved with the help of copper sieve having mesh size of 500 µ. Macro benthic invertebrates obtained after sieving were preserved in 4% formalin for further laboratory studies and identifications. Macro benthos were analyzed under the dissecting microscope (10 x; 20 x); acetocarmine stain was used for staining the fauna. The benthic macro invertebrates were sorted out by forceps and classified them species wise, counted and catalogued. The identification up to the species was done by following the standard literatures (Edmondson 1959; Needam 1962; Tonapi 1980; Pennak 1989) [3, 14, 19, 17].

#### Observation

**Table 1:** Benthic Invertebrates of Three Lakes in Nagpur. (+ Present; - Absent)

| Macro benthic Invertebrates |  | Lakes studied |        |             |
|-----------------------------|--|---------------|--------|-------------|
|                             |  | Ambazari      | Futala | Gandhisagar |
| Phylum-Platyhelminths       |  |               |        |             |
| Class-Turbellaria           | <i>Planaria</i>                              | -             | -      | +           |
| Phylum – Annelida           |  |               |        |             |
| Class -Oligochaeta          |  |               |        |             |
| Family-Tubificidae          | <i>Linnodrillus hoffemeistri</i>             | +             | +      | -           |
| Family-Nadidae              | <i>Nais communis</i>                         | +             | +      | +           |
|                             | <i>Aeolosoma bengalensis</i>                 | +             | +      | +           |
| Family-Lumbricidae          | <i>Lumbriculus variegatus</i>                | +             | +      | +           |
| <b>Class- Hirudinea</b>     |  |               |        |             |
| Family-Glossiphonidae       | <i>Glossiphonia sp.</i>                      | +             | +      | -           |
| Phylum – Arthropoda         |  |               |        |             |
| Class-Arachnida             | <i>Hydracarina sp.</i>                       | +             | +      | +           |
| <b>Class - Crustacea</b>    |  |               |        |             |
| Order-Decapoda              | <i>Caridina sp.</i>                          | -             | +      | -           |
|                             | <i>Paratelpusa jacquemontii</i>              | +             | +      | +           |
|                             | <i>Gelasimus sp.</i>                         | +             | +      | +           |
| Class- Insecta              |  |               |        |             |
| Order - Odonata             |  |               |        |             |
| Sub order- Anisoptera       | Dragonfly nymphs                             | +             | +      | +           |
| Sub order- Zygoptera        | Damselfly nymphs                             | +             | +      | +           |
| <b>Order- Diptera</b>       |  |               |        |             |
| Family-Tendipididae         | <i>Chironomus sp.</i>                        | +             | +      | +           |
| Family-Culicidae            | <i>Anopheles sp.</i>                         | +             | +      | +           |
|                             | <i>Culex sp.</i>                             | +             | +      | +           |
| Family-Syrphidae            | <i>Eristalis sp.</i>                         | +             | +      | +           |
|                             | <i>Rhpidolabis sp.</i>                       | +             | +      | +           |
| Family-Tabanidae            | <i>Tabanus sp.</i>                           | +             | +      | +           |
|                             | <i>Musca autumnialis</i>                     | +             | -      | -           |
| <b>Order - Hemiptera</b>    |  |               |        |             |
| Family-Nepidae              | <i>Nepa sp.</i>                              | +             | +      | +           |
|                             | <i>Ranatra elongate</i>                      | +             | +      | +           |
| Phylum – Mollusca           |  |               |        |             |
| Group-Gastropoda            | <i>Vivipara bengalensis</i>                  | +             | +      | +           |
|                             | <i>Melania stritella tuberculata</i>         | +             | +      | +           |
|                             | <i>Melania scabra</i>                        | +             | +      | +           |
|                             | <i>Lymnea lutiola</i>                        | +             | +      | +           |
|                             | <i>Indoplanorbis exustus</i>                 | +             | +      | +           |
|                             | <i>Faunus ater (Linnaeus)</i>                | +             | +      | +           |
| Group-Pelecypoda            | <i>Lamellidens correaanus</i>                | +             | +      | +           |
|                             | <i>Lamellidens marginalis</i>                | +             | -      | -           |
|                             | <i>Parreysia corrugatanagpoorensis (Lea)</i> | +             | -      | -           |

During the present investigation a total of 30 species of macro benthic invertebrates belonging to four phylum were recorded from all the three lakes. The Ambazari Lake showed high species diversity with 28 species, while 26 species were recorded from Futala Lake; however 24 species were recorded from Gandhisagar Lake. S.B. Zade and S.R. Sitre (2012) [23] observed 13 macro benthic species belonging to three phylum in a polluted urban Naik lake of Nagpur city. In the present investigation Phylum Platyhelminths are represented by class turbellaria with *Planaria* sp. Phylum Annelida are represented by class Oligochaeta, family tubificidae with *Limnodrilus hoffmeisteri*, family Nainidae with *Nais communis* and *Aeolosoma bengalensis*, family Lumbricidae with *Lumbricus variegatus* species respectively. The class Hirudinea, family Glossiphoniidae includes *Glossiphonia* sp. In the phylum Arthropoda class arachnida includes *Hydracarina* sp. (Water mites). The class crustacea was represented by *Caridina* sp., *Paratelphusa jacquemontii* and *Gelasimus* sp. The major benthic fauna are observed as the larvae, nymph, naids of Class Insecta, includes order Odonata with sub order anisoptera and zygoptera as dragonfly and damselfly naids respectively. The species belonging to order Diptera includes larva of *Chironomus* sp., *Anopheles* sp., *Culex* sp., *Eristalis* sp., *Rhaphidolabis* sp., *Tabanus* sp., *Musca autumnalis*. The species belonging to order Hemiptera includes *Nepa* sp. and *Ranatra elongata*. In the present investigation the second major group of species belongs to phylum Mollusca having group Gastropoda includes *Vivipara bengalensis*, *Melania striatella*, *tuberculata*, *Melania scabra*, *Lynea lutiola*, *Indoplanorbis exustus*, *Fanus ater* and group Pelecypoda includes *Lamellidens correatus*, *Lamellidens marginalis* and *Parreysia corrugata nagpoorensis* (Lea). The macrozoobenthic studies in lotic ecosystem of Gadchiroli district in Maharashtra is done by Bhandarkar S.V. and Bhandarkar W.R. (2013) [2].

### Results and Discussion

In the present investigation their presence is determined and calculated. The result shows Ambazari is having more count followed by Futala (Also named as Telangkhedhi) and Gandhisagar (Also named as Shukrawari). The present result is further analyzed as percentage of abundance and their frequency for each species. It is clear from the result of the present study that species belonging to phylum arthropoda, class insect and phylum Mollusca are abundant amongst the benthic invertebrates of all species. This clearly shows that Ambazari Lake is rich in benthic fauna compared to Futala Lake and Gandhisagar Lake. Such comparative studies of three seasonal ponds in relation to macro invertebrate fauna is studied by Sharma L.L. *et al.* (2007) [18] at southern Rajasthan. The presence of *Planaria* sp., Hirudinea and Hemiptera in the assessment of macro invertebrates in the ranjit sagar reservoir, Jammu and Kashmir (I) is recorded by Adarsh Kumar *et al.* (2006) [1]. In general the benthic communities of polluted water bodies are determined by the larval forms of species belonging to Tubificidae and chironomidae (Hynes, 1960) [8]. These have also been used as a pollution indicator (Gaufinn, 1957) [5]. Mandal and Moitra (1975) [13] have reported minimum benthic fauna in urban lentic reservoirs at Burdwan. Occurrence of the Oligochaeta in the lentic and lotic fresh water reservoirs in Nagpur are recorded by K.Vanamala Naidu and H.N. Shrivastava (1979) [11]. The studies regarding benthic fauna at Bhatgaon dam,

distt. Parbhani M.S. (I) indicates the presence of Crustacea including Decapoda species and Mollusca species, Kadam D.D. *et al.* (2005) [12]. Studies regarding trophic status of two lakes in Nagpur was carried by Indira Jayagoudar *et al.* (1984) [9]. This study reveals that Gandhisagar lake is subject to artificial eutrophication and the lake can be classified as hyper eutrophic. Futala lake is subjected to natural eutrophication and can be classified as mesotrophic. The benthic invertebrates act as a good foraging ground for standing fish crop, Jhingran (1982) [10]. The inference from the present study is the lakes harbors varied amount of benthic fauna and proved as a good productive ground for fish culture practice. It is also perceived that lakes are threatened to their productive grounds due to human anthropogenic activity and garbage waste dumped. It is in the need for conservation strategies to be implied and regulated.

### Conclusion

The study conducted on the macrozoobenthic diversity of three urban lakes in Nagpur City has revealed a rich and varied assemblage of 30 species across four phyla: Platyhelminths, Annelida, Arthropoda, and Mollusca. Among these, the highest species richness was observed in Ambazari Lake, followed by Futala and Gandhisagar lakes, indicating that habitat conditions play a critical role in supporting diverse benthic communities.

Phylum Arthropoda, particularly the larvae and nymphs of aquatic insects, dominated the benthic invertebrate community, while Mollusca also showed significant presence, highlighting the ecological importance of these groups. The notable abundance of Oligochaeta and Hirudinea within Annelida, along with the minimal representation of Platyhelminths, suggests a complex interplay of environmental factors influencing these ecosystems.

The findings underscore the correlation between organic enrichment and benthic fauna richness, pointing to the influence of human activities on these urban lakes. As such, the results emphasize the need for targeted conservation efforts to mitigate pollution and habitat degradation, ensuring the sustainability of these vital aquatic ecosystems. This study contributes to the understanding of benthic biodiversity in urban settings and underscores the importance of monitoring and protecting these ecosystems as indicators of ecological health.

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