



## Macro-benthic diversity and distribution in Thippagondanahally reservoir, Bangalore, Karnataka, India

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### Abstract

Aquatic macro invertebrate are used in fresh water quality assessment to identify the environmental stress from a variety of anthropogenic disturbances. They also play a significant role in the food chain of an ecosystem. Monthly survey of macrobenthic community diversity and water quality assessment was done from Dec. 2015 to Nov. 2016 in Thippagondanahally reservoir. Three phylums Arthropoda, Mollusca and Annelida were reported. Arthropoda was the most dominant group in all seasons.

**Keywords:** benthic macro-invertebrate, pollution, Thippagondanahally reservoir

### Introduction

Bio-monitoring is a valuable assessment tool that is receiving increased use in water quality monitoring. Benthic micro fauna are those organisms that live on or inside the deposits at the bottom of the water bodies (Barnes and Hughes, 1988, Idown and Ugwumba 2005) [2, 16]. Macro benthic invertebrates are useful bio-indicators provides more accurate understanding of changing aquatic conditions than chemical and microbiological data, which at least give short term fluctuations (Ikowi *et al.*, 2005). Obtaining representative benthic invertebrate samples in an important consideration for both ecological and bio monitoring studies that require the collection of multiple replicate samples from numerous sites (Barbour and Gerritsen, 1996) [15]. Benthic invertebrates are consumers of basal resources (algae, biofilms, organic matter) and secondary consumers. They are the link from basal resources to higher trophic levels, including fishes. The main object of the study was identified and uses macro benthic invertebrates to evaluating water quality status of Thippagondanahally reservoir in respect of benthic organism.

### Materials and Methods

Thippagondanahally reservoir located at the confluence of the Arkavathy and Kumudavathi rivers. Thippagondanahally reservoir is located at Magadi Road, near Bangalore. Also known as T.G.Hally dam. It has a catchment area of 1453 Sq.km. and covers Doddaballapur, Nelamangala, Devanahally, Magadi and Bangalore taluks. The reservoir is also a major source of drinking water for the western parts of Bangalore.

### Sampling Method for Macro Invertebrates

The present study samples were collected from 3 points of Thippagondanahally reservoir for a period of one year from December 2015 to November 2016. The reservoir is mainly composed of gravels, silt, clay, detritus and macrophytic vegetation. Two sampling devices used sieve (mesh size 0.6 mm) and hand net of the similar size. The sampling was carried out from the bank of reservoir. Sample was placed on

a sieve and washed with water. Alive benthic macroinvertebrates were picked up from the sample by forceps pins and preserved in 70% alcohol, for microscopic identification at laboratory. After isolation the macrobenthic organism were counted and identified to using keys provided by Edmondson (1959) [1], Needham and Needham (1974) [3] and Mitra and Kumar (1998) [4].

### Results and Discussion

The Thippagondanahally reservoir was found to be inhibited by a variety of benthic fauna all through the period of investigation. During the present investigation of a total 11 order of macro invertebrates belongs to 3 phylum Arthropoda, Mollusca and Annelida were recorded from Thippagondanahally reservoir. During monsoon Arthropoda contribute the largest share constituting (62%) of total macrobenthic invertebrate fauna, followed by Mollusca (28%) and Annelida (10%) respectively. In winter and summer Arthropoda also contributing largest share constituting (64%), (55%) of macrobenthic invertebrates fauna, followed by Mollusca (24%), (11%) and Annelida (12%), (24%) respectively. Shukla and Shrivastava (2004) [5] also reported similar observation.

**Table 1:** Seasonal percentage dominance of Benthic Macro-invertebrate Phylums

Phylum	Monsoon (%)	Winter (%)	Summer (%)
Arthropoda	62	64	55
Mollusca	28	24	11
Annelida	10	12	24

Ephemeroptera– May fly often an indicator of clean water quality and are also sensitive to pollution, but some of the tolerant species are also available. Ephemeroptera do not tolerant organic enrichment but Baetis sp. is an exception in being tolerant of appreciable organic enrichment. The seasonal percentage dominance of Ephemeroptera was in monsoon (12%) followed by in winter (9%), while in (7%) in summer. These clearly indicate that the presence of

Ephemeroptera in the monsoon and winter water quality was good in comparison to summer. Trichoptera – Trichoptera are important in aquatic ecosystem because they process organic matter and are an important food source for food fish. It is largest order on insecta, in which most members are truly aquatic. In the present study order Trichoptera represented by family Hydropsychidae. The seasonal percentage dominance of Trichoptera was reported in monsoon (10%), followed by (12%) in winter and (8%) in summer. Low frequency of Trichoptera in summer clearly indicate polluted water quality status in summer because Trichoptera are sensitive to pollution but can live in polluted water if good amount availability of food and oxygen. Similar distribution of Trichoptera was recorded by Flores and Zafaralla (2012) [6].

Coleoptera – Coleopterans, commonly known as water beetle. Beetles belong to the most diverse order of living organisms. Adult beetles are tolerant of a wide variety of pollutants. Often more than millions species of insect at least one third are beetles. Order Coleoptera represented by genera Psephanus, Gyrimus and Cybister. The seasonal percentage dominance of Coleoptera in monsoon was (15%) followed by (14%) in winter and (20%) in summer. The insects are not particular in their choice of water bodies and occur in wide variety of habitat. The abundance of Coleoptera in monsoon and winter can be related to the availability of food and macrophyte vegetation which helps in growth. Mishra and Prasad (2013) [12] also reported similar observations. Hemiptera – They are commonly known as water bugs. This is a larger order. Aquatic bugs live both in tuning and standing waters. Most of them are surface dwellers. Some of them are sensitive species but most of them prefer moderately polluted waters. They either carry air bubble while swimming or breathe through abdominal tall like siphon. This order represented by family Ranatra, Gerris, Belostoma, Corixa and Nepa. The seasonal percentage dominance of order Hemiptera in monsoon (23%), followed by (21%) in winter and (20%) in summer. During the study almost absence of Hemiptera in summer is related with high temperature, rainfall and pollution status affects the population fluctuation of Hemiptera. Habeeba and Saltant (2014) also reported similar observations.

Odonata – The presence of these animals indicates input of little organic pollution in the slow moving or standing clean waters. They can be observed around water bodies, nymph of dragons is robust while damsel is slender with distinct head, thorax and abdomen. Order Odonata represented by genera Aesha, Libelluilla and Lestes. The seasonal percentage of dominance of order Odonata in monsoon (8%), followed by (10%) in winter and in summer (4%). This observation clearly indicate highly polluted status in summer because Odonata nymph were found in only fresh water there is abundance of oxygen and unpolluted water. Lonkar and Kedar (2014) [8] also reported similar observations. Crustacea – The animals of this group are moderately intolerant of pollution. These animals can be observed in variety of standing and flowing waters, hiding in plants of shallow waters under the debris and organic debritus. Order was represented by genera Macrobrachium. The seasonal percentage dominance of Order Crustacea in monsoon (6%) in winter (8%) and in summer (5%). Sharma *et al.* (2013) [9] also reported similar observations.

Gastropoda – Class Gastropoda represented by two orders Pulmonata and Operculata. Order Placoptera and Pulmonata represented by family Planorbidae, Lymnaeidae, Physidae, Viviparidae and Thiaridae. The seasonal percentage dominance of order Pulmonata was (22%) in summer, followed by (7%) in winter and (4%) in monsoon, although order Operculata higher in monsoon (8%), followed by (7%) in winter and (4%) in summer. Order Pulmonata is tolerant to pollution the abundance reports of this organism where enrichment the organic matter and macrophyte, however order Operculata are intolerant to pollution. Waghmare *et al.* (2012) also reported similar observations.

Bivalvia – Group Bivalvia represented by order Pelecypoda, family Corbiculidae and Unionidae. Bivalvia are less tolerant to pollution. The seasonal percentage dominance of Order Pelecypoda was (8%) in monsoon, followed by (4%) in winter and (2%) in summer. This observation indicates that water was moderate in monsoon and highly polluted in summer. Kumar and Vyas (2012) [13] also reported similar observations. Annelida – Phylum Annelida represented by two orders Oligochaeta and Hirudinea. Oligochaeta are true worms of which the setae are arranged segmental. Annelida represented by genera Tubifex. Hirudinea commonly named leeches. These animals are indicator of highly polluted water and can live several days without oxygen. Both orders represented by genera Glossiphona and Eropobdella. The seasonal percentage dominance of Order Oligochaeta (6%) in summer, followed by (4%) in winter and (3%) in monsoon, although percentage dominance of Hirudinea was (3%) in monsoon, followed by (4%) in winter and (2%) in summer. Abundance of Annelida in summer clearly indicates the enrichment of nutrients and severe pollution status. Similar observations reported by Abida (2013) [14].

**Table 2:** Seasonal percentage dominance of Benthic Macro-invertebrate Phylum

Order	Monsoon (%)	Winter (%)	Summer (%)
Ephemeroptera	12	9	7
Trichoptera	10	12	8
Coleoptera	15	14	20
Hemiptera	23	21	20
Odonata	8	10	24
Crustacea	6	8	5
Pulmonata	4	7	22
Operculata	8	7	4
Pelecypoda	8	4	2
Oligochaeta	3	4	6
Hirudinea	3	4	2

### Conclusion

It is conclude that during this study it is observed abundance of Macrobenthic invertebrates was decreasing order winter > monsoon > summer. On the basis of abundance of macrobenthic invertebrates as pollution indicators, water quality of T.G.Hally reservoir less polluted in monsoon, moderately polluted in winter and higher polluted in summer.

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