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BENTHIC MACROINVERTEBRATES AS A BIOINDICATOR FOR WATER QUALITY IN TAMASI LAKE TAHSIL BHADRAVATI DIST. CHANDRAPUR

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ABSTRACT

Benthic macroinvertebrates serve as effective bioindicators of water quality due to their sensitivity to environmental changes and their crucial role in aquatic ecosystems.Benthic macroinvertebrates act as biosensors, reflecting changes in water quality and ecosystem stability. Seasonal and spatial variations were analysed alongside key physicochemical parameters. Study area was Tamasi Lake, Tamasi Rt village, located in Bhadravati tehsil of Chandrapur district in Maharashtra, India.This study examines benthos diversity in Tamasi lake over a two-year period Jan 2023–December 2024 to assess ecological health and water quality. In present investigation total of 44 macro invertebrate species were recorded and identified, from 4 Phylum ,18 Orders and 30 Families from all the study sites. The Phylum Mollusca of macro invertebrates showed their maximum appearance with 17 species, The present study concludes that Benthic community that shows changes in diversity pattern. The diversity of species at all the four sampling sites shows that lake water is suitable for benthic organisms.

INTRODUCTION

The term "benthic" refers to organisms that inhabit the bottom of aquatic environments, while "macroinvertebrates" are invertebrates large enough to be seen without a microscope. This diverse group includes insect larvae, molluscs crustaceans and annelids.Benthic organisms play a crucial role in freshwater ecosystems, contributing to nutrient cycling, organic matter decomposition, and serving as indicators of water quality (Covich *et al.*, 1999). The diversity of benthic macroinvertebrates in lakes is influenced by several environmental factors, including water chemistry, sediment composition, and anthropogenic disturbances (Rosenberg and Resh, 1993). Change in climate can significantly alter the benthic ecosystem suitability and their processes and functions.Sensitive taxa, such as Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT group), indicate clean, well-oxygenated waters. Conversely, the dominance of pollution-tolerant species, such as Chironomidae (midges) and Oligochaeta (aquatic worms), suggests degraded water conditions, thus resulting disturbance in benthic species distributions, community structures and diversity patterns (Halse et al., 2002) and (Walmiki*et al.*,2016).). This study aims to explore the composition and ecological significance of benthic macroinvertebrates, emphasizing their role in assessing water quality and maintaining aquatic ecosystemwith higher diversity often indicating a stable and balanced ecosystem (Wallace and Webster, 1996).Additionally benthic habitats offer ways to mitigate and adapt to the consequences of climate change.Therefore, assessing benthos diversity is essential for monitoring ecological integrity and guiding conservation efforts (Strayer, 2006).

This study aims to investigate the effects of climate change on benthos diversity inTamasi lake by analysing species composition, abundance, and environmental parameters. Present investigation indicated that macro-benthic community can be useful in evaluating the effects of organic enrichment in the aquatic systems.

Materials and Methods

Study Area

Tamasi Rt village is located in Bhadravati tehsil of Chandrapur district in Maharashtra, India. Catchment area of this project is 0.165 sq. mile and its design I.C.A is 2.40 Ha and 50% dependable yield is 40.73". This Ex.Mal.tank has 435 m long earthen dam. Present study area was within latitude 20028'25" and longitude 79026'78", the average number of rainy days more than 80 with hot summer 460 to 48˚C and average rainfall 1191.26 mm. The present investigation is carried out from Jan 2023 to Jan 2025 at four different sites of lake.

Sample Collection

Benthic macroinvertebrates were collected using a standard Ekman grab (15x15 cm) and hand net (mesh size 500 µm) to ensure efficient sediment sampling from various depths. At each site, three replicate samples were taken to account for spatial variability. The collected sediment samples were sieved through a 500 µm mesh sieve to separate macroinvertebrates from debris and sediment particles.The extracted benthic organisms were preserved in 5% formalin and stained with Rose Bengal to enhance visibility. In the laboratory, samples were sorted, identified, and classified under a stereo zoom microscope (10x-40x magnification) using standard taxonomic keys (Edmondson, 1959 andPennak, 1978). Identification was carried out up to the

lowest possible taxonomic level, with species classified into 7 orders and 8 families.The identification of organisms up to species level was done with the help of standard keys Tonapi (1980), Kazanci and Girgin (1998)

RESULT AND DISCUSSION

A total of 44Species belonging to 29 Families, 18 Orders of 4 Phyla, were collected from four sampling sites of Tamasi Lake, represented in Table -1.1 Among the total species phylum Mollusca shows dominance on three otherphylums, with 10 families and 05 orders, followed by, Arthropoda with 13 families and 06 orders, Annelida with 03 families and 04 orders and least presence of species from phylum Platyhelminthes, with 03 families and 03 orders. Site wise distribution of species when studied, site -I was dominant than other three sites, the least distribution of species was noted at site IV ,and site II and III showed moderate dominance of species.Most of the taxa were from aquatic insectsincluding Ephemeroptera, Plecoptera,and Trichoptera(EPT) taxa, Odonata,Coleoptera and Diptera.(Haidekkerand D. Hering, 2008).The highest taxonomic diversity and individual abundance are found in the groups of aquatic animals known asInsecta,Mollusca and Annelida. The dominating taxa were Diptera, Trichoptera,Ephemeroptera and Mollusca (Bhuteand Harney, 2017). The frequency and individual abundance of Baetidae and Chironomidae were particularly high. The taxonomic diversity of Platyhelminthes and Annelida was limited but their individual abundance and occurrence were high (Lenat 1988).

Indications of the biological health of waterbodies are depending on the presence of benthic macroinvertebrates. Because they live or spend the majority of their lives in aquatic ecosystem, and have varying levels of pollution tolerance. In contrast to fish, macroinvertebrates have limited mobility, can survive for more than a year, and react to disturbances from humans in fairly predictable ways. They are also relatively simple to identify in the lab. Actually, because they are incapable to avoid pollution, macroinvertebrates are able to integrate the impacts of the stressors they are exposed to, throughout time and in combination. For many years, biologists have been investigating the situation and make-up of benthic macroinvertebrate ecosystems.

In present investigation all the physico- chemical parameters was in permissible limit. Temperature and pH were within normal ranges for supporting freshwater invertebrates. The reduction of dissolved oxygen concentrations and increasing turbidity levels would be responsible to changes in the macroinvertebrate community. Most of the studies have already showed that oligochaetes and chironomids are the predominant benthic macroinvertebrates inhabiting organic sludge (Narasimhaand Benarjee ,2017). DO is one of the most significant abiotic factors for the aquatic life, Measure of dissolved oxygen defines the living conditions for oxygen-requiring aquatic organisms. DO affects the accessibility and dissolving of nutrients; a less concentration of dissolved oxygen facilitates the release of nutrients from the sediments and therefore affects the productivity of aquatic ecosystems.

Satellite view of Tamasi Lake Bhadravati, DistChandrapur

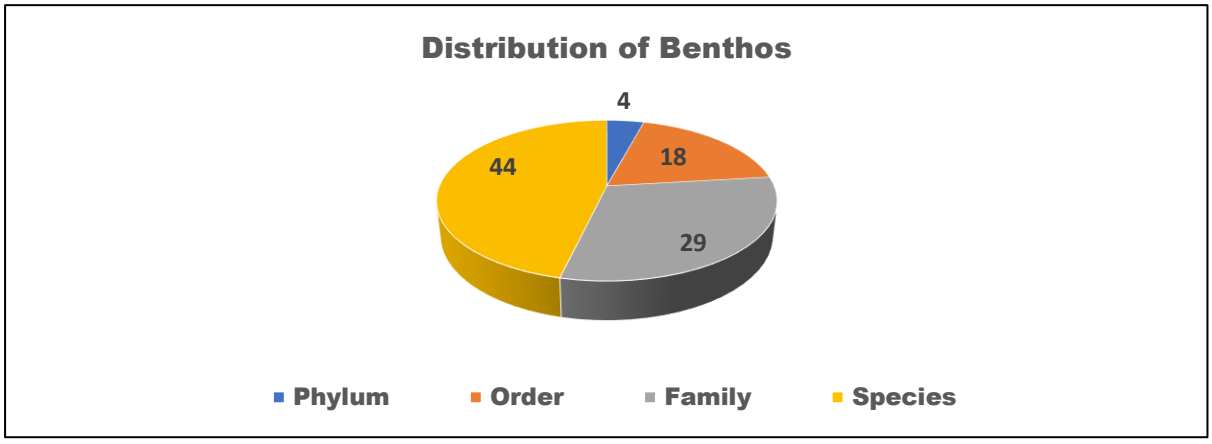

Fig. 1.1Graphical Representation of Benthic Macroinvertebratedistribution at Tamasi Lake Bhadravati, Dist.-Chandrapur

Table no.1.1: Distribution of Benthic forms of Tamasi lake during the year 2023 -2024

S.N.	Phylum	Order	Family	*Genera*	Site I	Site II	Site III	Site IV
					2023	2023	2023	2023
1	Platyhelminthes	Cestoda	Cyclophyllidae	*Taeniidae spp.*	++++	++++	++++	++++
		Tricladida	Planariidae	*Planaria spp.*	----	++++		++++
		Rabhtidida	Diplogastridae	*Diplogaster fictor*	++++	++++	++++	++++
2	Annelida	Tubificida	Naididae	*Stylaria spp.*	++++	++++	++++	----
				Derodorsalis	----	++++	++++	++++
				Limmodrilush offmeisteri	++++	----	----	++++
				Tubifex tubifex	++++	++++	++++	++++
		Haplotaxida		*Pristina aequiseta*	++++	++++	++++	++++
		Aciculata	Neredidae	*Platynereis spp.*	----	++++	----	++++
		Hirudinide	Hirudinidae	*Hiruda spp.*	++++	++++	----	++++
3	Arthropoda	Hemiptera	Corixidae	*Corixa spp.*	++++	++++	----	----
			Notonectidae	*Notonecta spp.*	++++	----	++++	++++
			Gerridae	*Gerris spp.*	----	++++	++++	++++
				Metrobates spp.	++++	++++	++++	++++
			Belostomatidae	*Diplonychus rusticus*	++++	----	----	++++
			Nepidae	*Ranatra spp.*	++++	++++	++++	++++
		Odonata	Coenagrionidae	*Ceriagrion spp.*	++++	----	++++	----
				Ischnura spp.	++++	++++	----	++++
				Enallagma spp.	++++	++++	++++	----
		Coleoptera	Staphylinidae	*Heterothops megalops*	----	++++	++++	----
			Gyrinidae	*Dineutus spp.*	----	++++	++++	----
			Coccinellidae	*Harmonia axyrida*	----	----	++++	++++
		Decapoda	Parathelpueidae	*Brachyurid spp.*	++++	++++	----	++++
			Palaemonidae	*Palaemonid spp.*	++++	++++	++++	----
		Amphipoda	Oxycephalidae	*Rhabdosoma minor*	++++	++++	++++	++++
		Diptera	Chironomidae	*Chironmous spp.*	++++	----	++++	++++
				Procladius spp.	++++	++++	----	++++
4	Mollusca	Architaenioglossa	Ampullariidae	*Pila spp.*	----	----	++++	++++
			Viviparidae	*Filopaludina bengalensis*	++++	++++	++++	----
				Vivipara bengalensis	++++	++++	++++	----
		Unionida	Unionidae	*Ligumial atissima*	++++	----	++++	++++
				Unio spp.	----	++++	++++	++++
		Pelecypoda	Naididae	*Lamellidens marginalis*	++++	++++	++++	----
				Lamellidens corrianus	++++	++++	----	++++
		Veneroida	Cyrenidae	*Corbicula fluminea*	++++	++++	++++	----
		Gastropoda	Lymnaeidae	*Lymnaea auricularia*	++++	++++	----	++++
				Lymnaea acuminata	++++	----	++++	++++
			Ariophantidae	*Ariophanta bristrialis*	----	++++	----	++++
			Pachychilidae	*Faunus ater*	++++	++++	++++	++++
			Planorbidae	*Heliosoma ancups*	++++	----	++++	++++
				Indoplanor bisexustus	++++	++++	++++	----
			Thiaridae	*Melanoides tuberculata*	----	----	++++	++++
				Thiara scabra	++++	++++	++++	++++
				Pomacea spp.	++++	----	++++	----

CONCLUSION

Study concluded that, the distribution and abundance of aquatic life are influenced by water quality, with a special focus on benthic macroinvertebrates, which have long been used as bioindicators in both lotic and lentic water bodies. Benthic macroinvertebrates are divided into four groups based on their tolerance levels to pollution: highly sensitive, semi sensitive, semi tolerant, and very tolerant.(Ramakrishna, 2014)The dissolved oxygen is reduced when the number of organic

pollutants rises, which makes it impossible for pollution-sensitive benthic macroinvertebrates to live. The presence of sensitive species suggests that water bodies wasin good health, and the abundance of these species suggests that freshwater ecosystems are stable. The more occurrence of pollution tolerant benthic macroinvertebrates in water resources reveals the ecological risk assessment.

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