DIVERSITY OF BENTHIC MACROINVERTEBRATES IN SHIVAN RESERVOIR OF AKOLA DISTRICT, MAHARASHTRA, INDIA

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Abstract
The present study assesses the diversity of benthic macroinvertebrates in Shivan Reservoir, Akola District, Maharashtra, India, during February 2023 to January 2025. Monthly sampling at three sites recorded 29 taxa belonging to Annelida, Mollusca, and Arthropoda. Mollusca, particularly gastropods, dominated the community, indicating favourable substratum and stable water conditions. The occurrence of both pollution-sensitive and tolerant taxa suggests moderate to good ecological health of the reservoir. The study provides baseline data highlighting the usefulness of benthic macroinvertebrates as bioindicators for freshwater ecosystem assessment.
Keywords: *Benthic macroinvertebrates; Species diversity; Freshwater reservoir; Bioindicators; Shivan Reservoir*

Introduction

Freshwater ecosystems such as reservoirs, lakes, rivers, and wetlands play a vital role in sustaining biodiversity and supporting human livelihoods. Among the biological communities inhabiting these ecosystems**,** benthic macroinvertebrates constitute one of the most important and functionally significant groups. These organisms, which include insects, molluscs, annelids, and crustaceans, inhabit the bottom substrates of aquatic habitats and are integral to energy flow, nutrient cycling, and organic matter decomposition. Owing to their limited mobility, varied life cycles, and differential tolerance to environmental stress, benthic macroinvertebrates are widely recognized as reliable indicators of aquatic ecosystem health and water quality.

Reservoirs, being artificial yet ecologically dynamic freshwater systems, exhibit complex interactions between physical, chemical, and biological components. The construction of reservoirs alters natural riverine conditions, leading to changes in hydrology, sediment composition, nutrient dynamics, and habitat heterogeneity. These changes, in turn, influence the structure and composition of benthic macroinvertebrate communities. Studying the diversity and distribution of these organisms in reservoirs therefore provides valuable insights into ecosystem functioning, habitat quality, and the impacts of natural as well as anthropogenic disturbances.

India possesses a vast network of reservoirs that contribute significantly to irrigation, drinking water supply, fisheries, and hydropower generation. However, many of these water bodies are increasingly subjected to pressures such as agricultural runoff, domestic effluents, siltation, fluctuating water levels, and climate variability. In this context, benthic macroinvertebrates serve as effective biological tools for assessing the ecological status of freshwater systems and for developing sustainable management and conservation strategies.

Shivan Reservoir, located in Akola District of Maharashtra, is an important freshwater resource supporting irrigation, fisheries, and local livelihoods. Despite its socio-economic significance, comprehensive ecological studies on this reservoir, particularly with respect to benthic macroinvertebrate diversity, remain limited. The region experiences pronounced seasonal variations in rainfall and temperature, which are likely to influence water quality parameters and benthic community structure. Establishing baseline information on benthic macroinvertebrate diversity is therefore essential for understanding the ecological condition of the reservoir and for monitoring future environmental changes.

The present study aims to document the diversity, composition, and distribution of benthic macroinvertebrates in Shivan Reservoir of Akola District, Maharashtra, India. By generating systematic data on benthic fauna, this investigation seeks to contribute to freshwater biodiversity documentation, support ecological assessment of the reservoir, and provide a scientific basis for conservation and management of freshwater resources in the Vidarbha region.

Materials and methods

The present study was carried out from February 2023 to January 2025 to assess the diversity of benthic macroinvertebrates in Shivan Reservoir,

located at 20°38′1″ N and 77°26′53″ E in Murtizapur Taluka of Akola District, Maharashtra. Water and benthic samples were collected monthly from three selected sites in the downstream region of the dam during the early morning hours (07:00–08:30 h) to minimize diurnal variations in physicochemical parameters.

Benthic macroinvertebrates were collected using a tray-type sampler, while organisms attached to stones and submerged substrates were hand-picked with forceps and soft brushes. The samples were washed and sieved through a 500-µm brass sieve, preserved in 5% formalin, and transported to the laboratory for further analysis (Patharde and Telkhade, 2024). Identification was performed using a stereomicroscope and a 6× hand lens, following standard taxonomic keys and reference literature (Edmondson, 1959; Tonapi, 1980; Pennak, 1989; Rao, 1989; Mitra and Dey, 2005; Naidu, 2005; Dey, 2007).

Result and discussion

A total of 29 taxa belonging to three major phyla namely Annelida, Mollusca, and Arthropoda were documented, indicating a moderately rich and ecologically heterogeneous benthic community in the reservoir.

The phylum Mollusca emerged as the dominant group, both in terms of species richness and taxonomic representation. Within Mollusca, the class Gastropoda was particularly well represented with a wide range of snail species such as *Pila*, *Lymnaea*, *Gyraulus*, *Indoplanorbis*, *Thiara*, and *Bellamya*. The presence of multiple gastropod genera suggests favourable bottom substratum, availability of periphyton and detritus, and relatively stable water conditions. Gastropods are known to be sensitive to changes in physicochemical parameters, especially calcium content, alkalinity, and dissolved oxygen, and their dominance indicates comparatively productive and moderately enriched conditions in the reservoir. The class Bivalvia, represented by *Lamellidens* and *Parreysia* species, further reflects suitable sediment texture and organic matter availability, as these organisms are filter feeders closely associated with sediment quality.

The phylum Annelida, represented by *Hirudinaria* and *Pheretima* species under the class Clitellata, was observed throughout the study period. The occurrence of annelids across all seasons indicates tolerance to a wide range of environmental conditions. Their presence often signifies organic enrichment of sediments, as annelids thrive in substrata rich in decomposing organic matter. Thus, their occurrence suggests moderate organic loading in the benthic zone of Shivan Dam.

The phylum Arthropoda, represented entirely by the class Insecta, contributed significantly to the functional diversity of the benthic community. Aquatic insect groups included nymphs of dragonflies, damselflies, stoneflies, and mayflies, along with aquatic bugs (*Diplonychus*, *Nepa*, *Ranatra*, *Belostoma*), beetle larvae (*Hydrophilus*), dipteran larvae (*Eristalis*, *Chironomus*), and mosquito larvae (*Anopheles* and *Culex*). The presence of mayfly and stonefly nymphs, which are generally considered pollution-sensitive taxa, indicates comparatively good water quality and adequate dissolved oxygen levels, at least during certain periods of the year. In contrast, the occurrence of chironomid and mosquito larvae, known for their tolerance to low oxygen and organic pollution, suggests localized or seasonal enrichment conditions within the reservoir.

The coexistence of pollution-tolerant and pollution-sensitive taxa reflects heterogeneous environmental conditions in Shivan Dam, influenced by seasonal fluctuations, water level variations, and physicochemical changes. The dominance of larval and nymphal stages among insects highlights the role of the reservoir as an important breeding and developmental habitat for aquatic insects, contributing to energy transfer between benthic and higher trophic levels.

Overall, the benthic macro-invertebrate assemblage recorded in Shivan Dam indicates a moderately healthy freshwater ecosystem with balanced ecological conditions. The observed diversity pattern suggests that the physicochemical characteristics of the reservoir support a wide range of benthic life forms, while also reflecting mild to moderate anthropogenic influence. These findings underscore the utility of benthic macro-invertebrates as effective bio-indicators for assessing the ecological status and water quality of reservoir ecosystems.

The diversity patterns show strong concordance with previous investigations conducted by Camara *et al.* (2012), Bhandarkar and Bhandarkar (2013), Lonkar and Kedar (2014), Meshram (2014), Paliwal and Bhandarkar (2015), Walmiki *et al.* (2016), Ramulu and Banerjee (2017), Shyam and Anand (2018), Singh *et al.* (2019), Bacher (2020), Bele *et al.* (2020), Khan and Shrivastava (2021), Singh and Tripathi (2021), Borkar (2022), Shanthakumar and Padmakumar (2023), Patharde and Telkhade (2024), and Kalyanrao *et al.* (2025) and name a few. The close similarity in community structure across these studies suggests comparable environmental drivers and ecological processes shaping freshwater benthic assemblages across different regions.

Table 1. Diversity of benthic macro invertebrates in Shivan Dam

Sr.no	Phylum	Class	*Species*
1.	**Annelida**	**Clitellata**	*Hirudinaria sp. (Whitman, 1886)*
2.			*Pheretima sp. (Kinberg, 1867)*
3.	**Mollusca**	**Bivalvia**	*Lamellidens corrianus (Lea, 1819)*
4.			*Lamellidens marginalis (Lamarck, 1819)*
5.			*Parreysia corrugata (Müller, 1774)*
6.		**Gastropoda**	*Pila globosa (Swainson, 1822)*
7.			*Lymnaea acuminata (Lamarck, 1822)*
8.			*Lymnaea luteola (Lamarck, 1822)*
9.			*Gyraulus rotula (Benson, 1850)*
10.			*Indoplanorbis exustus (Deshayes, 1834)*
11.			*Thiara lineata (Gray, 1822)*
12.			*Thiara scabra (Müller, 1774)*
13.			*Thiara tuberculata (Müller, 1774)*
14.			*Bellamya bengalensis (Lamarck, 1822)*
15.			*Bellamya dissimilis (Müller, 1774)*
16.			*Bellamya eburnea (Annandale, 1921)*
17.	**Arthropoda**	**Insecta**	*Dragonfly sp. (Selys, 1854)*
18.			*Damselfly sp. (Selys, 1854)*
19.			*Stonefly sp. (Burmeister, 1839).*
20.			*Mayfly sp. (Rohdendorf, 1968)*
21.			*Diplonychus rusticus (Fabricius, 1871)*
22.			*Nepa sp. (Latreille 1802)*
23.			*Ranatra elongate (Fabricius, 1871)*
24.			*Belostoma sp. (Latreille, 1807)*
25.			*Hydrophilus sp. (Geoffroy, 1762)*
26.			*Eristalis sp. (Linnaeus, 1758)*
27.			*Chironomus sp. (Meigen, 1803)*
28.			*Anopheles sp. (Meigen, 1803)*
29.			*Culex sp. (Linnaeus, 1758)*

Conclusion

The present investigation recorded 29 benthic macroinvertebrate taxa belonging to Annelida, Mollusca, and Arthropoda, indicating a moderately rich and ecologically heterogeneous benthic community in Shivan Reservoir. The dominance of molluscs, particularly gastropods, reflects favourable substratum conditions, adequate food availability, and relatively stable physicochemical characteristics. The coexistence of pollution-sensitive taxa (mayflies and stoneflies) along with tolerant forms (chironomids and mosquito larvae) suggests overall moderate to good water quality with localized or seasonal enrichment. The benthic assemblage structure signifies a moderately healthy freshwater ecosystem, influenced by natural seasonal variations and mild anthropogenic pressures. These findings highlight the effectiveness of benthic macroinvertebrates as reliable bioindicators and provide essential baseline data for future monitoring, management, and conservation of the Shivan Reservoir ecosystem.

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