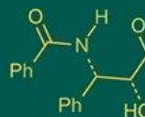


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Molecular diversity and relative abundance of 12 Molluscs from Navegaon Bandh reservoir, Taluka Arjuni Morgaon, Maharashtra, India

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Abstract

The present investigation was carried out in the Navegaon Bandh Reservoir, located within a National Park, in Taluka Arjuni Morgaon, District Gondia, Maharashtra, India. A total of 12 molluscan species belonging to two major classes, Gastropoda and Bivalvia, were recorded from three study sites during the period from November 2022 to February 2023. Among the gastropods, *Viviparus contextus* (13 individuals) was the dominant species, followed by *Pila globosa* (9 individuals) and *Planorbis planorbis* (7 individuals each). Among bivalve species, the most common species in the study area was *Planorbidae*. The relative abundance study revealed that gastropod species exhibited greater diversity and abundance than bivalves throughout the study period. In addition, 25% of the species recorded from the study region were categorized as rare, while 16.7% were very rare, indicating the need for proper conservation and sustainable management of freshwater habitats.

Keywords: Freshwater molluscs, Gastropoda, Bivalvia, Molluscan diversity, biodiversity, reservoir ecosystem, conservation

1. Introduction

Phylum *Mollusca* constitutes one of the most diverse and ecologically important groups of invertebrates, inhabiting a wide range of aquatic and terrestrial ecosystems. Molluscs form a dominant component of benthic (bottom-dwelling) communities and play a vital role in maintaining ecological balance. They are considered the second-largest group of invertebrates after insects and represent one of the most evolutionarily successful animal groups, with a fossil history extending over 500 million years. Globally, the number of molluscan species is estimated to range between 80,000 and 135,000, of which a majority inhabit marine ecosystems (approximately 37,000-100,000 species), while 14,000-35,000 species are terrestrial and around 5,000 species are confined to freshwater habitats (Abbott, 1989; Seddon, 1998) ^[1, 23]. This wide distribution reflects their remarkable adaptability to diverse environmental conditions and ecological niches.

Taxonomically, the phylum *Mollusca* is divided into 9-10 classes, most of which are predominantly marine. However, freshwater molluscs are mainly represented by the classes *Gastropoda* and *Bivalvia* (Pelecypoda), with gastropods being the most abundant and diverse group in freshwater ecosystems. The class *Gastropoda* is further subdivided into two subclasses based on respiratory adaptations: *Prosobranchia*, which possess gills for aquatic respiration, and *Pulmonata*, which possess lung-like structures enabling them to breathe atmospheric oxygen. Freshwater gastropods are of considerable ecological importance and are widely used as bioindicators for assessing water quality due to their sensitivity to environmental changes such as pollution, eutrophication, and habitat degradation. The presence or absence of specific gastropod species provides valuable information regarding the ecological status of aquatic ecosystems. In addition, molluscs contribute significantly to nutrient cycling and energy flow within aquatic food webs and serve as an important food source for fishes, birds, amphibians, and humans.

Freshwater molluscs are widely distributed across a variety of habitats, including rivers, lakes, ponds, streams, swamps, springs, underground aquifers, and temporary water bodies such as drainage channels and seasonal pools. Their distribution is influenced by several environmental factors, including water quality, temperature, substrate composition, and food

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availability. In India, freshwater ecosystems support a rich diversity of molluscan fauna. Rao *et al.* (1993) ^[20] documented 71 species belonging to 11 families from lake shore regions and adjoining areas, highlighting the considerable biodiversity present in freshwater habitats. Despite this richness, freshwater molluscs in India remain relatively underexplored compared to marine molluscs, and many regions still lack systematic surveys and comprehensive documentation, thereby limiting the understanding of their diversity, distribution, and conservation status.

In Maharashtra, several studies have been conducted to assess freshwater molluscan diversity in relation to environmental variables such as water quality and seasonal fluctuations. Notable contributions include the works of Patil *et al.* (2005) ^[19], Dorlikar *et al.* (2014) ^[6], Sarwade *et al.* (2015) ^[22], and Padghane *et al.* (2017) ^[17], which have reported the occurrence and ecological significance of molluscan fauna in different freshwater ecosystems. However, the eastern Vidarbha region of Maharashtra remains relatively unexplored, and there is a lack of comprehensive information on molluscan diversity in this area.

The present investigation was carried out in the Navegaon Bandh Reservoir, located within Navegaon National Park, at Navegaon Bandh in Taluka Arjuni Morgaon, District Gondia, Maharashtra. This reservoir is an important freshwater ecosystem characterized by diverse habitats, including open water zones, littoral regions, and surrounding wetlands, which provide suitable conditions for supporting a variety of aquatic organisms. Previous studies by Paliwal and Bhandarkar (2010-2012) ^[17] reported only a limited number of molluscan species from this area, including a few gastropods belonging to five families and six genera and pelecypods belonging to a single family and genus, indicating insufficient documentation of the region's biodiversity.

2. Materials and Methods

2.1 Study Area

The present investigation was carried out in Navegaon Bandh Reservoir, situated within Navegaon National Park, in Taluka Arjuni Morgaon, District Gondia, Maharashtra, India. Geographically, the study area is located between 20°45' to 21°02' North latitude and 80°05' to 80°15' East longitude. The reservoir represents a lentic freshwater ecosystem and is recognized as an Important Bird Area (IBA), supporting a rich diversity of flora and fauna.

Although officially designated as Navegaon National Park, the area is locally known as Navegaon Bandh National Park due to the presence of the Navegaon Bandh Reservoir, which forms the central ecological feature of the region. The reservoir is an impounded freshwater body with a water spread area of approximately 11 km² and a maximum depth of about 75 feet. The presence of varied habitats such as open water zones, littoral regions, and adjoining wetlands makes it a suitable site for studying molluscan diversity.

2.2 Sampling Period

Field surveys were conducted during the period from November 2022 to February 2023. This period was selected to capture post-monsoon and winter variations, which are favourable for studying molluscan diversity in freshwater ecosystems.

2.3 Sampling Techniques and Data Collection

Molluscan fauna were collected from different ecological zones of the reservoir using standard sampling techniques. Samples from the profundal zone were collected with the help of an Ekman dredge, whereas samples from the littoral zone were obtained using scoop nets and by hand-picking with forceps along the margins.

For quantitative assessment, a stratified random quadrat sampling method was employed at selected sampling stations following the procedure described by Christian and Harris (2005). Extensive field surveys and on-site observations were conducted to record species occurrence and distribution.

Collected samples were washed thoroughly and passed through a 40-mesh sieve to remove debris and sediments. The retained specimens were sorted, counted, and measured using a standard measuring scale.

2.4 Preservation and Identification of Specimens

Representative samples of molluscan fauna were preserved in 4% formalin solution for further laboratory analysis. The preserved specimens were identified up to the lowest possible taxonomic level using standard identification keys and reference literature, including Subba Rao (1993) ^[20].

2.5 Documentation

Photographic records of collected specimens and their habitats were maintained using a Nikon D5200 digital camera to support taxonomic identification and documentation of biodiversity.

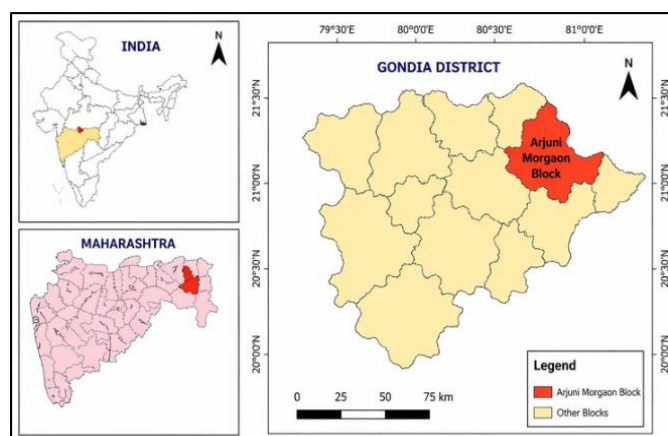


Fig 1: Map showing position of Arjuni Morgaon block in Gondia district in Maharashtra

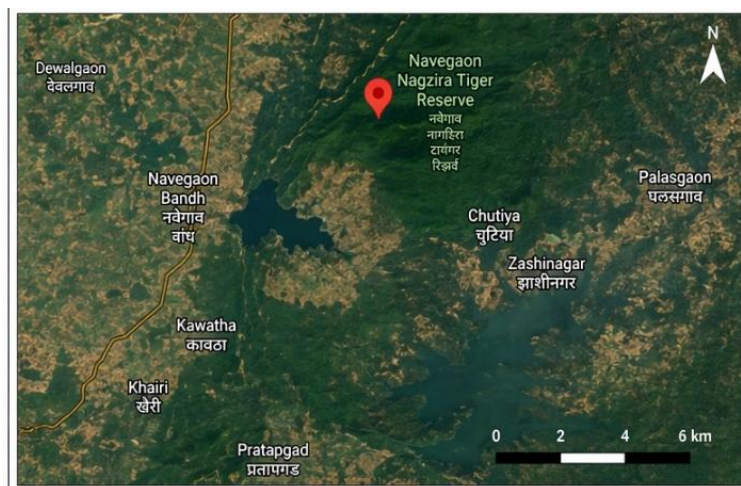


Fig 2: Map Location of Navegaon Bandh Reservoir

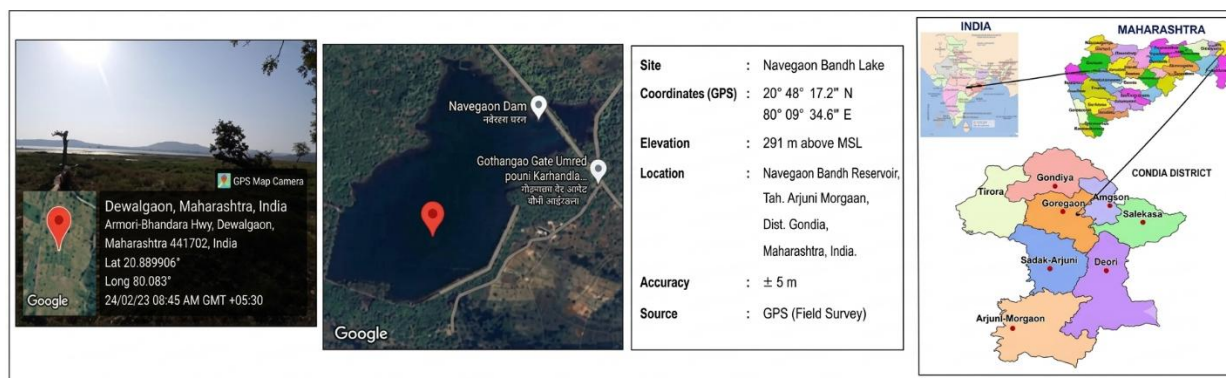


Fig 3: GPS Location of Navegaon Bandh Lake (site)

3. Results

3.1 Taxonomical Diversity of Recorded Molluscan Species

The recorded molluscan fauna of the study area belongs to two major classes, namely Gastropoda and Bivalvia, representing a diverse group of freshwater molluscs. Gastropods were represented by families such as Thiaridae, Viviparidae, Ampullariidae, Planorbidae, and Lymnaeidae, while bivalves were mainly represented by Unionidae and Margaritiferidae. Species such as *Melanoides tuberculata*, *Tarebia granifera*, *Bellamya bengalensis*, *Pila globosa*, *Planorbis planorbis*, and *Lymnaea acuminata* were commonly observed among gastropods. In bivalves,

Lamellidens marginalis, *Lamellidens corrianus*, *Parreysia corrugata*, and *Margaritifera margaritifera* were identified. Molluscs play an important ecological role in freshwater ecosystems by contributing to nutrient recycling, decomposition of organic matter, maintenance of food chains, and improvement of sediment quality. The presence and distribution of different molluscan species are strongly influenced by environmental factors such as water quality, dissolved oxygen, substrate type, vegetation cover, and availability of food resources. Therefore, molluscan diversity is often considered an important biological indicator of aquatic ecosystem health and environmental stability.

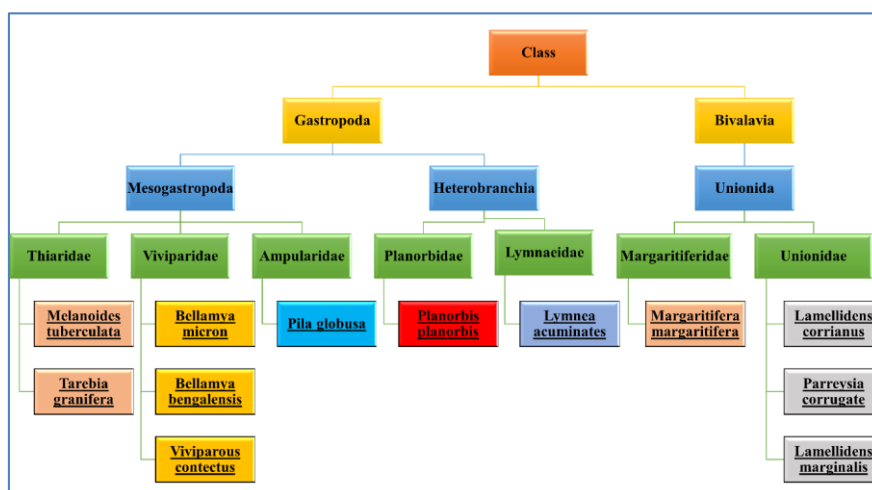


Fig 4: List of molluscan species with their Taxonomical Classification

3.2 Monthly Distribution of Molluscan Species during November

Monthly Distribution of Molluscan Species during November In November, 67 individuals from the Gastropoda and Bivalvia classes were recorded from the research sites. Gastropods show higher diversity and abundance than Bivalvia. Among the species recorded, *Pila globosa* has 11

species, followed by *Planorbis planorbis* (9 species), *Viviparus contectus*, and *Lamellidens marginalis* (8 species). Site 1 had the highest abundance (25 individuals), followed by Site 2 (24 individuals) and Site 3 (18 individuals). The results indicate that the species of gastropods were more widely distributed in all places in November.

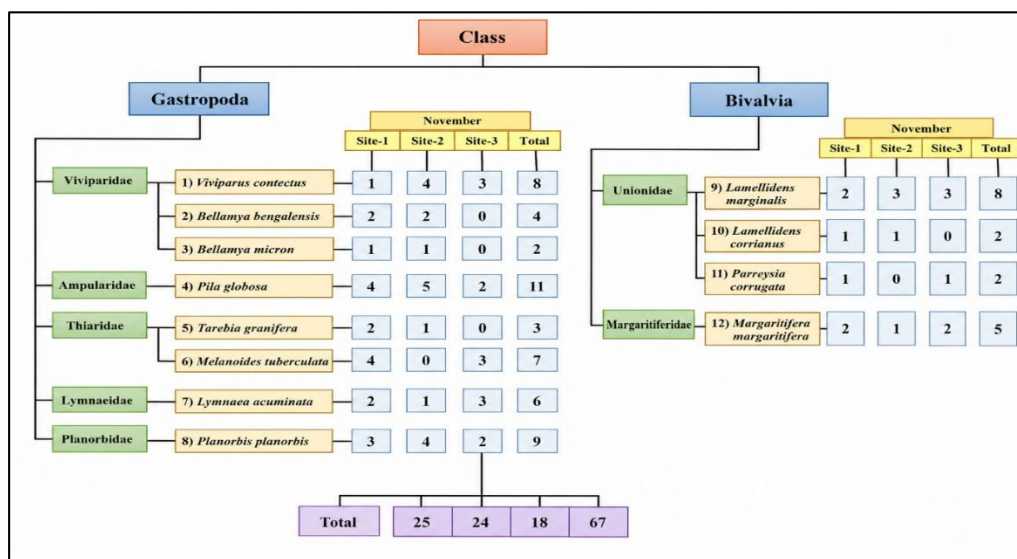


Fig 5: Distribution pattern of freshwater molluscan species across different sites during November

3.3 Population Abundance of Molluscan Species during December

In December, 57 individuals of Gastropoda and Bivalvia molluscs were documented at selected study sites. The Gastropoda class dominated both in diversity and population density over Bivalvia. *Pila globosa* was the richest species,

with 10 individuals, followed by *Planorbis planorbis*, *Viviparus contectus*, and *Lamellidens marginalis*. In the sampling sites, Site-2 has the highest abundance (27 individuals), while Site-1 and Site-3 have comparatively low populations. The results show a larger range of gastropod species in December.

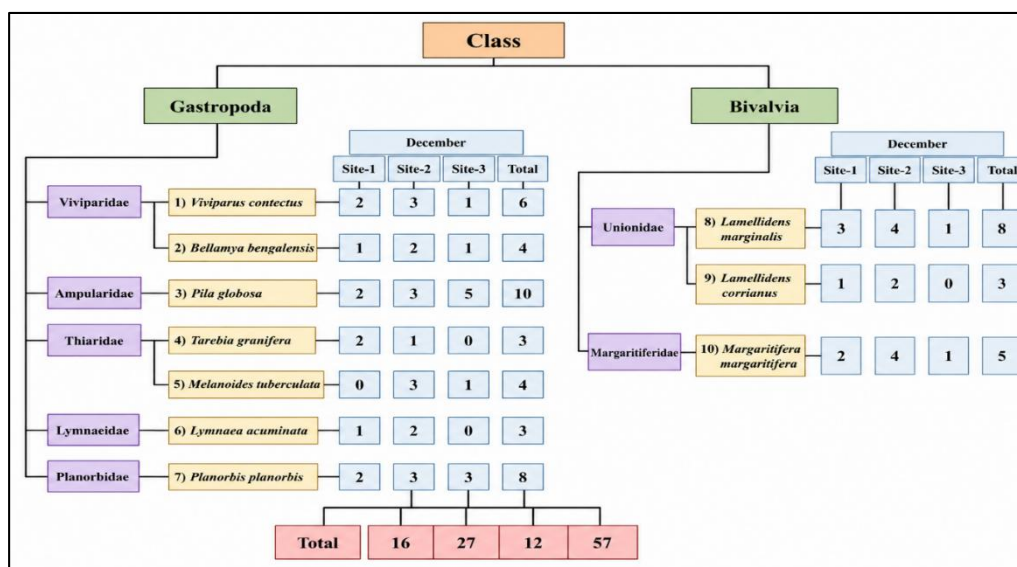


Fig 6: Abundance of molluscan species recorded from different sampling sites during December

3.4 Seasonal Distribution Pattern of Molluscan Species during January

In January, 67 molluscan individuals belonging to the two classes, Gastropoda and Bivalvia, were recorded from three study sites. Gastropoda showed greater diversity and abundance than Bivalvia. Among the gastropods, *Viviparus contectus* (13 individuals) was the dominant species, followed by *Planorbis planorbis* (8 individuals), and *Pila*

globosa and *Melanoides tuberculata* (7 individuals each). In Bivalvia, *Margaritifera margaritifera* (6 individuals) was the most abundant species. Site-1 recorded the highest number of individuals (24), followed by Site-2 (23 individuals) and Site-3 (20 individuals). The results indicate that gastropod species were more widely distributed across all study sites during January.

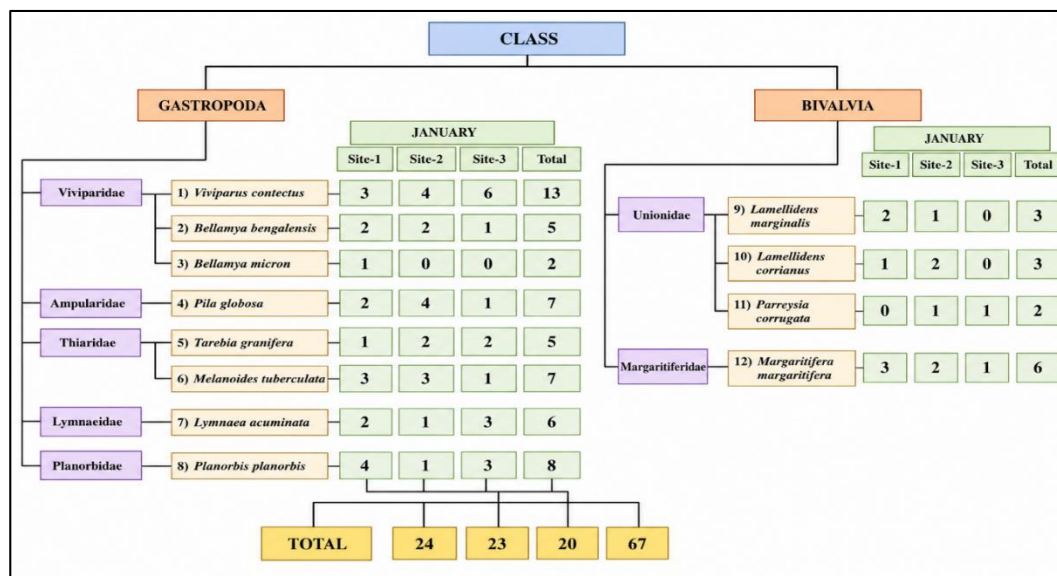


Fig 7: Distribution pattern of freshwater molluscan species across different sites during January

3.5 Assessment of Molluscan Distribution during February

In February, 72 molluscan individuals belonging to the two classes, Gastropoda and Bivalvia, were recorded from three study sites. Gastropoda showed higher diversity and abundance than Bivalvia. Among the gastropods, *Viviparus conctectus* (14 individuals) was the most dominant species, followed by *Pila globosa* (9 individuals) and *Planorbis planorbis* (7 individuals).

In Bivalvia, *Margaritifera margaritifera* (8 individuals) and *Lamellidens marginalis* (7 individuals) were commonly observed. Site-2 recorded the highest number of individuals (26), followed by Site-1 and Site-3 with 23 individuals each. The results indicate that gastropod species were more widely distributed across all study sites during February.

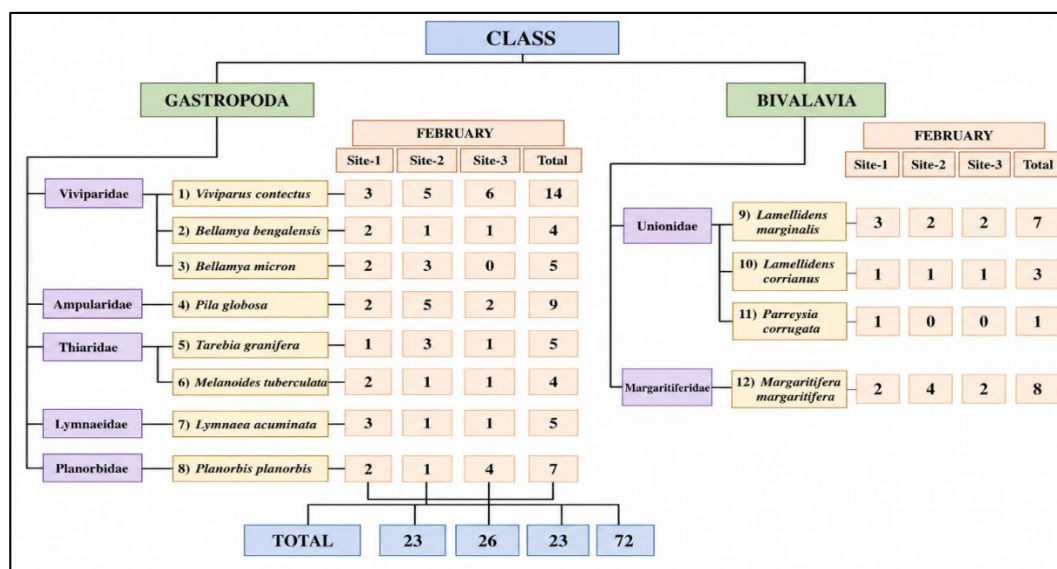


Fig 8: Assessment of molluscan species distribution at different locations during February

3.6 Overall Diversity and Occurrence Status of Molluscan Species

The molluscan diversity recorded from three research sites includes two main classes, namely gastropoda and bivalvia. A total of 12 species from different families were identified during the investigation. Among gastropods, it has been observed that *Viviparus conctectus*, *Pila globosa* and *Planorbis planorbis* are very common, with higher occurrences at all study sites, indicating favourable habitat conditions for these species. On the contrary, *Bellamya*

micron is very rare, indicating a limited distribution and low abundance. In Bivalvia, *Lamellidens marginalis* and *Margaritifera margaritifera* were commonly observed, while *Parreysia corrugata* was very rare. Variations in molluscan abundance and distribution can be attributed to differences in water quality, substrate composition, food availability, and ecological conditions in selected locations. Overall, the results show a moderate diversity of molluscs, with dominant gastropod species in the study area.

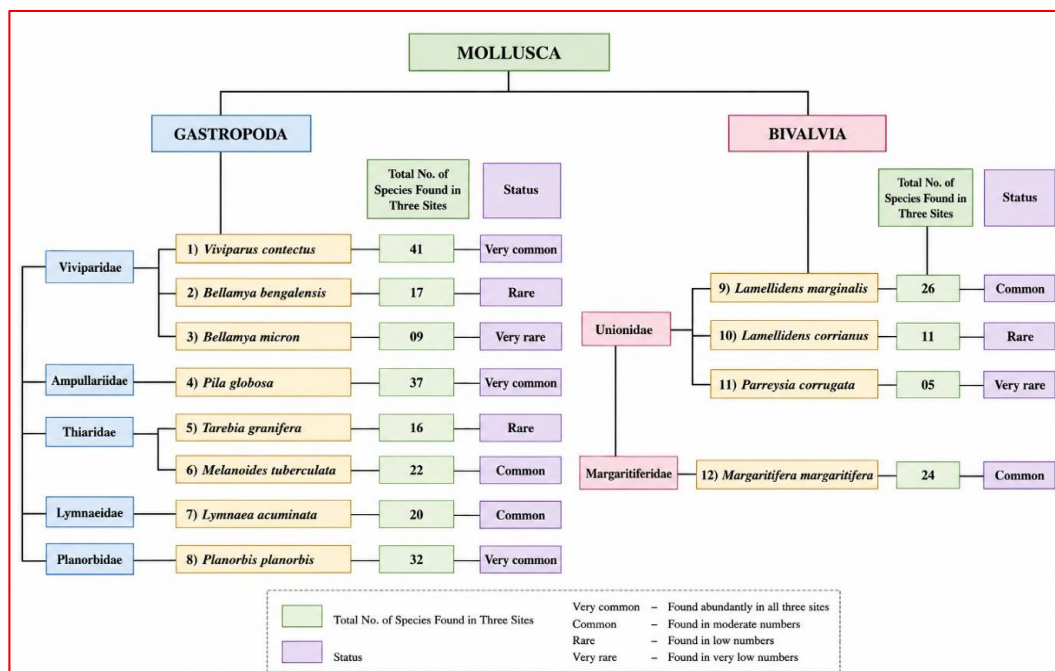


Fig 9: List of recorded species of Mollusca in Navegaon Bandh reservoir from November to February

3.7 Photographic Representation of Recorded Molluscan Species

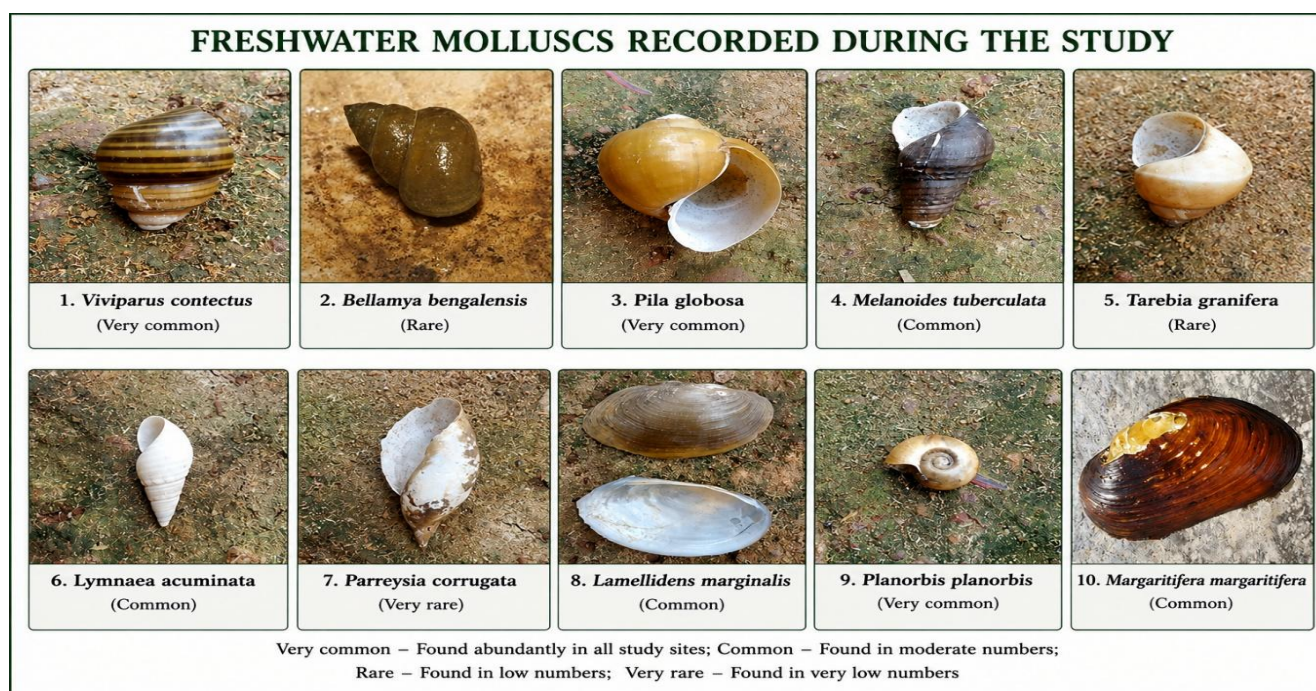


Plate 1: Freshwater Molluscan Species Recorded from Navegaon Bandh Reservoir

3.6 Discussion

3.6.1 Diversity of Molluscan Fauna

The present study conducted from November to February 2023 revealed the occurrence of 12 molluscan species belonging to two major classes, Gastropoda and Bivalvia, from three selected study sites. The recorded species belonged to seven families, namely Viviparidae, Ampullariidae, Thiariidae, Lymnaeidae, Planorbidae, Unionidae, and Margaritiferidae. Among these, gastropods exhibited greater diversity and abundance than bivalves throughout the study period. The dominance of gastropods may be attributed to their high adaptability to varying ecological conditions, efficient reproductive capacity, and availability of suitable habitats in freshwater ecosystems.

Similar observations of gastropod dominance have been reported in various freshwater ecosystems due to their greater tolerance to environmental fluctuations.

3.6.2 Taxonomic Composition of Molluscs

Among the total recorded species, six species belonged to the order Mesogastropoda, two species belonged to the subclass Heterobranchia, and four species belonged to the order Unionida. Within Mesogastropoda, family Viviparidae contributed the highest number of species followed by Thiariidae and Ampullariidae. In Heterobranchia, Lymnaeidae and Planorbidae were represented by one species each. Similarly, within Unionida, family Unionidae was represented by three species, while Margaritiferidae

contributed one species. The higher representation of gastropod families indicates favourable ecological conditions, including suitable substrate, food resources, and water quality for their growth and survival.

3.6.3 Relative Abundance and Occurrence Status

The relative abundance study revealed that *Viviparus* *contectus*, *Pila* *globosa*, and *Planorbis* *planorbis* were very common species in the study area. Their higher abundance may be associated with favourable habitat conditions, availability of food resources, and adaptability to environmental fluctuations. Species such as *Melanoides* *tuberculata*, *Lymnaea* *acuminata*, *Lamellidens* *marginalis*, and *Margaritifera* *margaritifera* were commonly distributed across the study sites. In contrast, *Bellamya* *bengalensis*, *Tarebia* *granifera*, and *Lamellidens* *corrianus* were recorded as rare species, while *Bellamya* *micron* and *Parreysia* *corrugata* were found to be very rare. The low abundance of these species may be associated with restricted habitat preference, competition, ecological sensitivity, and environmental disturbances.

3.6.4 Monthly Distribution of Molluscan Species

Monthly variations in molluscan abundance were observed during the investigation period. In November, 67 individuals were recorded, with *Pila* *globosa* showing maximum abundance. During December, the total population decreased to 57 individuals, possibly due to environmental fluctuations and changes in water temperature. In January, the abundance again increased to 67 individuals, with *Viviparus* *contectus* becoming the dominant species. February recorded the highest abundance with 72 individuals, indicating favourable environmental conditions for molluscan growth and survival during this period. Seasonal changes in temperature, dissolved oxygen, nutrient availability, and organic matter content may have influenced these population fluctuations.

3.6.5 Site-wise Distribution Pattern

The distribution pattern of molluscan species varied among the three study sites. Site-1 and Site-2 generally supported higher molluscan populations compared to Site-3. Site-2 recorded maximum abundance during December and February, while Site-1 showed comparatively higher abundance during November and January. Variations in species distribution among sites may be attributed to differences in aquatic vegetation, substrate composition, organic matter content, dissolved oxygen, and anthropogenic disturbances. Gastropod species were more widely distributed than bivalves across all study sites, possibly due to their greater ecological adaptability.

3.6.6 Ecological Importance of Molluscs

Molluscs play a significant role in freshwater ecosystems through nutrient cycling, decomposition of organic matter, and maintenance of ecological balance. Their presence and abundance are often considered important indicators of water quality and habitat condition. The dominance of gastropod species in the present study suggests that the selected freshwater habitats provide suitable ecological conditions for molluscan diversity and survival. Therefore, continuous monitoring and conservation of freshwater habitats are essential for maintaining molluscan

biodiversity, ecological stability, and overall ecosystem health.

4. Conclusion

The present study on the diversity of molluscs from Navegaon Bandh Reservoir revealed that both gastropod and bivalve communities inhabit different sites of the lake and are represented by a variety of species. The abundance of molluscan fauna indicates rich biological productivity of the reservoir ecosystem. The species inhabiting the bottom region of the lake play an important role in converting organic matter into biomass, which in turn serves as food for fishes. Thus, molluscs contribute significantly to secondary productivity and form an important component of the aquatic food web.

Freshwater molluscan species such as *Pila* spp., *Parreysia* spp., and *Lamellidens* spp. are extensively used as food and are sold by economically weaker communities, for whom freshwater resources are important for livelihood and food security. Dominance of *Pila* species and viviparid species was observed at the study sites. Furthermore, 25% of the molluscan species recorded from the study area were categorized as rare, while 16.7% were categorized as very rare, indicating the need for proper conservation and sustainable management of freshwater habitats.

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