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RESEARCH ARTICLE

Diversity, species richness and ethnomedicinal uses of malacofauna of varied habitats of Sonitpur district, Assam

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Abstract

A comprehensive survey on malacofaunal diversity was carried out across various localities and habitat types in the Sonitpur district of Assam from January to June 2025. Molluscan specimens were collected using a cast net with a mesh size of 0.5 mm, alongside photographic documentation and ethnobiological interviews. A total of 746 individuals representing 12 species across 10 families were recorded. Among these, 10 species are listed as *Least Concern* (LC) according to the IUCN Red List (2001). Two invasive species such as *Physella acuta* (European Physa) and *Achatina fulica* (Giant African Land Snail) were also documented. Out of the 12 recorded species, seven were recognised as edible, as confirmed by both literature and responses from local communities. The study further identified key threats to the survival of molluscan fauna in the region, including habitat degradation, pollution, over-exploitation, and the introduction of invasive species. These findings strongly suggest the need for conservation measures to safeguard freshwater molluscan biodiversity in this ecologically significant region.

Key words: Malacofauna; Species Diversity; Invasive species; Ethnomedicinal uses; Habitat; Sonitpur; Assam

1. Introduction

Molluscs are cosmopolitan in distribution, inhabiting marine, freshwater, and terrestrial environments. Within the Animal Kingdom, they are the second most diverse group after arthropods in terms of species richness. Among them, freshwater molluscs represent one of the most widely distributed groups of aquatic macroinvertebrates. They are considered an emerging biological asset of freshwater ecosystems (Maltchik et al., 2010) and play a pivotal role in maintaining ecosystem health (Vaughan et al., 2004; Lydeard et al., 2004; Budha et al., 2010). Freshwater molluscs, primarily belonging to the classes Gastropoda and Bivalvia, are found in a variety of aquatic habitats such as ponds, beels, ditches, streams, and rivers across the globe, with the exception of Antarctica (Schiaparelli et al., 2014). They serve as vital environmental bioindicators due to their sensitivity to ecological changes (Oehlmann et al., 2003). These molluscs also provide significant ecological and economic services. They are crucial food sources for birds, fish, mammals, and humans and possess medicinal and ornamental value (Sonowal, 2021). Functioning as natural water purifiers, molluscs contribute to aquatic ecosystem balance by scavenging algae and decaying plant material (Gosling, 2003; Dillon, 2006). Globally, an estimated 80,000 to 1,35,000 species of molluscs have been reported (Boss, 1973), highlighting their immense diversity and importance. They play a significant role in forest ecosystems by acting as soil producers and calcium concentrators, while also serving as an important food source for various vertebrate species (Sularte and Jumawan, 2016). About 212 molluscan species are known from the freshwater habitats of India. The highest number of mollusc species are confined to the Western Ghats and to Eastern Himalayan hotspots (D'Souza, 2025). However, certain terrestrial molluscs also function as vectors for diseases affecting both humans and livestock. Typically, terrestrial molluscs exhibit short life spans ranging from several months to a few years and their limited dispersal abilities make them highly effective bioindicators for monitoring ecosystem health and environmental changes (Watters et al., 2005). Within aquatic systems, molluscs are common constituents of benthic communities. However, the distributional data on Indo-tropical freshwater molluscs remains geographically limited. Most of the existing knowledge is derived from studies conducted in biodiversity-rich regions such as the Eastern Himalaya (Budha et al., 2010), the Western Ghats (Aravind et al., 2011), and the Indo-Burma region (Köhler et al., 2012). Notably, Mollusca research in India is predominantly focused on the Western Ghats in southern India and selected areas of the Himalayan region (Sonowal et al., 2021). Kumar and Vyas (2012) studied the diversity of molluscan communities in the River Narmada, India, and recorded 19 species altogether. According to a previous study, the phylum Mollusca, with its vast number of species, is the second largest animal group after Arthropoda and plays a significant role in the biomass of both terrestrial and freshwater ecosystems (Tripathi et al., 2018). Baghele et al (2022) reviewed the nutritional potential of edible snails and found that the protein, fat, and ash content of snail meat is 14.0, 1.4, and 2.1% based on fresh matter, respectively. Sarkar (2022) studied the diversity and conservation status of malacofauna from the river Teesta, West Bengal, India. The study reported a total of nine species belonging to seven families, of which seven are edible molluscs. Jadhav et al (2023) studied the edible freshwater molluscs of northeast India and reported that 12 species are consumed by the people of northeast India. A study on molluscan diversity in the River Barak and its tributaries, Assam, India, reported a total of 16 molluscan taxa belonging to 2 classes (Roy and Gupta, 2010). A study on the diversity of freshwater molluscs in Maguri Beel in Tinsukia district in Assam, India, reported a total of 26 species of freshwater molluscs belonging to 9 families (Kardong et al., 2016). Das and Biswas (2016) have reported 1 species of the Bivalvia class and 2 species of Gastropoda

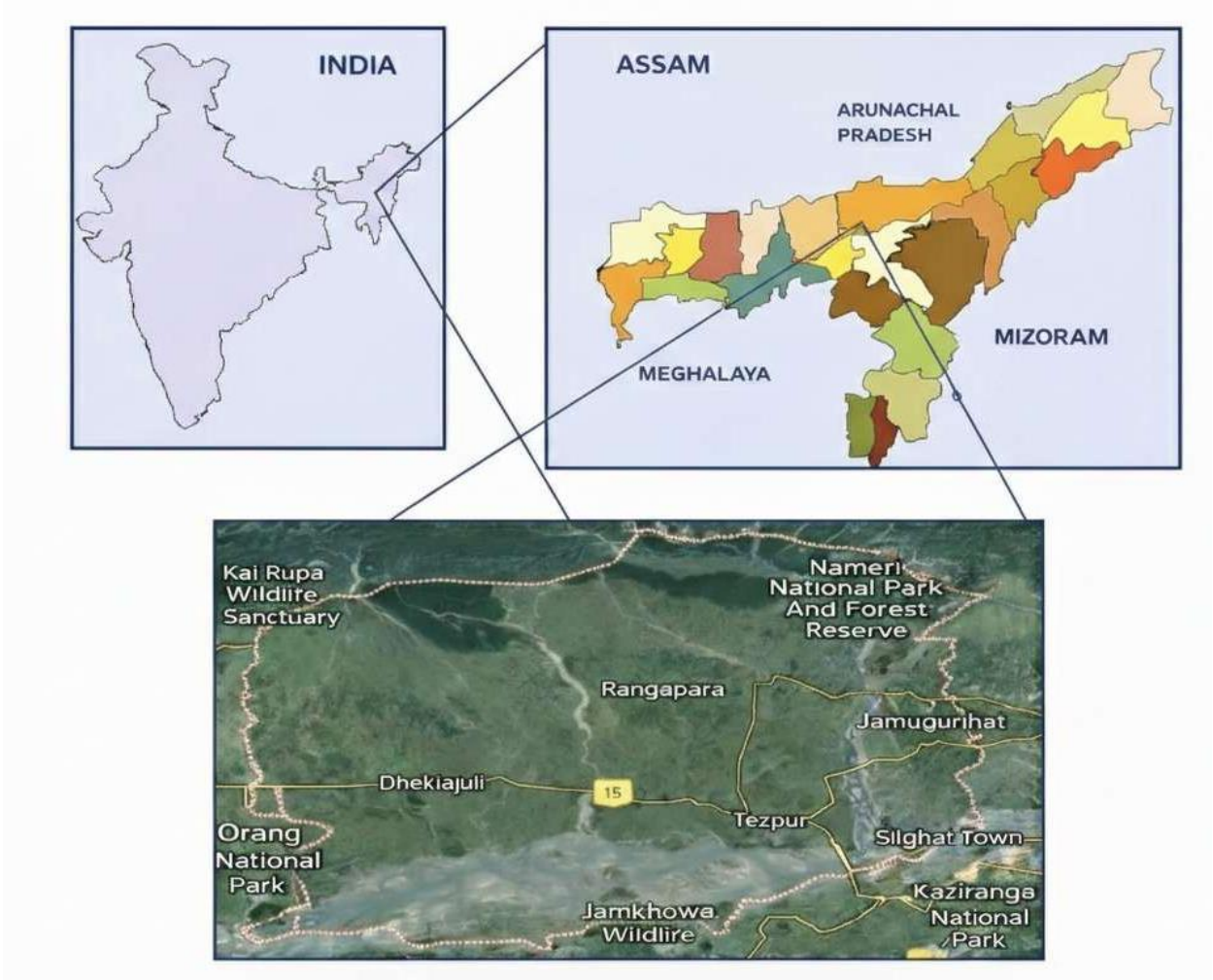

Figure 1. Location map of the study area in Sonitpur district of Assam (Source: Google Map, 2024).

Table 1. The survey and sampling sites along with GPS coordinates.

Study site	Description
Site 1: Brahmaputra river at Batamari region of tezpur:	The Brahmaputra River is a transboundary river that flows through Tibet (China), northeastern India, and Bangladesh. It is the ninth largest river in the world in terms of discharge. The river originates in the Manasarovar Lake region near Mount Kailash, located on the northern side of the Himalayas. In Assam, the Brahmaputra traverses approximately 700 km through the Assam Valley, where it flows predominantly as a braided river system. The river has an average depth of around 30 meters, contributing significantly to the hydrological and ecological characteristics of the region.
Site 2: Bharali river, Tol Gereki:	The Jia Bharali River, formerly known as the Bharali River, originates from a glacial lake near the India-Tibet border in the Tawang district of Arunachal Pradesh. It flows through the Bhalukpong circle of West Kameng district before entering the Sonitpur district of Assam. In its lower reaches, the river adopts a braided channel pattern. The Jia Bharali is one of the major tributaries of the Brahmaputra River, with its confluence located at Tezpur, just east of the Kolia Bhomura Setu bridge. The river plays a significant role in the hydrology and ecology of the region, particularly in the floodplain dynamics of the Brahmaputra basin.
Site 3: Dipoota river, Beseria:	The Dipoota River, a local distributary of the Brahmaputra River, flows through the Beseria region. For the purpose of specimen collection, several wetlands, including beels and lakes, were surveyed in the Beseria area. The sites were selected based on their ecological relevance and accessibility, contributing valuable data to the study of freshwater molluscan diversity in the region.
Site 4 : Kala song region of Dipoota:	The Dipoota River, a distributary channel of the Brahmaputra River, flows through the Beseria region. Several wetlands, including beels and lakes, in the Kala Songa and Beseria areas were surveyed for the collection of molluscan specimens. These aquatic habitats provide suitable ecological conditions for diverse freshwater mollusc populations and were therefore selected as key sampling sites for the study.
Site 5 : Ganesh Ghat :	Terrestrial mollusc specimens were collected from selected locations in the Ganesh Ghat region of Tezpur. This area was chosen due to its varied microhabitats and vegetation cover, which support a diversity of terrestrial molluscan fauna.

in their study on the molluscan diversity of the Mara Bharali River

Table 2. Check list of malacofauna, including class, family, and number of added individuals for the time period of six months for each species, from January 2024 to June 2024 at various sites of Sonitpur district.

Class	Family	Species and status		January 2024 to June 2024					
				JAN.	FEB.	MARCH	APR.	MAY	JUNE
Bivalvia	Unionidae	*Lamellidens marginalis* (Lamarck, 1819) LC	S1	2	3	1	4	4	8
			S2	3	4	0	5	7	12
			S3	5	3	2	0	8	6
			S4	0	0	0	2	1	0
			S5	0	0	0	0	0	0
		Lamellidens corrianus(Lea, 1834) LC	S1	0	2	0	5	4	4
			S2	5	4	10	5	9	7
			S3	6	4	9	8	4	9
			S4	2	3	0	1	0	2
			S5	0	0	0	0	0	0
Gastropoda	Planorbidae	*Gyraulus ladacensis* (Nevill, 1878) LC	S1	5	2	4	0	9	11
			S2	3	2	11	4	5	4
			S3	0	3	0	0	0	3
			S4	1	0	0	2	3	0
			S5	0	0	0	0	0	0
	Ampullariidae	*Pila globosa* (Swainson, 1822) LC	S1	0	2	0	3	2	0
			S2	2	2	1	5	3	2
			S3	0	3	3	0	1	2
			S4	5	7	3	9	3	5
			S5	0	0	0	0	0	0
	Viviparidae	*Idiopoma dissimilis* (Mueller, 1774) LC	S1	3	0	2	5	0	7
			S2	1	0	2	2	4	5
			S3	0	2	2	5	0	4
			S4	0	2	4	5	0	6
			S5	0	0	0	0	0	0
		Filopaludina bengalensis (Lamarck, 1882) LC	S1	12	7	11	9	11	8
			S2	9	7	5	6	5	8
			S3	3	4	6	7	9	4
			S4	5	0	6	2	0	4
			S5	0	0	0	0	0	0
	Pachychilidae	*Brotia costula* (Rafinesque, 1833) LC	S1	3	5	3	6	0	4
			S2	0	0	0	0	0	0
			S3	3	0	2	1	0	3
			S4	0	1	0	1	2	1
			S5	0	0	0	0	0	0
	Bithyniidae	*Gabbia orcula* (Frauenfeld, 1862)LC	S1	2	3	0	0	4	2
			S2	0	2	0	0	1	2
			S3	0	1	2	0	0	1
			S4	1	0	1	2	0	0
			S5	0	0	0	0	0	0
	Physidae	*Physella acuta* (Draparnaud, 1805) EX	S1	2	4	5	4	3	3
			S2	2	3	3	5	2	3
			S3	2	0	1	3	2	1
			S4	2	1	0	0	3	1
			S5	0	0	0	0	0	0
	Lymnaeidae	*Lymnaea ovalior* (Annandale & Prasad, 1921) LC	S1	6	3	2	3	3	2
			S2	3	0	7	3	4	5
			S3	1	5	0	0	3	1
			S4	2	0	2	0	3	2
			S5	0	0	0	0	0	0
	Achatinidea	*Achatina fulica*(Ferussac,1821)	S1	0	0	1	0	1	0
			S2	0	2	0	0	0	1
			S3	0	2	0	1	0	0
			S4	0	0	0	2	0	0
			S5	2	0	1	3	0	1
	Cyclophoridae.	*Cyclophorus zebrinus* (Benson, 1836)	S1	0	0	0	0	0	0
			S2	0	0	0	0	0	0
			S3	0	0	0	0	0	0
			S4	0	0	0	0	0	0
			S5	7	9	6	5	6	4

S1-S5: Study sites. S1: Brahmaputra river at Batamari region of Tezpur; S2: Bharali river, Tol Gereki; S3 :Dipoota river, Beseria; S4: Kala song region of Dipoota; S5 : Ganesh Ghat.

in the Sonitpur District of Assam, India. Kalita (2017) recorded 16 species of mollusca in the Garanga Wetland of Pobitora Wildlife Sanctuary, Assam. Pegu et al (2019) proposed that the molluscan community could be investigated for potential use as food value and for ethno-medicinal purposes in the rural area of Dhemaji, Assam. A study on the diversity of freshwater molluscs from the Upper Brahmaputra Basin, Assam, India, reported altogether 18 gastropods and 27 bivalve species representing nine families (Sonowal et al., 2021). Kalita (2022) reported a total of 12 species of land snails in Guwahati, Assam, India. Das and Dutta (2013) found approximately 17 species of molluscs, 16 freshwater species, and 1 terrestrial species from Nalbari district. In their study of the water quality of the River Mara Bharali in Assam, India, Das and Biswas (2019) discovered six species of molluscs from five different families. The study was based on fish and macroinvertebrate diversity indices. Biswas and Das (2022) also reported six species of mollusca from the River Mara Bharali in Assam, India. According to the mentioned papers, research on the mollusca of northeast India is limited to a small portion of the study area. The

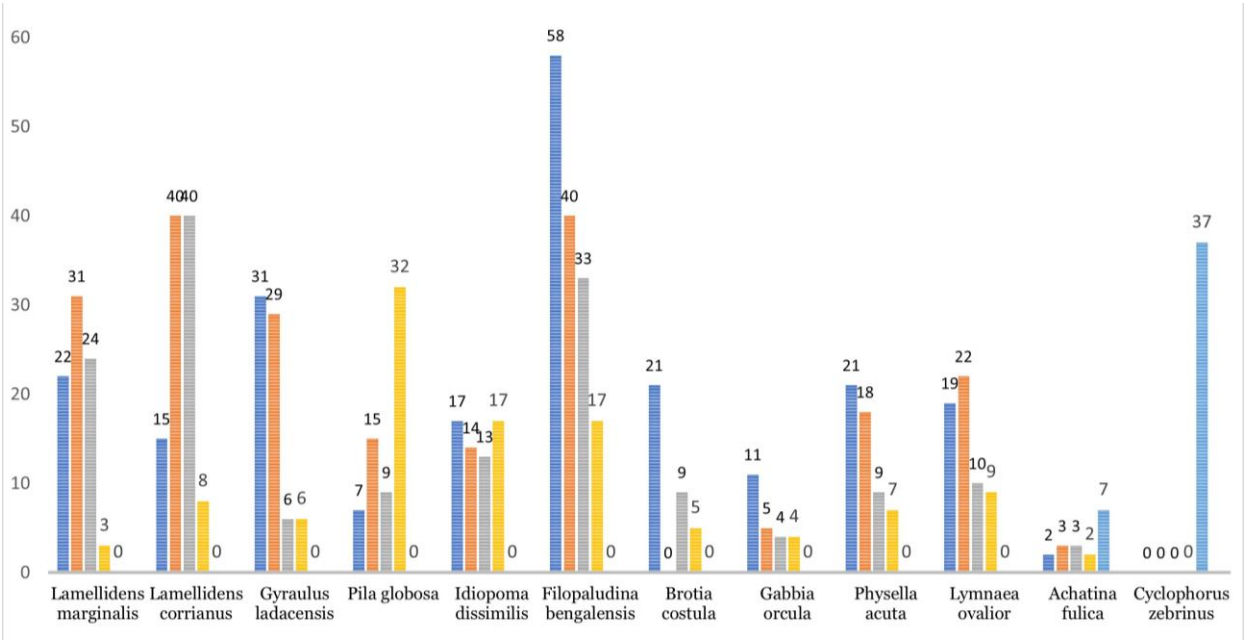

Figure 2. Diagram showing the species abundance of mollusca in the five study sites (S1: Brahmaputra River at Batamari region of tezpur; S2: Bharali river, Tol Gereki; S3: Dipoota river, Beseria; S4: Kala song region of Dipoota; S5: Ganesh Ghat.

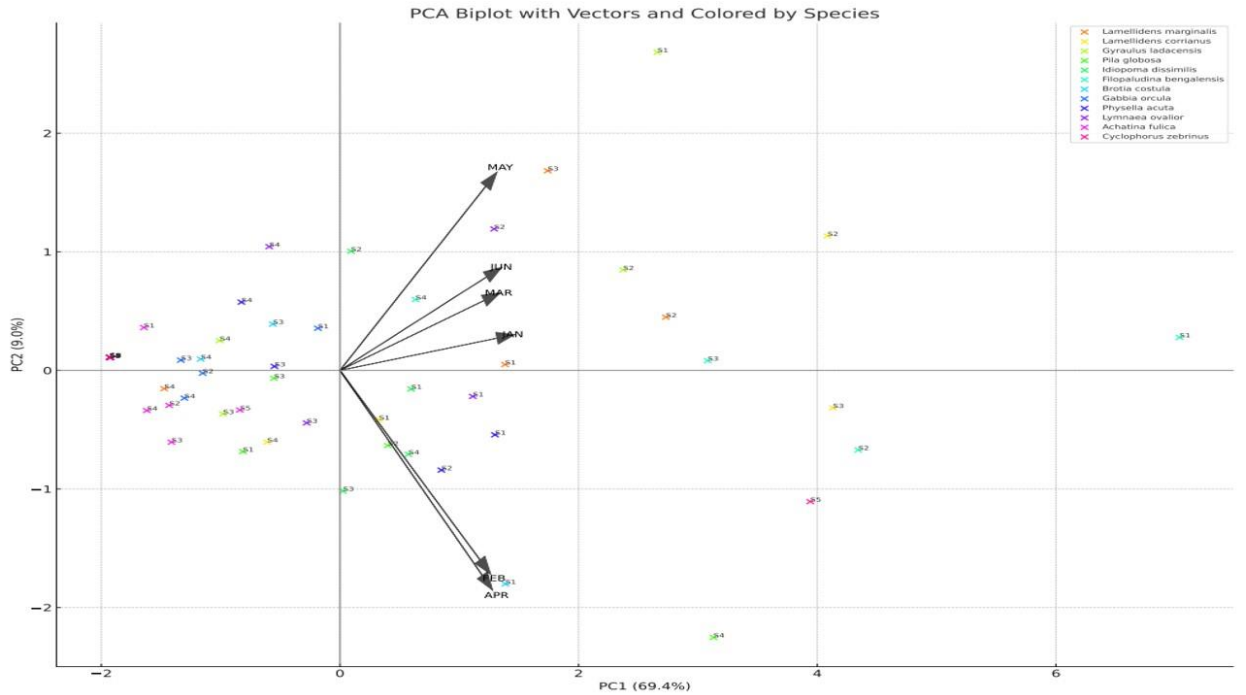

Figure 3. PCA bioplots of diversity indices of mollusca within its sites.

diversity of malacofauna in Sonitpur District, Assam, India, is poorly explored. In this context, the present study was designed to understand the species diversity of freshwater molluscs in different ecosystems in the Sonitpur district of Assam.

2. Material and method

2.1. Study Area

The present study was conducted in the Sonitpur district of Assam, located at the intersection of the Himalayan and Indo-Malayan biodiversity hotspots. Molluscan species were collected from a designated wetland within the district. Covering an area of approximately 2,077 km², Sonitpur is situated on the northern bank of the Brahmaputra River, between 26.30°N and 27.01°N latitude and 92.16°E and 93.40°E longitude (Figure 1).

The district is bordered by Arunachal Pradesh to the north, Lakhimpur district to the east, and Darrang district to the west. In addition to the Brahmaputra, several important tributaries flow through the region, including the Jiabharali, Gabharu, Borgang,

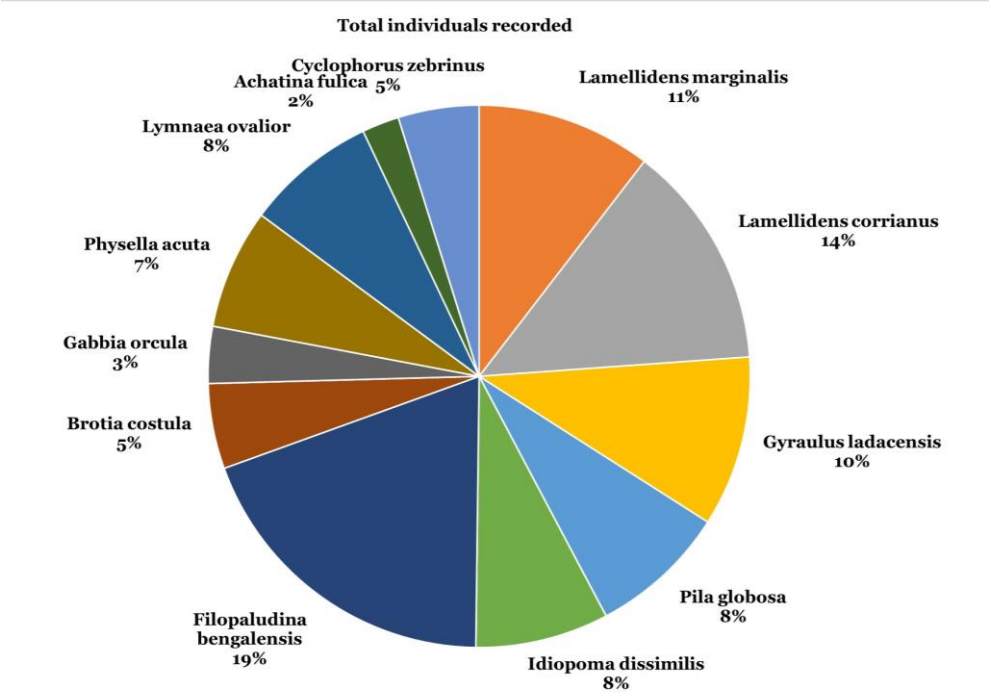

Figure 4. Pie diagram showing the number of individuals recorded for each species during the study period.

and Baroi rivers. The area falls within a subtropical rainforest climate zone, characterised by a hot and humid climate with substantial rainfall. Sonitpur is also notable for its extensive tea cultivation, which plays a vital role in the economy of Assam.

2.2. Survey method

The survey and sampling were carried out in five different sites of different habitats of the Sonitpur district of Assam, as shown in Table 1 and Figure 5.

2.3. Sampling

The study was conducted over a period of six months, from January 2025 to June 2025, across randomly selected sampling sites along riverbanks and beels within the Sonitpur district of Assam. The geographic coordinates of each sampling location were recorded using a Global Positioning System (GPS) device to ensure spatial accuracy. Molluscan specimens were collected using a cast net with a mesh size of 0.5 mm, covering an area of approximately 100 metres per site. Additional specimens were collected manually from shallow riverbeds and wetland margins. Freshwater molluscs were also obtained from local riverside fish markets to supplement the field collections. All collected specimens were initially washed with clean water to remove debris and sediment. Species identification was performed on-site whenever possible. For taxonomic verification and further analysis, five representative specimens of each identified species were preserved in 70% ethanol.

2.4. Species identification

Identification of freshwater molluscan specimens was conducted following the taxonomic keys and descriptions provided by Subba (1989), Dey (2007), and Ramakrishna & Dey (2007). Following identification, five representative specimens of each species were preserved in 70% ethanol for reference and further study. All surplus specimens were subsequently released back into their respective natural habitats to minimise ecological disturbances.

2.5. Ethnomedicinal uses

Table 3. Number of individuals recorded for each species during the study period

Species	***Total Individuals recorded***
Lamellidens marginalis	80
Lamellidens corrianus	103
Gyraulus ladacensis	78
Pila globosa	63
Idiopoma dissimilis	61
Filopaludina bengalensis	148
Brotia costula	39
Gabbia orcula	26
Physella acuta	55
Lymnaea ovalior	60
Achatina fulica	17
Cyclophorus zebrinus	37

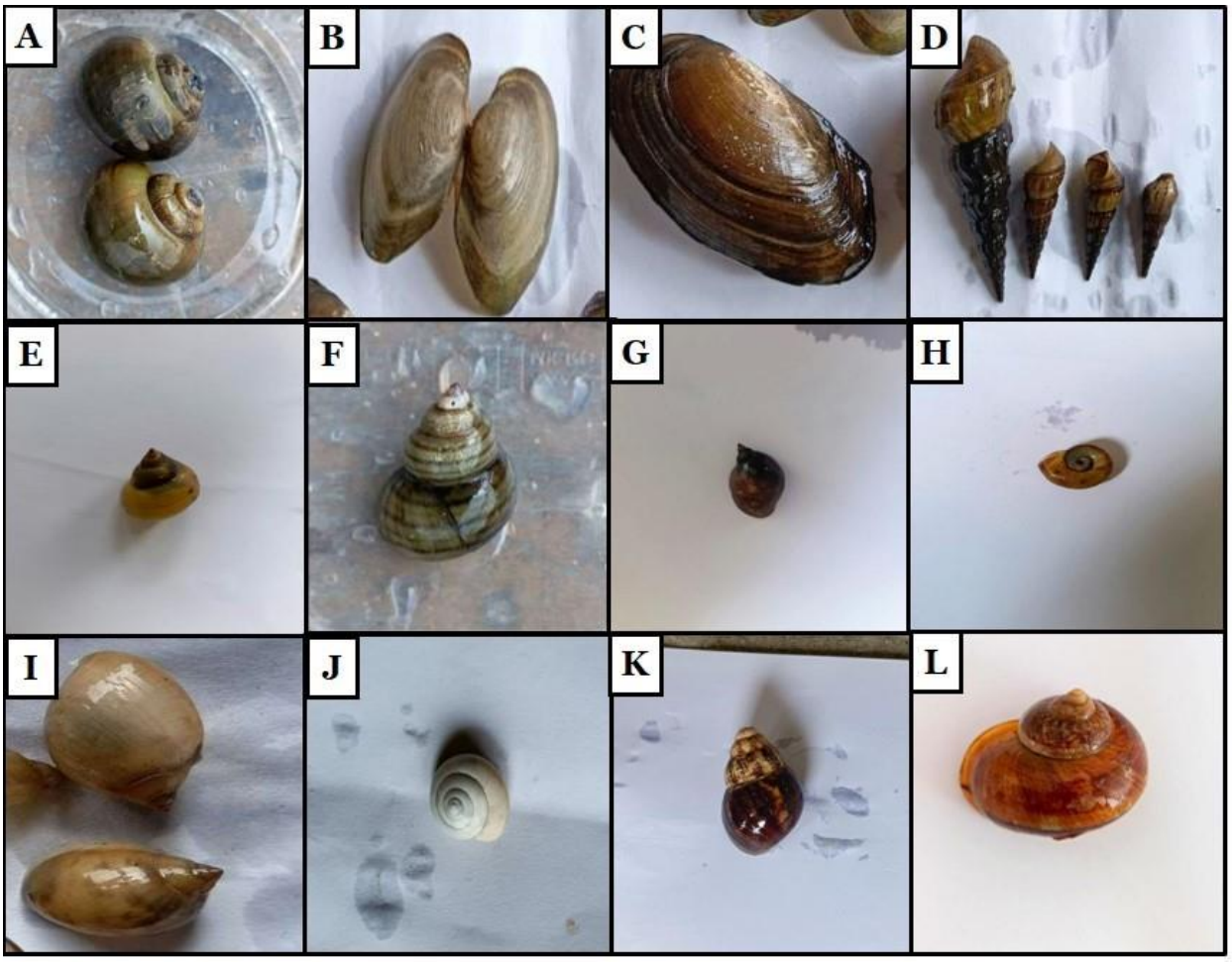

Figure 6. Photographs of a few malacofauna. (A) *Pila globosa* (B) *Lamellidens corrianus* (C) *Lamellidens marginalis* (D) *Brotia costula* (E) *Idiopoma dissimilis* (F) *Filopaludina bengalensis* (G) *Physella acuta* (H) *Gyraulus ladacensis* (I) *Lymnaea ovalior* (J) *Gabbia orcula* (K) *Achatina fulica* (L) *Cylophorus zebrinus.*

Table 4. Ethnomedicinal use of malacofauna.

CLASS	Scientific name	Family	Part used	Disease condition	Method of application
GASTROPODA	*Filopaludina bengalensis*	Viviparidae	flesh	Asthma,arthritis, joint pain,rheumatism,conjunctivities, rickets cardiac ailments, blood pressure, giddiness and dehydration,night blindness, anemia	The meat is cooked with dali,tenga paat or khar.
	Idiopoma dissimilis	Viviparidae	flesh	As a cure of jaundice , eyesight	The meat is cooked with dali or khar.
	Pila globosa	Ampullariidae	flesh	Asthma, tuberculosis, stomach disorders and eye related problems	Boiled and cooked
	Lymnaea sp.			Used to treat measles, liver ailment and jaundice. Swellings and sprain.	Washed with common salt and cooked
	Brotia costula	Pachychilidae	Flesh	Jaundice	Boiled and cooked
BIVALVIA	*Lamellidens* sp.	Unionidae	Flesh	Rheumatism, cardiac diseases, controlling blood pressure and asthma.	Boiled and cooked

Ethnomedicinal use of the Mollusca was documented using a questionnaire survey among indigenous people and in the literature review.

3. Result

A Check list of malacofauna, including class, family, and number of added individuals for the time period has been shown in Table 2. A total of 746 individual freshwater Mollusca was collected during the six-month study period. The survey recorded 12 species belonging to 10 different families. Of these, the class Gastropoda was represented by 10 species, indicating a higher dominance compared to Bivalvia, which was represented by only 2 species (Table 2, Figure 2, Figure 6 (A-L). The predominance of gastropods among freshwater molluscs aligns with previous studies that have highlighted the dominance of this class in freshwater ecosystems (Lydeard et al., 2004). The number of individuals recorded for each

species during the study period has been documented in Table 3. The findings of the present study are further supported by Budha et al (2010), who documented over 180 species of freshwater molluscs in the Eastern Himalayan region. Principal Components Analysis (PCA) bioplots of diversity indices of mollusca within its sites are shown in Figure 3. Pie diagram (Figure 4) showed the number of individuals recorded for each species during the study period.

3.1. Ethnomedicinal uses

Molluscs hold a significant place in the traditional medicinal practices of India, valued not only for their therapeutic potential but also for their nutritional content. Their uses in ethnomedicine reflects a deep-rooted understanding of natural resources within diverse cultural and regional contexts. Globally, many molluscan species are consumed either raw or cooked due to their high nutritional value. Molluscan meat is recognized as a rich source of essential amino acids, vitamins, and minerals, making it a salutary component of local diets. Ethnomedicinal use of malacofauna recorded in the present study has been listed in Table 4.

India has a long history of consuming snails in the coastal and inland tribal communities. Freshwater snails belonging to the genus *Pila* are known to be consumed for food as well as for medicinal purposes in various parts of India, but more frequently in Northeast (NE) Indian states. Freshwater gastropods are in great demand as they are easy to access and collect and comprise some economic importance to the tribal community that sells them. Other studies from the Indian subcontinent have reported that snails are a rich source of calcium and substantial amounts of phosphorus, iron and zinc, especially in species like *Pila globosa, Filopaludina bengalensis, Melanoides tuberculata* and *Lamellidens marginalis* (Jadhav et al., 2023). These molluscs are a cheap source of protein for impoverished and marginal tribal communities in India. There are studies that show that snails are rich in calcium and substantial amounts of phosphorus, iron and zinc, notably in species like *Pomacea canaliculata, Pila globosa, Bellamya bengalensis, Melanoides tuberculata* and *Lamellidens marginalis* (Baby et al., 2010; Ghosh et al., 2017).

Pharmacologically, molluscs have been reported to exhibit a range of bioactivities, including antimicrobial, anticancer, antioxidant, anti-inflammatory, and analgesic properties. In a local ethnobotanical survey conducted in Gereki, Tezpur, it was found that two species of freshwater snails are traditionally used by local inhabitants as medicinal food. According to the respondents, the snails are first dried and preserved in salt for 2–3 days before being incorporated into traditional Assamese dishes such as Tenga Paat, Dali, and Khar.

Local knowledge suggests that regular consumption of these snails is believed to improve eyesight. Furthermore, community members reported no observable adverse effects associated with their consumption. The market price of these snails varies depending on availability, ranging from approximately ₹80 to ₹100 per kilogram. Of the 12 species recorded during the study, 7 are found with ethnomedicinal uses, which are shown in Table 4.

3.2. Threats

Following threats to the Mollusca habitats were observed during the study:
a. Over exploitation
b. Pollution
c. Habitat alteration
d. Invasive species

4. Discussion

The present study documented a total of 746 individual molluscs, representing 12 species across 10 families from various freshwater and terrestrial habitats in the Sonitpur district of Assam. Among the recorded families, Viviparidae and Unionidae were represented by the highest number of species (two species each). Of the five sampling sites surveyed, Site 2 (Bharali River, Tol Gereki) exhibited the highest species richness, with nine species recorded. In contrast, only a single species was documented at Site 5 (Ganesh Ghat), likely due to its primarily terrestrial nature and limited aquatic habitat availability.

The species *Filopaludina bengalensis* was found to be the most abundant, with 148 individuals recorded, while *Achatina fulica* was the least represented. The dominance of gastropods over bivalves observed in this study is consistent with patterns reported in other freshwater ecosystems and supports findings by Lydeard et al (2004).

Comparative analysis with previous studies indicates a higher diversity of molluscan fauna in the present investigation. For instance, Das and Biswas (2016) reported only one species of Bivalvia and two species of Gastropoda from the Mara Bharali River in Sonitpur district. In a subsequent study, Das and Biswas (2019) recorded six molluscan species belonging to five families from the same river, focusing on diversity indices for fish and macroinvertebrates. Biswas and Das (2022) similarly reported six species from the Mara Bharali River. In contrast, the current study, conducted across five distinct sites, recorded 12 species—representing the highest number of freshwater molluscan species reported from the Sonitpur district to date.

Sonowal et al (2021) reported 45 freshwater molluscan species from the upper Brahmaputra Basin, indicating greater species richness at the basin scale. Mir and Bakhtiyar (2022) recorded 12 species from the Aripal stream in the Kashmir Himalayas, a number comparable to the present study. Additionally, two species previously considered extinct were recently rediscovered in Dibrugarh, Assam, by Prof. Devid Kardong and Dr. Jyotish Sonowal (Bolotov et al., 2024), emphasizing the ecological importance of continued malacological surveys in the region.

Roy and Gupta (2010) documented 16 molluscan species from the Barak River and its tributaries, suggesting higher diversity in that region relative to the current findings. Notably, one invasive species, *Physella acuta*, was detected at all sites except Site 5. This exotic species has also been reported from the Aripal stream by Mir and Bakhtiyar (2022), highlighting its widespread distribution across Indian freshwater systems. Among native species, *Filopaludina bengalensis* emerged as the most dominant, while *Lamellidens sp*. was among the least represented.

Several species identified in this study are also recognized for their economic and nutritional importance. According to Sarkar et al (2022), commonly consumed edible molluscs in India include *Lamellidens marginalis, Lamellidens corrianus, Pila globosa, Filopaludina bengalensis, Idiopoma dissimilis,* and *Brotia costula*, all of which were observed during this study. Based on the IUCN Red List (2001), all recorded species are categorized as Least Concern (LC), with the exception of *Physella acuta*, listed as exotic, and *Achatina fulica*, which is classified among the world's 100 worst invasive alien species (Table 1).

5. Conclusion

This study represents a pioneering effort to assess the diversity and distribution status of freshwater molluscs in the Sonitpur district of Assam. Over a six-month survey period, a total of 12 molluscan species were recorded from various aquatic habitats, including both lentic (still water) and lotic (flowing water) systems. The moderate species richness observed reflects the ecological variability of the region. Among the 12 recorded species, 10 were freshwater molluscs and 2 were terrestrial. Notably, 7 of the freshwater species are known to possess significant food value, as confirmed through both a literature review and a questionnaire-based survey among local communities. The invasive species *Physella acuta* was recorded at all sampling sites, indicating its widespread establishment and potential ecological impact. *Brotia costula* was primarily found in the Brahmaputra River near the Batamari and Beseria regions, while *Pila globosa, Gyraulus ladacensis*, and *Gabbia orcula* were predominantly observed in the Kala Songa area and the Mara Bharali River. The terrestrial species *Cyclophorus zebrinus* and *Achatina fulica* (commonly referred to as the garden snail and African giant snail, respectively) were restricted to upland and terrestrial habitats. Out of the 12 species identified, seven were reported to be edible and are actively utilized by indigenous communities, highlighting their ethno-nutritional and cultural significance. However, several anthropogenic threats were identified that may pose risks to the conservation of molluscan diversity in the region. These include habitat degradation, water pollution, over-exploitation, and the

introduction of invasive species. The findings underscore the need for continued monitoring and conservation initiatives focused on freshwater molluscs, particularly in biodiversity-sensitive regions such as Sonitpur district of Assam. Sustainable management practices, coupled with community awareness, are essential to safeguard the ecological and economic value of malacofauna in this area.

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