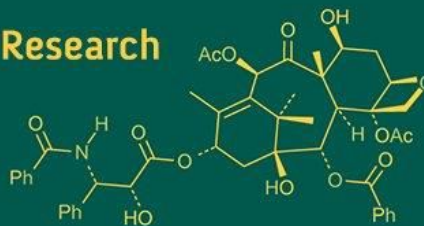
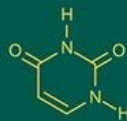


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Diversity, burrow morphology, and ecological significance of freshwater crabs in the Burhi Gandak River and Manika Oxbow Lake, Bihar

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Abstract

This study examines the diversity and ecological roles of freshwater crabs inhabiting the Burhi Gandak River and its adjacent Manika Oxbow Lake in Muzaffarpur district, Bihar, India, over a 12-month period (August 2022-July 2023). A total of seven crab species—*Acanthopotamon martensi*, *Sartoriana tribolata*, *Sartoriana spinigera*, *Barytelphusa guerini*, *Barytelphusa cunicularis*, *Inglethelphusa fronto*, and *Paratelphusa masoniana*—were identified, belonging to five genera across two families. Specimens were collected using traditional fishing methods and identified through taxonomic classification. The study also categorized crab burrows into J-shaped, T-shaped, and U-shaped types, highlighting species-specific adaptations that aid in moisture retention, protection from predators, and environmental stability. These burrows contribute significantly to ecosystem processes such as sediment aeration, nutrient cycling, and biodiversity enhancement, particularly in muddy substrates. Despite their ecological adaptability, a decline in species diversity compared to previous studies suggests potential threats like habitat degradation. This research emphasizes the importance of conservation initiatives to protect these keystone species and maintain the ecological balance of riparian habitats.

Keywords: Freshwater crabs of Bihar, crab burrows, riparian ecosystems

Introduction

Freshwater crabs are integral to aquatic ecosystems worldwide, playing crucial roles in nutrient cycling, detritus decomposition, and maintaining ecological connectivity. To date, over 1,564 species of freshwater crabs have been described globally (Darren *et al.*, 2008; Costa *et al.*, 2016) [8, 6], with India accounting for 125 species distributed across eight families: *Pseudothelphusidae*, *Trichodactylidae*, *Potamonautidae*, *Deckenidae*, *Platythelphusidae*, *Potamidae*, *Gecarcinidae*, and *Parathelphusidae* (Cumberlidge *et al.*, 2009; Pati & Sharma, 2012) [7, 13]. Apart from their ecological importance, these crabs also hold cultural and economic value, particularly in regions like Bihar, where they contribute to traditional fisheries and local diets.

Bihar's hydrological landscape, consisting of an extensive network of rivers such as the Ganges, Gandak, Kosi, and Sone, along with numerous wetlands like Kanwar Lake and Manika Lake, provides a suitable habitat for freshwater crabs. Previous studies have documented 15 freshwater crab species from different districts of Bihar, including Begusarai, Saran, and Sabour. Among the reported species are *Barytelphusa guerini*, *Barytelphusa lugubris*, *Inglethelphusa fronto*, *Paratelphusa masoniana*, *Paratelphusa spinigera*, *Barytelphusa cunicularis*, *Vanni travancorica*, *Maydellithelphusa lugubris*, *Potamon lugubre*, *Acanthopotamon martensi*, *Neorhynchoplax sp.*, *Indoxysticus minutus*, and *Thomisus sp.* (Yadav *et al.*, 2016; Dey, 2017; Priyadarshini *et al.*, 2018) [17, 9, 15]. Notably, the Burhi Gandak River and its associated oxbow lakes, including Manika Lake in Muzaffarpur district, are home to unique species such as *Sartoriana tribolata*, *Acanthopotamon martensi*, and *Sartoriana spinigera* (Dey, 2017) [9]. These crabs play essential ecological roles, including recycling nutrients and serving as prey for higher trophic levels, while also supporting the livelihoods of local communities. Despite their significance, freshwater crabs are increasingly threatened by habitat destruction, pollution, and deforestation.

Many species remain poorly studied and are classified as "Data Deficient" by the IUCN, highlighting the urgent need for research on their population status and ecological contributions (Brook *et al.*, 2003) ^[5]. Given these concerns, this study aims to document the freshwater crab diversity in the Burhi Gandak River and Manika Oxbow Lake while assessing their ecological importance and the threats they face. By analysing their unique adaptations and roles in the ecosystem, this research emphasizes the critical need for conservation efforts to ensure the sustainability of both the species and the communities that depend on them.

Materials and Methods

This study was conducted in the Burhi Gandak River and its associated wetland, Manika Oxbow Lake, situated in Muzaffarpur district, Bihar, India, over a 12-month period from August 2022 to July 2023. Manika Oxbow Lake, formed due to the meandering and cutoff of the Burhi Gandak River, is geographically located at approximately 26.1695° N latitude and 85.3848° E longitude (Fig. 1). Covering an area of about 50 hectares, the lake is characterized by shallow waters and dense aquatic vegetation, providing a favorable habitat for various fish species (Gautam *et al.*, 2021) ^[10].

Crab Sampling and Identification

Crab specimens were collected using traditional fishing methods, including drag nets and traps. Local fishers were actively engaged in the sampling process, leveraging their knowledge to identify optimal fishing sites within the lake. The collected crabs were promptly preserved in a 10% formalin solution to ensure the preservation of their morphological characteristics. Each specimen was labelled with relevant details such as the date of collection, location,

and the type of fishing gear used before being transported to the laboratory for further examination. Species identification was conducted using classical taxonomic techniques (Alcock, 1910; Pati & Sharma, 2012) ^[1, 13].

Results and Discussion

The study documented a total of 7 species of crabs (*Acanthopotamon martensi*, *Sartoriana tribolata*, *Sartoriana spinigera*, *Barytelphusa guerini*, *Barytelphusa cunicularis*, *Inglethelphusa fronto* and *Paratelphusa masoniana*) from five genera and two family from Burhi Gandak River and its wetlands Manika Oxbow Lake (Fig. 2.). The species diversity observed in this study appears to be lower than the earlier studies from Bihar (Yadav *et al.*, 2016; Dey, 2017; Priyadarshini *et al.* 2018) ^[17, 9, 15].

Table 1: List showing Freshwater crabs of Bihar (Yadav *et al.*, 2016; Dey, 2017; Priyadarshini *et al.* 2018) ^[17, 9, 15]

Family	Species
Gecarcinucidae	1. <i>Sartoriana spinigera</i>
	2. <i>Sartoriana tribolata</i>
	3. <i>Barytelphusa guerini</i>
	4. <i>Barytelphusa lugubris</i>
	5. <i>Inglethelphusa fronto</i>
	6. <i>Paratelphusa masoniana</i>
	7. <i>Paratelphusa spinigera</i>
	8. <i>Barytelphusa cunicularis</i>
	9. <i>Vanni travancorica</i>
	10. <i>Maydelliathelphusa lugubris</i>
Potamidae	11. <i>Potamon lugubre</i>
	12. <i>Acanthopotamon martensi</i>
Hymenosomatidae	13. <i>Neorhynchoplax</i> sp.
Thomisidae	14. <i>Indoxysticus minutus</i>
	15. <i>Thomisus</i> sp.

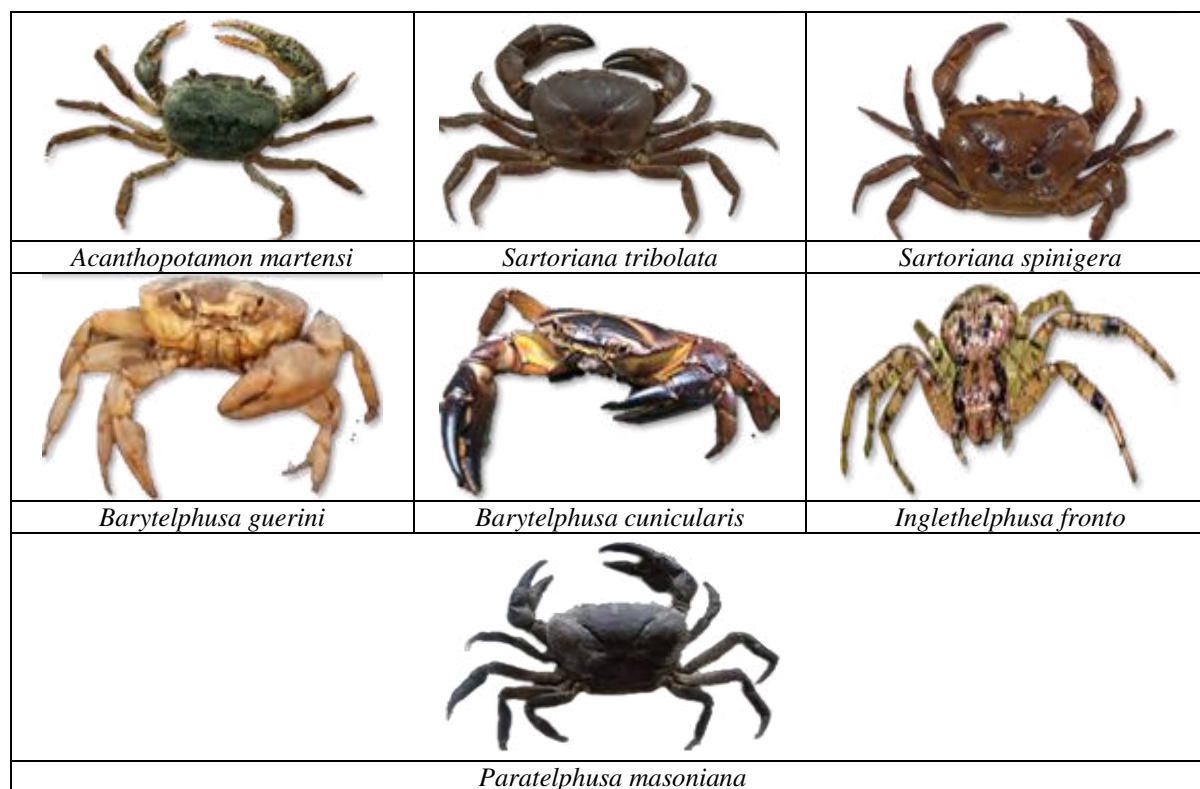


Fig 1: Freshwater crabs of Burhi Gandak River and its wetlands Manika Oxbow Lake

Burrow Morphology and Ecological Significance

The diversity in crab burrow structures—J-shaped, T-shaped, and U-shaped—along the Burhi Gandak River demonstrates species-specific adaptations to varying environmental conditions (Fig. 3). J-shaped burrows, frequently found in semi-terrestrial crabs, aid in moisture retention and offer protection from predators (Pinder & Smits, 1993) [14]. T-shaped burrows, often incorporating a horizontal chamber, provide a stable refuge against temperature fluctuations and potential flooding, particularly in riverbank ecosystems (Bhattacharya & Acharya, 1997) [2]. U-shaped burrows, characterized by dual openings, facilitate improved aeration and ease of movement, benefiting species that transition between aquatic and terrestrial habitats (Lim *et al.*, 2012) [12]. These variations in burrow morphology are influenced by factors such as soil composition, moisture availability, predation pressure, species behaviour, and riverbank stability, highlighting the crabs' ecological adaptability to dynamic riparian environments (Williams, 1983) [16].

Crab burrows in clayey and muddy substrates serve as essential habitat modifiers, enhancing sediment aeration, nutrient cycling, and microbial activity. Their burrowing activity promotes bioturbation, which facilitates oxygen penetration, reduces anoxic conditions, and accelerates organic matter decomposition, playing a crucial role in

estuarine and mangrove ecosystems (Botto & Iribarne, 2000; Kristensen, 2008) [4, 11]. Compared to clayey substrates, muddy burrows tend to support greater biodiversity due to their softer texture, higher organic matter content, and increased structural stability, attracting a more diverse range of infaunal organisms (Blamires *et al.*, 2022) [3]. Additionally, these burrows offer shelter, regulate microhabitat temperature, and shape species composition by modifying habitat structures, thereby contributing to sediment stability and overall ecosystem resilience.



Fig 2: Different shapes of crab burrows along Burhi Gandak River and its wetlands Manika Oxbow Lake



Fig 3: Muddy and Clayey Burrows along River Burhi Gandak

Conclusion

This study emphasizes the ecological importance of freshwater crabs in the Burhi Gandak River and Manika Oxbow Lake, highlighting their role as habitat engineers through burrow construction and key ecosystem functions such as nutrient cycling and sediment stabilization. However, the observed decline in species diversity compared to previous studies signals increasing threats from habitat degradation. To safeguard these ecologically significant yet vulnerable species, targeted conservation measures are crucial for maintaining the health and biodiversity of riparian ecosystems.

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