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Ichthyofauna of Baya River During Pre-Monsoon Season Near Koiria Nizamat Bihar, India

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ABSTRACT

Fish species diversity and richness are influenced by ecological niches, environmental stress, and the tolerance range of species traits. The Baya River, which flows between the Ganga River basin and the Burhi Gandak River basin, has been a significant site for ichthyofaunal studies. A total of 56 fish species were previously reported near Koiria Nizamat, representing 39 genera, 22 families, and 9 different orders. However, during the pre-monsoon period, only 34 fish species were collected from the same site. These 34 species were classified under 24 genera, 13 families, and 6 orders. The family Cyprinidae was found to be the most diverse, comprising 15 species. Most of the identified species fall under the Least Concern (LC) category of the IUCN Red List. The observed decline in fish diversity and related ecological concerns are discussed in this study, highlighting the need for conservation efforts to protect and preserve native fish germplasm.

INTRODUCTION

Ichthyofauna refers to the assemblage of fish species within a particular waterbody or zoogeographic region **(Ortiz, 2016)**. Globally, there are approximately 35,800 described species of fishes **(FishBase Search, 2025)**, accounting for more than 50% of all vertebrate species **(Nelson *et al*., 2016; Thakur *et al*., 2021)**. India contributes significantly to global fish diversity, with estimates ranging from 7.7% **(Froese & Pauly, 2020)** to 11.7% **(Stephen *et al*., 2015)** of the total piscine species. Fish taxonomy, a crucial branch of zoology and fisheries science, represents a rich and expansive field of study **(Shah, 2017)**.

India, recognized as a megadiverse country, hosts a wide array of ecosystems and exhibits considerable taxonomic and genetic diversity **(Hamilton, 1822)**. The taxonomy and diversity of Indian freshwater fishes have been extensively studied, with significant

contributions made by **Talwar and Jhingran (1992)**, **Menon (1999)** and **Jayaram (2010)**. However, despite these advances, certain freshwater systems remain understudied.

The Baya River, a lotic ecosystem located in North Bihar, represents one such region with limited ichthyological exploration. While **Kumari (2006)** documented fish species from the Baya Canal at Vaishali, and **Kumar and Kumar (2023)** examined the ichthyofauna at Koiria Nizamat; however, further studies are needed to understand seasonal variations and anthropogenic influences on fish diversity in this system.

The present study focused on the ichthyofaunal composition of the Baya River during the early pre-monsoon season. It aimed to provide a comparative assessment of fish diversity, evaluate temporal shifts in species composition, and analyze the impact of environmental and human-induced factors associated with seasonal climatic changes.

MATERIALS AND METHODS

The Baya River, also known in its upper reaches as the Raghua River, originates in North Bihar and flows eastward, ultimately joining the Ganga River near Semariaghat (**https://nwda.gov.in**). The river's catchment area spans approximately 2,776 square kilometers, with the Burhi Gandak River basin forming its northern boundary and the Ganga basin forming the southern boundary.

The present study was conducted in Koiria Nizamat village, located in the Paroo block of Muzaffarpur district, at a latitude of 26.2021° N and longitude of 85.1129° E. During the sampling period in April 2024, the river depth was recorded at approximately 2 feet. Sampling was carried out at three designated locations along the river, as shown in Fig. (1).

Various traditional fishing gears were employed, including cast nets, gill nets, drag nets, hooks, and chachari (a type of trap). Gill nets and cast nets had mesh sizes ranging from 18 to 100mm, locally measured in finger units (½, 1, 1.5, 2, 2.5, 3, 4, and 5 fingers). Except for the drag net, all fishing gears used were locally made.

Specimens were fixed using a 10% formaldehyde solution for preservation. In the laboratory, morphometric and meristic measurements were taken using standard tools such as steel rulers and calipers. Fish species were identified and classified based on established taxonomic references including **Day (1878)**, **Srivastava (1998)**, **Talwar and Jhingran (1999)**, **Jayaram (1999, 2010)** and **Nelson (2016)**.

Fig. 1. Map depicting study area site 1, 2, 3 of Baya tributary of Ganga River, Bihar

RESULTS AND DISCUSSION

Understanding fish diversity is essential for ecological research and future scientific advancements, particularly in regions with rich aquatic ecosystems. India, with its tropical monsoon climate, experiences four official seasons as defined by the Indian Meteorological Department: winter (December to early April), summer or pre-monsoon (April to June), monsoon or rainy season (June to September), and post-monsoon (October to December). During the summer months, increasing temperatures lead to a gradual reduction in water levels across various water bodies, influencing fish distribution and abundance.

In the present study, conducted at the Koria Nizamat site of the Baya River during the pre-monsoon season, a total of 34 fish species were collected and identified, representing 24 genera, 13 families, and 7 orders, as listed in Table (1). The recorded orders include:

- **Clupeiformes** (2 species)
- **Cypriniformes** (18 species)
- **Beloniformes** (1 species)
- **Channiformes/Ophiocephaliformes** (2 species)
- **Perciformes** (3 species)
- **Mastacembeliformes** (2 species)
- **Siluriformes** (6 species across 4 families)

Within Cypriniformes, two families were represented: Cyprinidae with 15 species and Cobitidae with 3 species. Cyprinidae emerged as the most diverse family in the study. Among the identified species, most were categorized as Least Concern (LC) according to the IUCN Red List of Threatened Species, Version 2024-1. However, Cyprinus carpio and Wallago attu were listed as Vulnerable (VU), while Labeo pangusia, Ompok pabda, and Ailia coila fell under the Near Threatened (NT) category.

India is globally recognized as a megadiverse country, and fish biodiversity forms an integral part of this status. **Nelson *et al*. (2016)** recognized 85 orders and 536 families of fishes, with freshwater species comprising approximately 43% of global fish diversity **(Coad & Murray, 2006; Nelson *et al*., 2016)**. India alone is home to 1,081 freshwater fish species.

In the Ganga River system, **Sarkar *et al*. (2012)** reported 143 species (133 native and 10 exotic) from 32 families; **Das *et al*. (2013)** noted the same number of species from 40 families, while **Das *et al*. (2023)** documented 190 species (182 indigenous and 8 exotic) belonging to 133 genera, 62 families, and 23 orders. From the Baya Canal at Vaishali, **Kumari (2006)** recorded 44 species. **Kumar and Kumar (2023)** reported 56 species from the Baya River at Koria Nizamat, though *Notopterus notopterus* was not observed in their findings. In contrast, the current study recorded 34 species from the same site during the pre-monsoon season, including *Notopterus notopterus*.

These findings align with similar studies, such as **Sharma and Paul (2025)**, who reported 61 fish species from the Ghaghara River in Bihar, comprising 47 genera, 21 families, and 7 orders. In their study, Cypriniformes accounted for 42% of the fish species, followed by Siluriformes (31%) and Perciformes (18%). Cyprinidae was the most dominant family (39.3% of species), followed by Bagridae (6 species) and Sisoridae (4 species).

The decline in diversity observed during the pre-monsoon period at Koria Nizamat may reflect seasonal ecological stressors, such as reduced water depth and increased anthropogenic pressures. These patterns highlight the need for continued biodiversity monitoring and habitat conservation, particularly for vulnerable and near-threatened species in understudied river systems like the Baya.

Fig. 2. Photographs of fish gear (chachari) operated and Fish catch spectrum of collected fish species

The majority of fish species reported in the present study are indigenous. Exotic species such as *Cyprinus carpio* and *Ctenopharyngodon idella*, which were abundant during the 2023 study, showed a marked decline in the current pre-monsoon survey. This reduction in abundance may be attributed to the seasonal disconnection of the Baya River from local ponds where these exotic species are typically cultured. The absence of connectivity during the summer months supports the hypothesis proposed in previous studies assuming that local ponds serve as the source of these exotics.

In comparison, **Sarkar *et al.* (2012)** recorded 143 species from the Ganga River, including 133 native and 10 exotic species across 32 families. **Das *et al.* (2013)** also reported 143 species but documented a higher family diversity with 40 families. They observed that fish abundance and distribution tend to increase with river width and depth—an observation that aligns with the findings of the present study. During the pre-monsoon season, the Baya River narrows significantly and reaches a depth of only about two feet. It often dries up completely by the end of summer, leading to reduced habitat availability.

Such seasonal hydrological constraints likely contribute to the reduction in fish species richness, as observed in the current study where only 34 species were recorded, compared to 56 species in the previous year. Fish were found to be more concentrated in "Zeng" areas—localized depressions within the riverbed where water accumulates and aquatic vegetation, such as weeds, is deposited, providing shelter and food.

The decline in exotic species like *Cyprinus carpio* may also be partially explained by environmental toxicity. **Bhardwaj *et al.* (2020)** reported significant haematological and biochemical changes in *C. carpio* due to exposure to the pesticide Imidacloprid, suggesting that environmental contaminants may influence species survival and physiological health.

Earlier studies on ichthyofaunal diversity in other freshwater systems support the observed trends. **Negi and Johal (2005)** studied fish diversity in Pong Dam, while **Singh *et al.* (2021)** focused on fisheries resource management in Gobindsagar Dam at Bhakra. **Bhatnagar *et al.* (2016)** reported 59 fish species from freshwater habitats in Haryana, which resonates with the declining diversity trend observed in the Baya River.

These findings are consistent with those of **Sharma and Paul (2025)**, who reported 61 fish species from the Ghaghara River in Bihar, comprising 47 genera, 21 families, and 7 orders. Similar to the present study, Cypriniformes dominated the species composition (42%), followed by Siluriformes (31%) and Perciformes (18%). The family Cyprinidae was the most prevalent (39.3% of species), followed by Bagridae and Sisoridae.

The Baya River, a tributary of the Ganga, exhibits dynamic ichthyofaunal patterns due to its combination of lentic (still water) and lotic (flowing water) characteristics, as well as seasonal transformations into lake-like ecosystems in certain depressions. These environmental shifts, coupled with niche-specific interactions, significantly influence the appearance and disappearance of species across seasons. The increasing intensity of heat and light during summer may further exacerbate ecological stress, reducing fish diversity during this period.

Table 1: Comparative Fish diversity of Baya river during 2023 and 2024 (present study)

S No	Order	Family	Zoological Name	Vernacular Name	IUCN status	Fishes missing
1	Clupeiformes	Notopteridae	*Notopterus notopterus*	Moya	LC	G *chapra*
2			*Notopterus chitala* (Ham)	Moya	LC	A *microlepis*
3	Cypriniformes	Cyprinidae	*Amblypharyngodon mola* (Ham)	Dhawai	LC	B *bendelisis*
4			*Catla catla* (Ham)	Bhakur	LC	A *bola*
5			*Cirrhinus mrigala* (Ham)	Naini	LC	L *gonius*
6			*Cirrhinus reba* (Ham)	Rewah	LC	O *gora*
7			*Ctenopharyngodon idellus* (Valenciennes)	Grass carp	LC	P *chola*
8			*Cyprinus carpio* (Linn)	Common carp	VU	L *guntea*
9			*Rasbora doniconius* (Ham.) or *Esomus danricus* (Ham)	Derwa	LC	O *aor*
10			*Labeo calbasu* (Ham)	Basadi	LC	R *rita*
11			*Labeo pangusia* (Ham)	Rewa	NT	B *bagarius*
12			*Labeo rohita* (Ham)	Rohu	LC	C *chaca*
13			*Osteobrama cotio* (Ham)	mushihani	LC	E *vacha*
14			*Oxygaster bacaila* (Ham)	Chalhawa	LC	C *batrachus*
15			*Puntius sarana* (Ham)	Daraheee	LC	R *corsula*
16			*Puntius conchonius* (Hamilton-Buchanan) *Pethia conchonius*	Pothi	LC	C *gachua*
17			*Puntius ticto* (Ham)	Pothi	LC	C *marulius*
18		Cobitidae	*Botia Dario* (Ham)	Baghaua	LC	A *cuchia*
19			*Botia lohachata* (Chaudhuri)	Bagha	LC	C *nama*
20			*Nemacheilus botia* (Ham)	Natwa	LC	S *coitor*
21		Siluridae	*Ompok pabda*	Pabda	NT	A *testudineus*
22			*Wallago attu* (Bl. & Schn.)	Boari	VU	C *fasciatus*
23		Bagridae	*Mystus cavasius* (Ham)	Palawa	LC	M *aculeatus*
24			*Mystus vittatus* (Bloch)	Tengari	LC	T *cutcutia*
25		Schilbeidae	*Ailia coila* (Ham)	Patasi, Banspatta	NT	----------
26		Saccobranchidae	*Heteropneustes fossilis* (Bloch)	Singhi	LC	----------
27	Beloniformes	Belonidae	*Xenentodon cancila* (Ham)	Kauwa	LC	----------
28	Channiformes	Channidae	*Channa punctatus* (Bl)	Garai	LC	----------
29			*Channa striatus* (Bl.)	Sauri	LC	----------
30	Perciformes	Centropomidae	*Chanda ranga* (Ham)	Chanari	LC	----------
31		Nandidae	*Nandus nandus* (Ham)	Dhebari, dhalo	LC	----------
32		Gobidae	*Glossogobius giuris* (Ham)	Bulla	LC	----------
33	Mastacembeliformes	Mastacembelidae	*Mastacembelus armatus* (Lacepede)	Baam	LC	---------
34			*Mastacembelus pancalus* (Ham)	Pataya, gaichi	LC	---------
	6 orders	13 families	24 genera, 34 species			24 Fish species

CONCLUSION

The 2024 study on fish diversity in the Baya River highlights the influence of seasonal fluctuations and localized fishing practices on species composition. During the pre-monsoon season, the river becomes fragmented into zengs—pond-like depressions in fertile, culturally influenced lands—which were found to support higher populations of exotic species such as the grass carp (*Ctenopharyngodon idella*) and common carp (*Cyprinus carpio*). These microhabitats act as temporary refuges but are limited in size and resources.

The observed reduction in fish diversity, particularly in comparison to previous records, underscores the need for effective management of the waterbody, especially concerning water inflow along the shoreline belt of this Ganga tributary. Seasonal declines in river width, depth, and overall water volume were closely associated with the absence of several native species. As indicated in Table (1), some species, such as *Notopterus notopterus* (locally known as "moya"), were detected in the current study but not in previous surveys. This may reflect seasonally shifting breeding grounds or habitat preferences influenced by changing environmental conditions.

Although the study site and its upstream sections are not affected by major industrial activities, the region presents a notable case of anthropogenic, non-industrial pollution, likely resulting from agricultural runoff, domestic waste, and unregulated fishing practices. The findings also highlight the ecological impact of warmer seasonal conditions, including increased temperature, light intensity, reduced dissolved oxygen (DO), and the narrowing and shallowing of the river channel.

To better understand the causes of declining fish diversity during the pre-monsoon season in the Baya River, further investigations are essential, particularly studies that integrate water quality monitoring, habitat assessment, and reproductive biology of key species.

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