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Research Article

Ichthyofaunal Composition, Distribution Patterns and Abundance in the Baralia River of Bodoland Territorial Region, Assam

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ABSTRACT

Background: The Baralia River, an important north bank tributary of the Brahmaputra River, originates from Bherberi Bhumuk in Tamulpur district and remains insufficiently explored with respect to ichthyofaunal diversity and ecological status. **Objectives:** To evaluate fish diversity, distribution patterns, and their relationship with physico-chemical parameters across different seasons and sampling sites of the Baralia River. **Materials and Methods:** Fish samples were collected from five sampling sites during different seasons. Species composition, abundance, diversity indices, spatial clustering, conservation status, and correlations with physico-chemical parameters were analyzed. **Results:** A total of 9,607 individuals belonging to 61 species, 46 genera, 22 families, and eight orders were recorded. *Oreochromis mossambicus* was the only exotic species observed. Cypriniformes was the dominant order (52.46%), followed by Siluriformes (21.31%) and Anabantiformes (13.11%). At the family level, Cyprinidae (26.23%) and Danionidae (16.39%) showed highest species richness, while Danionidae (32.96%) and Cyprinidae (30.16%) together contributed 63.12% of total abundance. Seasonal variation indicated dominance of Danionidae during premonsoon, monsoon, and winter, whereas Cyprinidae dominated during retreating monsoon. Cluster analysis revealed distinct spatial heterogeneity, with upstream sites (S1 and S2) differing markedly from midstream and downstream sites (S3-S5). Diversity indices showed high species diversity and evenness, peaking during the monsoon season. According to the International Union for Conservation of Nature Red List (2026), 88.52% of species were Least Concern, while 4.92% were Vulnerable, 3.28% Near Threatened, and 3.28% Endangered. Dissolved oxygen (7.06-11.56 mg l^{-1}) showed strong positive correlation with species richness (r=0.864) and abundance (r=0.745), whereas water temperature, total dissolved solids, electrical conductivity, free CO_2, and nitrate were negatively correlated. **Conclusion:** The Baralia River supports rich freshwater fish diversity and exhibits significant ecological value. Immediate conservation and management strategies are necessary to safeguard its ichthyofaunal resources and maintain ecosystem health.

Keywords: Baralia River, Ichthyofaunal Diversity, Physico-Chemical Parameters, Spatial distribution, Species Richness.

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INTRODUCTION

India is widely recognized as one of the world's megadiverse nations and ranks ninth in terms of freshwater biodiversity (Myers *et al*., 2000). The country supports nearly 2,500 fish species, of which about 930 are restricted to freshwater habitats (Jayaram, 1999). The northeastern region of India is regarded as a global hot spot of freshwater fish diversity (Kottelat and Whitten, 1996). This region, distinguished by its complex topography and the confluence of two major biodiversity hot spots, that is, the Eastern Himalaya and Indo-Burma, which harbors an exceptionally rich ichthyofaunal assemblage. Such diversity is largely attributed to its varied geomorphology, encompassing hills, plateaus and valleys, which give rise to a wide range of aquatic habitats, including torrential hill streams, rivers, lakes and swamps (Goswami *et al*., 2012). A total of 217 fish species has been documented from Assam, encompassing 104 genera, 37 families, and 10 orders (Bhattacharjya *et al*., 2003). The ichthyofaunal diversity of Jamlai Wetland in Kamrup District comprises 54 species representing 36 genera and 22 families (Goswami and Goswami, 2006). Similarly, 116 indigenous freshwater fish species have been reported from the Kaldia River, including 72 genera, 31 families, and nine

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orders (Sarma, 2014). In the Sankosh River of Kokrajhar District, 83 species have been recorded (Baro and Sharma, 2014). The Jia Bharali River harbors 56 species belonging to 19 families and eight orders (Das and Sarmah, 2014). The Umtrew River system supports 49 species, with environmental variables playing a significant role in structuring species distribution (Mudoi *et al*., 2022). More recently, 31 species have been recorded from the Beki River, with the family Cyprinidae contributing 64.51% of the total abundance (Goswami and Singha, 2023).

Collectively, these studies highlight the rich ichthyofaunal diversity of Northeast India and Assam. The Brahmaputra River, with 42 major tributaries (27 north bank and 15 south bank), supports rich ichthyofaunal diversity and provides livelihood and nutritional security (Bhattacharjya *et al*., 2017). Regarding diversity and species richness, the Baralia River is an important north bank tributary of the Brahmaputra, originating from Bherberi Bhumuk in the Tamulpur district (BTR), Assam. It flows through the Tamulpur and Kamrup (Rural) districts before reaching the Brahmaputra. Despite extensive studies on ichthyofaunal diversity across Northeast India, particularly in Assam, there appears to be a lack of documented studies on the diversity, abundance and distribution of fish fauna in the Baralia River in the BTR, Assam. Considering these aspects, the present study was undertaken to investigate the ichthyofaunal diversity and physico-chemical water parameters of the Baralia River within the BTR, Assam.

MATERIALS AND METHODS

Study Area

The Baralia River originates at Bherberi Bhumuk near the Nagrijuli Tea Estate, where several small streams from the Bhutan hills converge. It flows for about 75 km before joining the Pagladiya River near Dusutimukh, draining a catchment area of approximately 270 km². The river follows a meandering course, flowing west of the Puthimari River and nearly parallel to it up to the RG. Railway line. It is bounded by the Puthimari River to the east and the Nona and Mutunga rivers to the west. In its upper course, it receives the Balti River on its right bank about 2.4 km downstream of Nagrijuli Tea Estate (Baishya and Sahariah, 2017).

Data Collection and Identification

The present study was conducted from March 2022 to February 2024, covering four seasons: Premonsoon (March-May), Monsoon (June-September), Retreating Monsoon (October-November) and Winter (December-February) (Borthakur, 1986). Ichthyofaunal diversity was assessed using standard methodologies (Armontrout, 1990). Fish samples were collected both from landing centers and directly from active fishing sites. Hence, for convenience, sampling was carried out at five sampling (landing) stations (Figure 1 and Table 1). The study area map was constructed using QGIS.

Fish samples were preserved in 10% formaldehyde for subsequent laboratory analysis. Taxonomic identification and systematic classification were performed using standard taxonomic keys (Jayaram, 1999; Jhingran, 1975; Nelson, 2006; Talwar and Jhingran, 1991; Vishwanath *et al*., 2014). Species identification was further verified using online databases, including *Eschmeyer's Catalogue of Fishes* and FishBase (Froese and Pauly, 2026), to ensure updated taxonomic status.

Data Analysis

Fish distribution, relative abundance and diversity analyses were carried out using MS® Excel, R and MEGA software.

Relative abundance

$$RA\ (\%) = (n_i/N) \times 100$$

Diversity Indexes

Species diversity was assessed using standard indexes:

Shannon-Wiener Index (H′) (Shannon and Weaver, 1949):	$H' = -\Sigma\ (p_i \ln p_i)$, where $p_i = n_i/N$
Pielou's Evenness (J) (Kottelat and Whitten, 1996)	$J = H' / \ln S$
Simpson's Dominance Index (D) (Mudoi *et al*., 2022)	$D = \Sigma\ (p_i^2)$ or $\Sigma\ n_i\ (n_i - 1)/N(N-1)$

where n_i is the number of individuals of species *i, N* is the total number of individuals and S is the total number of species.

Physico-chemical Analysis of Water

Water samples for physico-chemical analysis were collected from all selected sites twice per month. Dissolved Oxygen (DO), Free Carbon Dioxide (FCO_2), total hardness (as $CaCO_3$), alkalinity (as $CaCO_3$), chloride and nitrate were determined using standard titrimetric methods (American Public Health Association, American Water Works Association, Water Environment Federation, and APHA, 2023). Water temperature was measured using a mercury thermometer, while Electrical Conductivity (EC), Total Dissolved Solids (TDS) and pH were recorded using a conductivity meter, TDS meter and pH meter (*Hanna*), respectively.

RESULTS

Species Assemblages

A total of 9,607 fish individuals *were* recorded during the study period, comprising 61 species, 46 genera, 22 families and eight orders (Table 2). Among these, *Oreochromis mossambicus* (Mozambique tilapia) was the only exotic species identified. Cypriniformes was the most dominant order, contributing 32 species (52.46%), followed by Siluriformes with 13 species

(21.31%), Anabantiformes with 8 species (13.11%) and Synbranchiformes with 4 species (6.56%). The remaining orders, that is, Beloniformes, Cichliformes, Gobiformes and Mugiliformes, were each represented by a single species (1.64%). Out of the 22 families, Cyprinidae was the most dominant family, contributing 16 species (26.23%), followed by Danionidae with 10 species (16.39%). Bagridae and Sisoridae with 4 species each (6.56%), Channidae and Mastacembelidae with 3 species each (4.92%), Osphronemidae, Cobitidae, Nemacheilidae, Psilorhynchidae and Schilbeidae contributed 2 species each (3.28%), while the remaining families were represented by a single species (1.64%) each (Figure 2) A χ^2 test showed that species are significantly unevenly distributed among fish families ($\chi^2 \approx 96.7$, d_f=21, p<0.001) and also indicating a moderate variability in species distribution across families (95% CI: 1.56-4.53).

Species abundance

The total relative abundance of fish families showed that Danionidae (32.96%) and Cyprinidae (30.16%) together dominated the assemblage, accounting for 63.12% of the total abundance. 14 families, each contributing 1-5%, collectively accounted for 32.61% of the total abundance, while the remaining six families representing <1%, contributed 4.28% (Figure 3). There was also a significant difference in relative abundance between different families of fishes found in the river (t=2.414, d_f=21, p≤0.05, 95% CI: .6306-8.4631).

Seasonal distribution indicated that Danionidae was the dominant family during premonsoon (37.96%, n=692), monsoon (30.42%, n=1,369) and winter (37.16%, n=482), whereas Cyprinidae dominated during the retreating monsoon (32.26%, n=489). This was followed by Cobitidae, Ambassidae, Bagridae and Sisoridae, which maintained moderate representation across all seasons (Figure 4). A significant difference is also observed in fish families between premonsoon (t = 2.180, d_f=21, p≤0.05, 95% CI: .2095-8.8814), monsoon (t=2.583, d_f=21, p≤0.05, 95% CI:0.8855-8.2045), retreating monsoon (t=2.432, d_f= 21, p≤0.05, 95% CI:0.6587-8.4323) and winter (t=2.208, d_f =21, p≤0.05, 95% CI:0.2636-8.8282). Further, there was a statistical variation between all seasons (F=3.709, d_f=3,395, p≤0.05) in fish families. Additionally, Tukey HSD showed a significant variation in fish families between premonsoon and monsoon, as well as between monsoon and winter.

Spatially, Danionidae dominated at sites S1 (39.43%, n=429), S4 (32.75%, n=998) and S5 (33.97%, n=654), while Cyprinidae was most abundant at S2 (35.82%, n=548) and S3 (30.39%, n=613) (Figure 5).

The dendrogram (Figure 6) reveals that S1 and S2 exhibit greater dissimilarity from the other stations, merging with the rest at a lower similarity level. In contrast, S3, S4 and S5 form a relatively compact cluster, indicating higher similarity in their fish assemblages. Within this group, S4 and S5 are the most similar, while S3 also shows close affinity with them.

IUCN status

According to the IUCN Red List, the conservation status of the 61 ichthyofaunal species recorded from the Baralia River reveals that 54 species (88.52%) are categorized as Least Concern, while 3 species (4.92%) are Vulnerable, 2 species (3.28%) are Near Threatened and 2 species (3.28%) are Endangered (International Union for Conservation of Nature, 2026). The study documented two Near Threatened species, *Neolissochilus hexagonolepis* and *Glyptothorax striatus*, and two Endangered species, *Tariqilabeo latius* and *Clarias magur*. Additionally, three species, *Oreochromis mossambicus, Wallago attu* and *Bagarius Bagarius* were identified under the Vulnerable category (Figure 7).

Species diversity

The diversity indexes, viz., Shannon-Wiener index (H′), Pielou's evenness index (J) and Simpson's dominance index (D) were calculated across sites and seasons (Table 3). Among the sites, the highest species diversity was recorded at S3 (H′=3.800), followed by S4 (3.733) and S5 (3.694), while the lowest was observed at S1 (H′=3.284). Evenness was highest at S1 (J=0.947) and S3 (0.944), whereas the lowest evenness was recorded at S4 (J=0.912). The dominance index was highest at S1 (D=0.042) and lowest at S3 (D=0.027).

Seasonal analysis revealed that species diversity was highest during the monsoon (H ft=3.883), followed by retreating monsoon (3.814) and lowest during the premonsoon (H′=3.554). Evenness was highest in the monsoon season (J=0.944) and lowest during the premonsoon (J=0.891). The dominance index showed slight seasonal variation, with the highest value in the

Table 1: Selected landing stations of the Baralia River, Assam.

Sampling stations	GPS coordinates		Elevation (m)
	Latitude (N)	Longitude(E)	
S1 (Nagrijuli market)	26°42′45.78″	91°39′10.21″	117.31
S2 (Latibari bazar)	26°38′44.11″	91°39′32.22″	98.36
S3 (Dhekiputa Chowk)	26°37′22.79″	91°39′21.09″	92.46
S4 (Gandhibari bazar)	26°35′41.33″	91°38′59.74″	89.25
S5 (Dwarkuchi market)	26°32′12.48″	91°35′48.78″	87.55

Table 2: Comprehensive list of fish faunal diversity of the Baralia River, Assam, India.

Sl. No.	Scientific names	Family	IUCN status	Relative abundance					
				S1	S2	S3	S4	S5	Overall
1.	*Anabas testudineus*	*Anabantidae*	LC	0.00	0.33	1.78	1.64	1.66	1.28
2.	*Badis badis*	*Badidae*	LC	0.00	0.65	2.68	1.87	1.71	1.60
3.	*Channa gachua*	*Channidae*	LC	0.00	0.26	1.59	1.31	0.94	0.98
4.	*Channa punctatus*	*Channidae*	LC	0.00	0.46	0.30	0.85	1.77	0.76
5.	*Channa striata*	*Channidae*	LC	0.00	0.00	0.00	0.66	0.68	0.34
6.	*nandus nandus*	*Nandidae*	LC	0.00	0.00	1.24	0.92	1.35	0.82
7.	*Trichogaster fasciatus*	*Osphronemidae*	LC	0.00	0.00	0.00	1.08	1.25	0.59
8.	*Trichogaster lalius*	*Osphronemidae*	LC	0.00	0.00	0.50	0.36	0.78	0.37
9.	*Xenentodon cancila*	*Belonidae*	LC	0.00	0.26	1.64	1.08	0.36	0.80
10.	*Oreochromis mossambicus*	*Cichlidae*	VU	0.00	0.00	0.79	0.82	0.94	0.61
11.	*Canthrophys gongota*	*Cobitidae*	LC	2.48	3.86	2.68	2.13	1.51	2.44
12.	*Lepidocephalichthys guntea*	*Cobitidae*	LC	2.85	3.14	2.53	1.48	1.25	2.07
13.	*Bangana dero*	*Cyprinidae*	LC	4.14	4.71	2.73	1.84	2.08	2.79
14.	*Chagunius chagunio*	*Cyprinidae*	LC	3.95	4.31	2.83	2.40	3.27	3.14
15.	*Cirrhinus mrigala*	*Cyprinidae*	LC	0.00	0.13	1.04	0.69	0.36	0.53
16.	*Cirrhinus reba*	*Cyprinidae*	LC	4.04	1.96	2.28	2.26	2.03	2.37
17.	*Garra annandalei*	*Cyprinidae*	LC	3.40	2.61	2.03	0.89	1.25	1.76
18.	*Garra gotyla*	*Cyprinidae*	LC	3.22	1.83	2.18	1.35	1.14	1.77
19.	*Garra lamta*	*Cyprinidae*	LC	3.68	3.53	2.43	1.58	2.13	2.41
20.	*Labeo bata*	*Cyprinidae*	LC	0.00	2.68	2.33	1.77	2.39	1.96
21.	*Labeo dyocheilus*	*Cyprinidae*	LC	2.11	2.03	0.55	0.13	0.00	0.72
22.	*Labeo gonius*	*Cyprinidae*	LC	0.00	0.13	1.49	1.67	1.51	1.17
23.	*Labeo rohita*	*Cyprinidae*	NT	0.00	0.00	0.30	1.08	1.04	0.61
24.	*Neolissochilus hexagonolepis*	*Cyprinidae*	LC	3.22	1.83	2.18	0.00	0.52	1.22
25.	*Pethia ticto*	*Cyprinidae*	LC	0.37	0.00	0.35	2.33	1.51	1.16
26.	*Puntius sophore*	*Cyprinidae*	LC	0.55	0.00	2.63	4.59	4.10	2.89
27.	*Puntius terio*	*Cyprinidae*	LC	2.30	3.92	1.78	0.69	1.51	1.78
28.	*Tariqilabeo latius*	*Cyprinidae*	EN	3.77	3.07	1.93	2.07	1.56	2.29
29.	*Tor putitora*	*Danionidae*	LC	3.77	3.07	1.34	0.82	0.62	1.58
30.	*Amblypharyngodon mola*	*Danionidae*	LC	10.02	8.63	6.49	8.83	11.64	9.00
31.	*Barilius barila*	*Danionidae*	LC	3.77	3.07	4.02	6.66	6.29	5.13
32.	*Barilius vagra*	*Danionidae*	LC	3.86	3.59	1.09	1.08	1.04	1.79
33.	*Danio rerio*	*Danionidae*	LC	0.00	1.31	1.14	1.02	1.14	1.00
34.	*Devario aequipinnatus*	*Danionidae*	LC	3.49	1.70	0.74	0.85	0.21	1.13
35.	*Esomus danrica*	*Danionidae*	LC	0.00	0.00	0.59	1.90	1.71	1.07
36.	*Opsarius barna,*	*Danionidae*	LC	7.90	5.69	5.26	1.97	2.18	3.97
37.	*Osparius bendelisis*	*Danionidae*	LC	3.68	3.53	1.44	1.38	2.08	2.13
38.	*Raiamas bola*	*Danionidae*	LC	2.76	2.29	2.13	2.26	2.34	2.31
39.	*Salmostoma bacaila*	*Nemacheilidae*	LC	3.95	3.40	5.70	6.79	5.35	5.41
40.	*Paracanthocobitis botia*	*Nemacheilidae*	LC	3.22	2.94	1.34	0.82	0.88	1.55

Sl. No.	Scientific names	Family	IUCN status	Relative abundance					
				S1	S2	S3	S4	S5	Overall
41.	*Psilorhynchus balitora*	*Psilorhynchidae*	LC	0.18	0.72	1.59	1.48	1.66	1.27
42.	*Psilorhynchus sucatio*	*Psilorhynchidae*	LC	3.86	3.59	1.09	0.98	1.04	1.76
43.	*Glossogobius giuris*	*Gobidae*	LC	0.00	0.00	1.83	1.71	1.51	1.23
44.	*Chanda nama*	*Ambassidae*	LC	0.00	0.59	3.92	6.73	5.97	4.25
45.	*Batasio tengana*	*Bagridae*	LC	1.93	2.42	1.19	0.30	0.00	0.95
46.	*Mystus tengara*	*Bagridae*	LC	0.00	0.00	0.00	2.99	2.18	1.38
47.	*Mystus vittatus*	*Bagridae*	LC	0.00	0.00	0.00	1.02	0.94	0.51
48.	*Sperata seenghala*	*Bagridae*	LC	1.93	1.96	0.84	0.07	0.00	0.73
49.	*Clarias magur*	*Clariidae*	EN	0.00	1.18	0.94	0.89	1.30	0.93
50.	*Heteropneustes fossilis*	*Heteropneustidae*	LC	0.00	1.63	1.69	1.18	1.25	1.24
51.	*Eutropichthys vacha*	*Schilbeidae*	LC	0.00	0.46	0.10	0.62	0.94	0.48
52.	*Pachypterus antheroides*	*Schilbeidae*	LC	1.93	2.75	1.14	1.38	0.52	1.44
53.	*Wallago attu*	*Siluridae*	VU	0.00	0.00	1.74	1.64	1.51	1.19
54.	*Bagarius Bagarius*	*Sisoridae*	VU	0.83	0.13	0.84	0.43	0.21	0.47
55.	*Gagata cenia*	*Sisoridae*	LC	2.21	3.01	2.53	1.44	1.51	2.02
56.	*Glyptothorax striatus*	*Sisoridae*	NT	0.00	0.13	0.94	0.36	0.62	0.46
57.	*Nangra assamensis*	*Sisoridae*	LC	0.00	0.00	0.59	0.59	0.00	0.31
58.	*Macrognathus aral*	*Mastacembelidae*	LC	0.00	0.00	0.45	0.53	0.47	0.35
59.	*Macrognathus pancalus*	*Mastacembelidae*	LC	0.00	0.00	1.09	0.69	0.26	0.50
60.	*Mastacembelus armatus*	*Mastacembelidae*	LC	0.64	0.52	1.44	0.82	1.71	1.06
61.	*Monopterus cuchia*	*Synbranchidae*	LC	0.00	0.00	0.00	0.23	0.36	0.15

Abbreviations: EN: Endangered; IUCN: International Union for Conservation of Nature; LC: Least Concern; NT: Near Threatened; S: Sampling site; VU: Vulnerable.

premonsoon (D=0.047) and the lowest during the monsoon (D=0.026) (Table 4).

Physico-chemical Parameters

Seasonal variations in physico-chemical parameters across the sampling sites are summarized in Table 5. The measured parameters exhibited considerable spatial as well as seasonal variability throughout the study period. Water temperature was recorded at its minimum at S1 during winter and reached its maximum at S5 during the monsoon season. The pH values ranged from 6.3 to 9.1 across all sites and seasons, indicating slightly acidic to alkaline conditions. TDS attained their highest values at S4 during the monsoon, while the lowest concentrations were observed at S2 in winter. EC was highest at S5 and lowest at S4. DO concentrations varied between 7.06 and 11.56 mg l^{-1}, with the lowest value recorded at S3 during the premonsoon period and the highest at S1 in winter. Free CO_2 concentrations ranged from 4.3 to 7.94 mg l^{-1}, peaking at S5 and reaching a minimum at S2. Total alkalinity fluctuated between 87 and 183.31 mg l^{-1}, with the highest values observed at S4 and the lowest at S1. Similarly, total hardness and chloride concentrations varied from 48.63 to 112.67 mg l^{-1} and 11.38-17.85 mg l^{-1}, respectively, across the sampling sites. Nitrate concentrations ranged from 0.1 to 0.4 mg l^{-1}, with an average value of 0.23 mg l^{-1}.

To examine the relationship between fish species richness, abundance and physico-chemical parameters, Pearson's correlation analysis was performed (Figure 8). The results revealed a strong positive correlation of both species richness and abundance with DO in the Baralia River (r=0.92 and r =0.8, respectively). In contrast, water temperature, pH, TDS, EC, free CO_2 and total nitrate exhibited strong to moderate negative correlations with both richness and abundance. Conversely, total alkalinity, hardness and chloride concentrations showed positive correlations with both fish species richness and abundance.

DISCUSSION

The present study reveals that the Baralia River supports a rich and diverse ichthyofaunal assemblage comparable to other tributaries of the Brahmaputra Basin. The dominance of Cypriniformes (Das *et al*., 2021; Goswami and Singha, 2023; Rani and Jobiraj, 2017) and the high representation of Cyprinidae and Danionidae are consistent with earlier studies conducted in northeast Indian rivers (Khesoh *et al*., 2025; Nanda *et al*., 2025; Tyagi *et al*., 2021), where cyprinids typically constitute the major component of freshwater fish diversity due to their adaptive flexibility and wide ecologic tolerance (Johal *et al.*, 2002).

Spatial clustering indicates significant habitat heterogeneity along the river continuum. The dissimilarity of S1 and S2 from other sites may be attributed to upstream environmental conditions such as lower anthropogenic disturbance, substrate types or variations in water parameters (Konan *et al.*, 2015). In contrast, the similarity among S3, S4, and S5 suggests relatively homogeneous ecologic conditions in midstream and downstream stretches, supporting comparable fish assemblages (Buisson and Grenouillet, 2009; Ongh *et al.*, 2025).

The diversity indexes (high Shannon-Wiener values and evenness) indicate a stable and well-balanced fish community. The highest diversity recorded during the monsoon season can be linked to increased water volume, connectivity of habitats and

Table 3: Fish diversity and richness of Baralia River among different sites.

Sites	Species richness	Species abundance	Shannon (H)	Simpson (D)	Evenness (J)
S1	32	1,088	3.284	0.042	0.947
S2	44	1530	3.489	0.035	0.922
S3	56	2017	3.800	0.027	0.944
S4	60	3,047	3.733	0.033	0.912
S5	57	1925	3.694	0.036	0.913

Table 4: Fish diversity and richness of Baralia River among different seasons.

Season	Species richness	Species abundance	Shannon (H)	Simpson (D)	Evenness (J)
PM	54	1823	3.554	0.047	0.891
M	61	4,691	3.883	0.026	0.944
RM	60	1516	3.814	0.027	0.931
W	54	1577	3.609	0.033	0.905

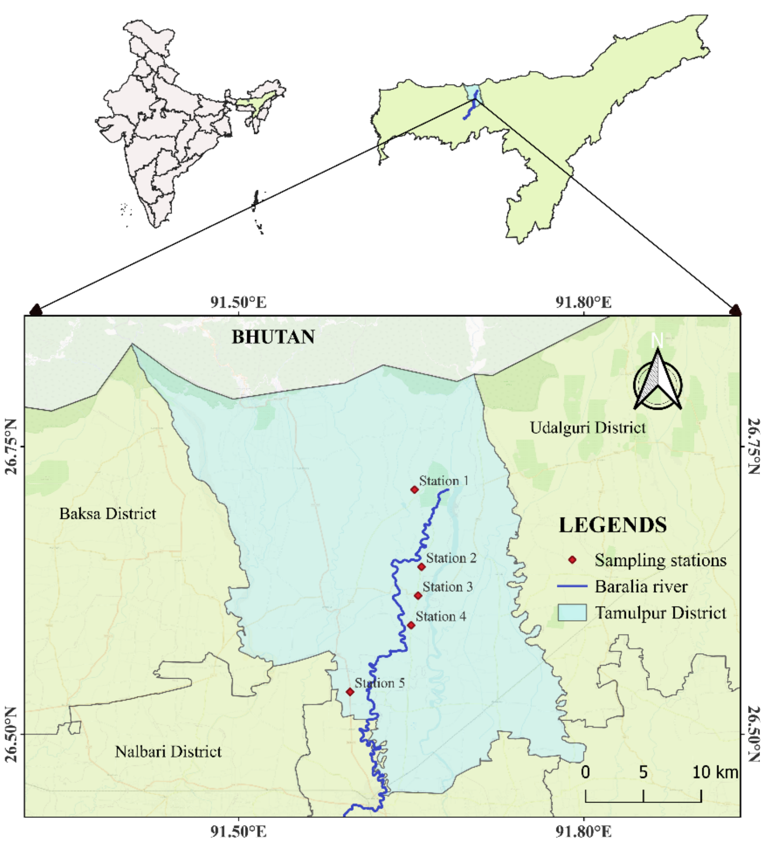

Figure 1: Map of the Baralia River showing the fish Sampling Stations (S1-S5).

Table 5: Mean Physico-Chemical Variables of Five Sampling Sites of the Baralia River.

Sl. No.	Variables	S1	S2	S3	S4	S5
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
1.	WT (°C)	18.05±1.04	18.18±1.01	18.45±1.02	18.65±0.98	18.91±0.98
2.	pH	7.33±0.22	7.26±0.19	7.25±0.25	7.44±0.73	7.66±0.65
3.	TDS	75.15±13.47	76.90±15.36	72.69±17.53	80.75±21.78	83.35±14.05
4.	Conductivity	34.44±6.29	32.34±1.19	37.05±2.18	45.39±11.11	48.21±11.74
5.	DO (p.p.m.)	9.51±1.04	9.44±1.02	9.04±1.08	8.58±0.66	8.42±0.65
6.	Free carbon dioxide (p.p.m.)	5.58±0.29	5.61±0.63	5.78±0.44	5.80±0.75	6.53±0.86
7.	Alkanity (mg L^{-1})	94.77±5.91	104.40±12.68	99.24±5.17	126.79±20.82	129.12±17.86
8.	Hardness (mg L^{-1})	57.24±7.00	61.20±6.77	59.09±5.76	81.10±12.38	73.97±9.24
9.	Chloride (mg L^{-1})	13.01±0.91	13.68±1.03	13.75±0.68	15.03±1.24	17.26±2.15
10.	Nitrate (mg L^{-1})	0.14±0.02	0.22±0.02	0.21±0.02	0.27±0.04	0.32±0.04

Abbreviations: DO: Dissolved Oxygen; TDS: Total Dissolved Solids.

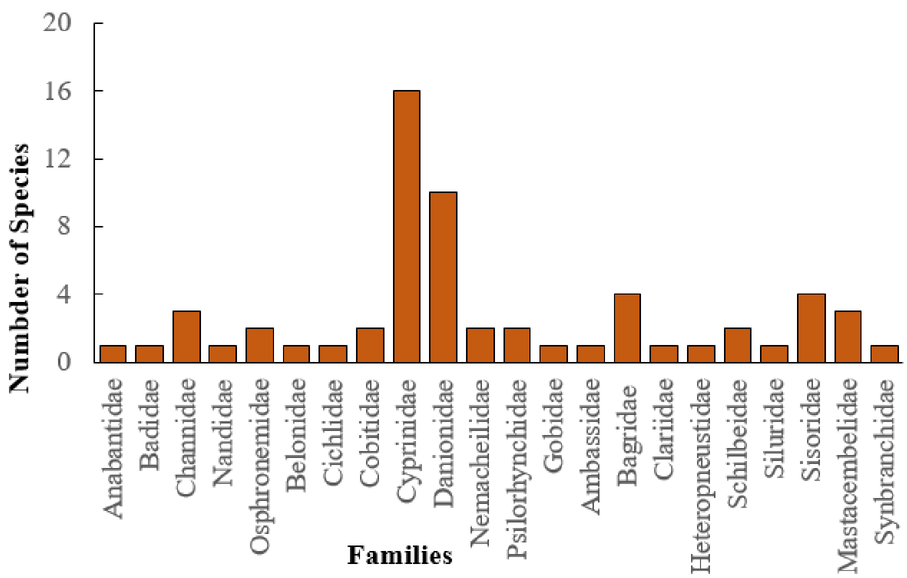

Figure 2: Family-wise distribution of fish species in the Baralia River.

availability of breeding and feeding grounds (Debnath *et al.*, 2022; Shetty *et al.*, 2015). Lower diversity and higher dominance during premonsoon suggest restricted habitats and environmental stress conditions (Wanjari *et al.*, 2025).

The correlation analysis underscores the critical role of dissolved oxygen in sustaining fish diversity and abundance, a finding widely supported in freshwater ecologic studies (Zhao *et al.*, 2025). Increased water temperature also reduces the ability of water to hold dissolved oxygen (Tan *et al.*, 2022). Negative correlations with temperature, TDS, EC and free CO_2 indicate that elevated levels of these parameters may create suboptimal conditions for many species. Conversely, positive correlations with alkalinity, hardness and chloride suggest their role in maintaining ionic balance and productivity within acceptable limits (Sahu *et al.*, 2025).

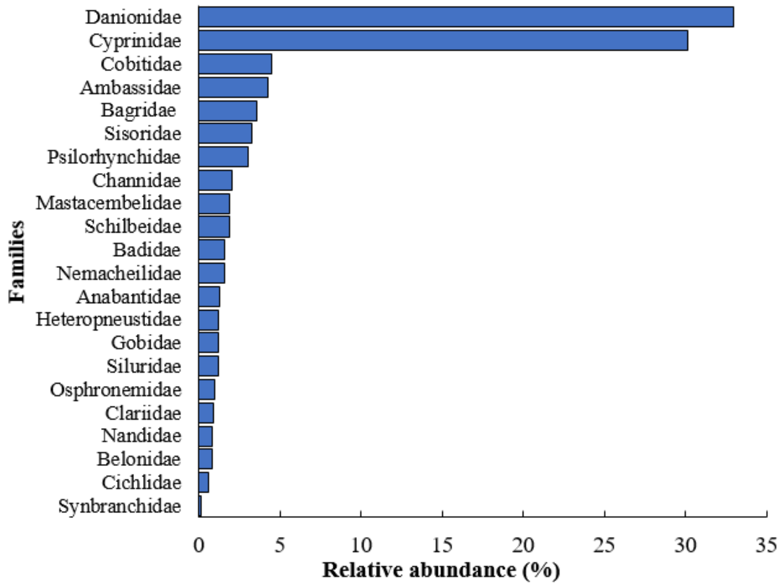

Figure 3: Overall relative abundance of fish species with respect to their families.

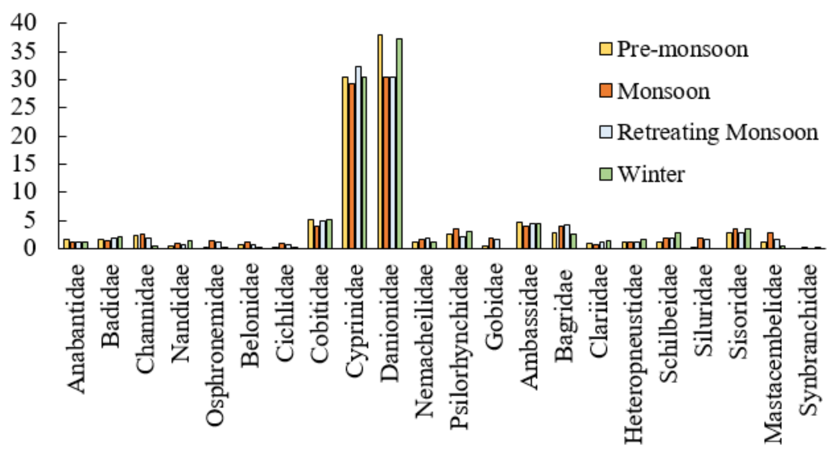

Figure 4: Seasonal variation in the relative abundance of different families.

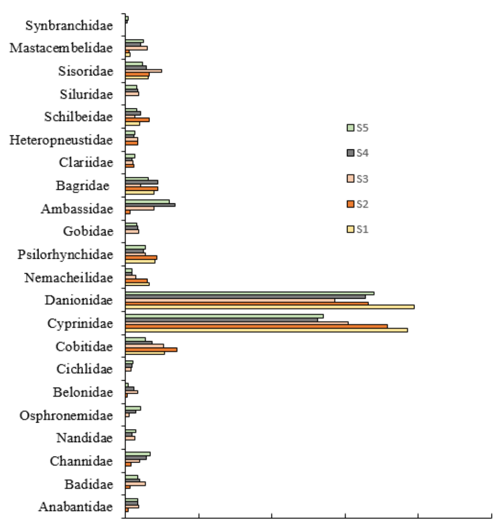

Figure 5: Relative abundance of different families across different landing stations. (s) Sampling site.

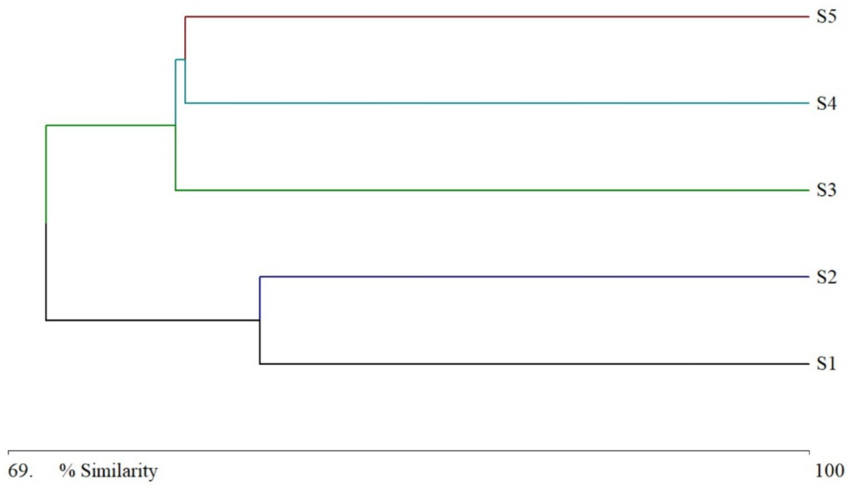

Figure 6: Dendrogram showing similarity in species composition of fish species across five sampling stations.

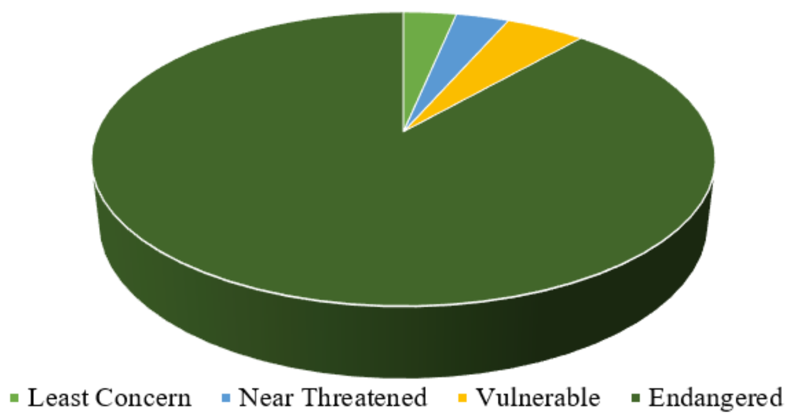

Figure 7: International Union for Conservation of Nature (IUCN) Red List Category of fish in the Baralia River.

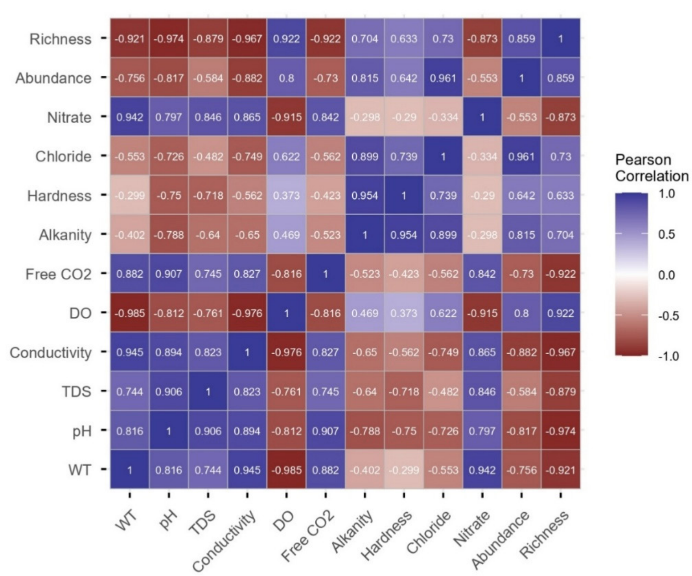

Figure 8: Heatmap of Pearson correlation matrix among environmental parameters and fish abundance and richness.

Despite the predominance of Least Concern species, the presence of Near Threatened and Endangered species such as *Neolissochilus hexagonolepis, Glyptothorax striatus, Tariqilabeo latius*, and so on highlights the conservation importance of the river.

CONCLUSION

The Baralia River supports high ichthyofaunal diversity, characterized by a well-structured community and marked seasonal and spatial variations driven by physico-chemical parameters. The dominance of Cyprinidae and Danionidae, along with relatively high diversity and evenness indexes, reflects a stable and productive ecosystem. Among environmental factors, dissolved oxygen plays a pivotal role in regulating fish diversity and abundance, while other parameters further influence species distribution patterns. The presence of threatened species highlights the ecologic importance of the river and emphasizes the need for effective conservation and management strategies. Ensuring habitat integrity, maintaining water quality and reducing anthropogenic pressures are essential for sustaining its biodiversity. This study provides baseline data valuable for long-term ecologic monitoring and conservation planning in the Baralia River system.

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ABBREVIATIONS

BTR: Bodoland Territorial Region; **IUCN:** International Union for Conservation of Nature; **TDS:** Total Dissolved Solids; **EC:** Electrical Conductivity; **CO_2:** Carbon Dioxide; **NE:** Northeastern; **QGIS:** Quantum Geographic Information System; **RA:** Relative Abundance; **MEGA:** Molecular Evolutionary Genetics Analysis; **DO:** Dissolved Oxygen; **WT:** Water Temperature; **SD:** Standard Deviation; **PM:** Pre-monsoon; M: Monsoon; **RM:** Retreating Monsoon; **W:** Winter; **H′:** Shannon-Wiener Index; **J:** Pielou's Evenness; **D:** Simpson's Dominance Index; **LC:** Least Concern; **NT:** Near Threatened; **VU:** Vulnerable; **EN:** Endangered; **S:** Sampling site.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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