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Diversity of ichthyofauna in headwater streams of Pamba River Basin, Southern Western Ghats, Kerala, India

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Abstract

This study investigates the diversity of ichthyofauna in the upstream tributaries of the Pamba River Basin in the Western Ghats of Kerala, India. A total of 45 fish species, representing 26 genera, 10 families, and five orders, were recorded from five sampling sites: Nilackal–Kaduvappara (S1), Karimthookku (S2), Veluthodu (S3), Chorakakki (S4), and Chekuthanthodu (S5). The family Cyprinidae was the most species-rich family, with 21 species. Species recorded from all five study streams included *Haludaria melanampyx* (Day, 1865), *Opsarius bakeri* (Day, 1865), *Opsarius barna* (Hamilton, 1822), *Devario aequipinnatus* (McClelland, 1839), *Devario malabaricus* (Jerdon, 1849), *Rasbora dandia* (Valenciennes, 1844), and *Garra mullya* Sykes, 1839, indicating their broad ecological tolerance. Species richness was highest at Chorakakki (S4), as indicated by the highest Margalef's species richness index (D_{Mg} = 2.853), whereas Karimthookku (S2) exhibited the highest species dominance. Endemic species constituted 60.00% of the total recorded ichthyofauna (27 of 45 species). Among these, 13 species (28.89% of the total ichthyofauna) were categorized as Western Ghats endemics (EN-WG), while the remaining endemic species belonged to other endemicity categories, including the Southern Western Ghats (EN-SWG), Kerala (EN-K), Peninsular India (EN-PI), India (EN-I), the Nilgiri Hills (EN-NI), and the Anamalai landscape (EN-AL). Endemism was assessed following Gopalakrishnan and Ponniah (2000), and no exotic species were recorded. Conservation status was assessed according to the IUCN Red List, which classified eight species as Endangered (EN) and two as Vulnerable (VU), while the remaining taxa were classified as Near Threatened, Least Concern, or Data Deficient. The Jaccard similarity analysis indicated that Veluthodu (S3) and Chorakakki (S4) shared the highest degree of species similarity among the five study streams. This relationship was also reflected in the UPGMA dendrogram. The findings highlight the high conservation value of the headwater stream ecosystems of the Pamba River Basin and emphasize the need for targeted conservation efforts to protect endemic fish species.

Key words: Biodiversity indices, endemism, ichthyofauna, species similarity, threat status

Introduction

The state of Kerala supports a rich and diverse array of fishery resources, and its ichthyofaunal communities provide significant nutritional benefits while also serving as valuable indicators of aquatic ecosystem health. Fish, as an integral component of aquatic vertebrate communities, play a crucial role in aquatic food webs by maintaining ecosystem structure and ecological balance (Meinam et al., 2023; Flandrin et al., 2024).

Understanding the diversity of fish species across different aquatic ecosystems is essential for the sustainable management and conservation of freshwater habitats affected by anthropogenic activities (de Sa Ferreira Lima et al., 2025). Moreover, the composition, abundance, and species richness of fish assemblages are strongly influenced by the complexity and heterogeneity of their aquatic habitats.

The Pamba River Basin, in particular, represents an important habitat for numerous endemic fish species, including several species of economic importance for aquaculture and the ornamental fish trade. Radhakrishnan (2006) identified 174 fish species in Kerala's rivers, 55 of which were recorded from the Pamba River. Numerous studies have documented the ichthyofaunal diversity of the major streams and rivers of southern Kerala, including those by Bijukumar and Sushama (2001), Jameela and Ramachandran (2009), Swapna (2009), Jancy and Jobiraj (2017), Arunkumar and Arunachalam (2018), Salu and Ambili (2019), Sheeja (2019), and Sojomon (2022). More recently, Vishnu et al. (2023) reported 35 fish species from a perennial tributary of the Achankovil River in Kerala.

Such diversity studies are essential for advancing systematics and taxonomy by updating fish species inventories, refining taxonomic classifications, and improving our understanding of regional freshwater biodiversity. For example, Plamoottil and Zupancic (2017) described *Labeo filiferus* Plamoottil and Zupancic, 2017, a cyprinid species new to science, from the Pamba River Basin of Kerala, India.

Forested headwater streams are ecologically significant components of river networks, providing heterogeneous habitats that support high diversity of native and endemic freshwater fishes. These streams contribute to maintaining ecological connectivity, serve as important refugia for habitat-specialist species, and play key roles in sustaining biodiversity within tropical river basins. Despite these previous investigations, comprehensive and systematic assessments of ichthyofaunal diversity in the forested headwater streams of the Pamba River Basin remain scarce. Consequently, the present study addresses this knowledge gap by documenting the taxonomic composition, diversity, species occurrence, and endemism of fish assemblages inhabiting the headwater streams of the Pamba River Basin, thereby providing important baseline information for future ecological research, biodiversity monitoring, and conservation studies.

Material and Methods

Study area

The study was conducted in five streams of the Pamba River within the Ranni Forest Division: Nilackal–Kaduvappara (S1), Karimthookku (S2), Veluthodu (S3), Chorakakki (S4), and Chekuthanthodu (S5). Among these, Chekuthanthodu (S5) flows through areas influenced by anthropogenic activities within the Ranni Forest Range, whereas the remaining streams are located within the Goodrical Reserve Forest of the Western Ghats.

The location map (Fig. 1) was prepared using Geographic Information System (GIS) tools based on Google Earth imagery and published forest division maps. Sampling locations were plotted using GPS coordinates recorded during field surveys.

The Goodrical Reserve Forest, located in southern Kerala, is the largest forest range in the state, encompassing approximately 653.97 km² of predominantly West Coast Tropical Evergreen Forest. It is bordered to the north by the Periyar Tiger Reserve (PTR). Geographically, the area extends between 76°55′–77°17′ E longitude and 9°10′–9°30′ N latitude, with an altitudinal gradient ranging from 100 to 1,400 m above sea level. The region experiences a moderately hot and humid climate, with diurnal temperature variations generally not exceeding 10 °C. The highest mean daily temperature in the plains reaches approximately 32 °C in March, whereas the lowest is approximately 20 °C in January (Menon, 2006). The Goodrical Reserve Forest is drained by numerous lower-order streams and major tributaries of the Pamba River, including the Kakki and Kakkad Aar, which are susceptible to flooding during the monsoon season.

Assessment of ichthyofaunal diversity

The assessment of ichthyofaunal diversity was conducted monthly from January 2019 to December 2020 across the five study streams. Fish were sampled using (i) a nylon cast net with a mesh size of 14 mm and a length of 2.33 m; (ii) a scoop net with a mesh size of 2 mm, a depth of 50 cm, and a diameter of 20 cm; and (iii) cheesecloth to sample stream habitats. Sampling was conducted randomly along a 200 m stretch of each stream, with sampling points spaced approximately 20–30 m apart. Each sampling visit lasted approximately 1.5–2 hours per stream, and comparable sampling effort was maintained across all sites and monthly surveys. Fish abundance was estimated by counting all individuals of each species captured at the sampling stations during each survey. Representative voucher specimens of each species were retained for taxonomic identification, rinsed with water to remove debris, and preserved in 10% formalin or absolute alcohol. All collected specimens were preserved and deposited in the reference collection of the Department of Zoology, Mar Thoma College, Tiruvalla, Kerala, India. Fish sampling was carried out with prior permission from the Kerala Forest and Wildlife Department.

For fish identification, standard taxonomic keys by Talwar and Jhingran (1991), Jayaram (2010), and Froese and Pauly (2026) were used. The conservation status and global extinction risk of the recorded species were assessed using the most recent version of the IUCN Red List of Threatened Species (IUCN, 2026).

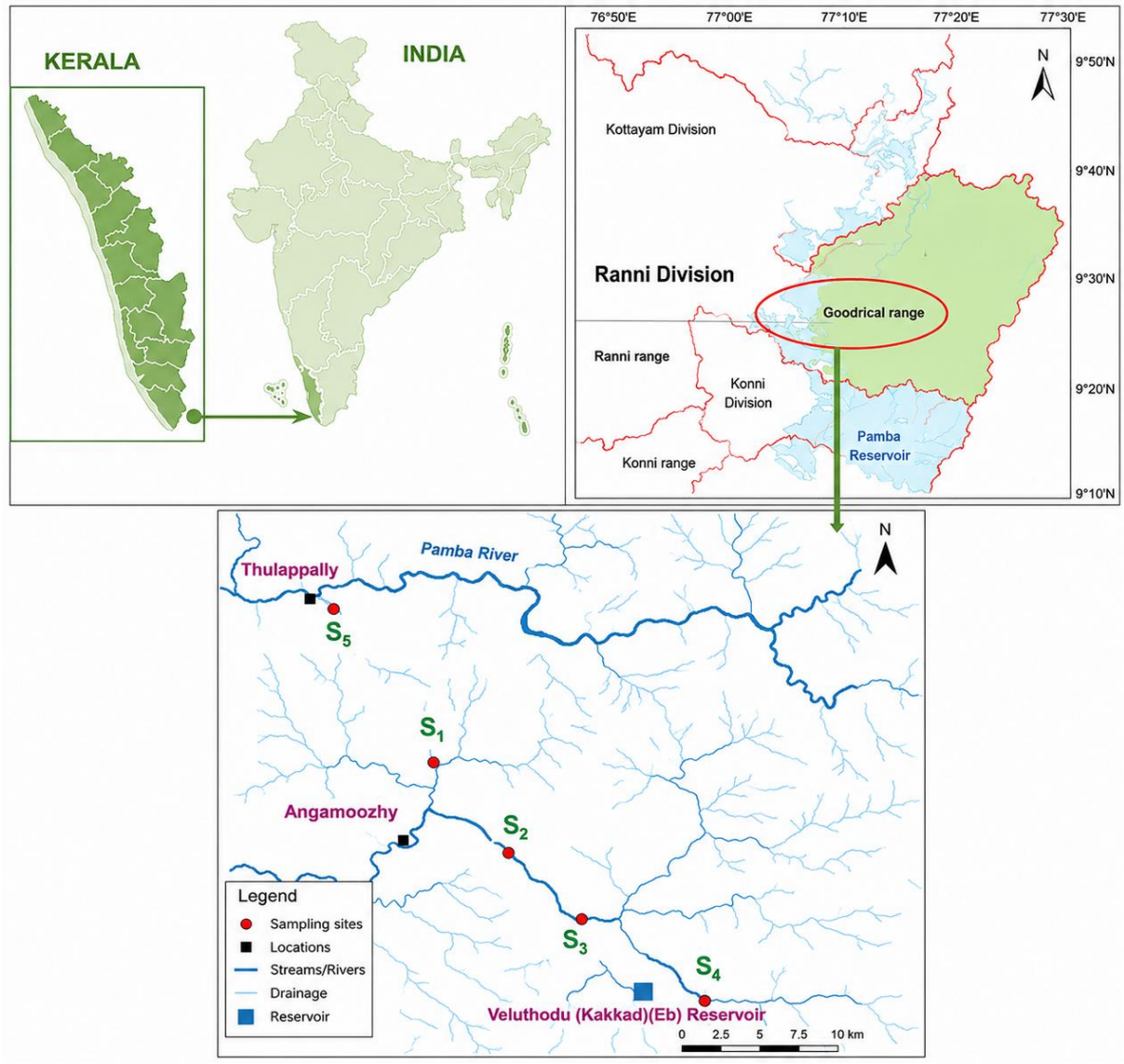

Figure 1: Location of the sampled streams—Nilackal–Kaduvappara (S1), Karimthookku (S2), Veluthodu (S3), Chorakakki (S4), and Chekuthanthodu (S5)—in the Western Ghats of southern Kerala, India. The map shows the locations of the sampled streams within the forested landscapes, with emphasis on the Goodrical Reserve Forest and the anthropogenically influenced areas of the Ranni Forest Range (inset, upper right).

Endemism was evaluated based on the species' natural distribution ranges, considering taxa restricted to India or to specific biogeographic regions within the country (e.g., the Western Ghats or the southern Western Ghats), following the criteria proposed by Gopalakrishnan and Ponniah (2000) and updated distributional information available up to 2025. Species diversity and community structure were evaluated using the Shannon–Wiener diversity index (Shannon and Weaver, 1949), which accounts for both species richness and evenness; Simpson's dominance index (Simpson, 1949), which reflects the dominance of abundant species; Margalef's species richness index (Margalef, 1958); Buzas and Gibson's evenness index (Buzas and Gibson, 1969), which measures the evenness of species distribution; and Jaccard's similarity index (Jaccard, 1901), which was used to compare species composition among streams. All indices were calculated using PAST version 4.03.

Shannon–Wiener Diversity Index (H') = $-\Sigma(n_i/N)\ln(n_i/N)$

where n_i is the number of individuals of the i th species, and N is the total number of individuals in the sample.

Margalef's Species Richness Index (D_{Mg}) = $(S-1)/\ln N$

where S is the total number of species, and N is the total number of individuals across all species.

Simpson's Dominance Index (D) = $\Sigma(n_i/N)^2$

where n_i is the number of individuals of taxon i.

Buzas and Gibson's Evenness Index = e^H/S

where H is the Shannon–Wiener diversity index, and S is the total number of species.

Jaccard's Similarity Index (Sj) = $j/(a+b-j)$

where *j* represents the number of species common to the two streams being compared, and *a* and *b* represent the total number of species recorded in the respective streams. Pairwise Jaccard similarity was calculated for all combinations of the five study streams (S1–S5). The resulting pairwise similarity matrix was subjected to hierarchical cluster analysis using the Unweighted Pair Group Method with Arithmetic Mean (UPGMA) in PAST version 4.03 to generate the dendrogram.

Results

A total of 6,773 individual fish representing 45 species, five orders, 10 families, and 26 genera were recorded from the five study streams of the Pamba River Basin (Table 1; Appendix). The order Cypriniformes was the dominant order, with Cyprinidae being the most species-rich family, represented by 21 species, followed by Nemacheilidae with six species. Seven cyprinid species—*Haludaria melanampyx* (Day, 1865), *Opsarius bakeri* (Day, 1865), *Opsarius barna* (Hamilton, 1822), *Devario aequipinnatus* (McClelland, 1839), *Devario malabaricus* (Jerdon, 1849), *Rasbora dandia* (Valenciennes, 1844), and *Garra mullya* Sykes, 1839—were recorded across all five study streams. These were the only species recorded across all five streams, although several other species occurred in multiple streams but were absent from at least one stream.

Species composition differed among streams, with several taxa restricted to specific sites. *Nemacheilus pulchellus* (Day, 1873) and *Mystus keletius* (Valenciennes, 1840) were recorded exclusively from Nilackal–Kaduvappara (S1), where *Haludaria melanampyx* (Day, 1865) (33.04%) and *Garra mullya* Sykes, 1839 (21.49%) were the dominant species. *Longischistura striatus* (Day, 1867), *Mastacembelus alboguttatus* Boulenger, 1893, *Mesonoemacheilus guentheri* (Day, 1867), *Channa marulius* (Hamilton, 1822), and *Mystus armatus* (Day, 1865) were restricted to Karimthookku (S2). *Pethia ticto* (Hamilton, 1822) and *Nemacheilus* sp. were recorded only from Veluthodu (S3). At both Karimthookku (S2) and Veluthodu (S3), *Haludaria melanampyx* (Day, 1865) and *Rasbora dandia* (Valenciennes, 1844) were the most abundant species, together accounting for 59.7% of the total fish abundance at Veluthodu (S3).

Chorakakki (S4) harbored several hillstream-associated species, including *Homaloptera montana* Herre, 1945, *Mystus montanus* (Jerdon, 1849), *Glyptothorax* sp., *Channa gachua* (Hamilton, 1822), and *Amblypharyngodon* sp. Rheophilic species *Garra mullya* Sykes, 1839 (42.63%) and *Mesonoemacheilus triangularis* (Day, 1865) together accounted for 68.11% of the total abundance at this site. *Devario neilgherriensis* (Day, 1867), *Lepidocephalichthys thermalis* (Valenciennes, 1846), *Garra hughi* Silas, 1955, *Garra mcclellandi* Jerdon, 1849, and *Ompok malabaricus* (Valenciennes, 1840) were recorded exclusively from Chekuthanthodu (S5), where *Haludaria melanampyx* (Day, 1865) (31.73%) and *Opsarius bakeri* (Day, 1865) (27.52%) were the dominant species. No exotic fish species were recorded during the study.

According to the most recent assessments available from the IUCN Red List of Threatened Species (IUCN, 2026), eight species were classified as Endangered (EN), two as Vulnerable (VU), and one as Near Threatened (NT). Endemic species accounted for 60.00% of the recorded ichthyofauna (27 of 45 species), including 13 species (28.89% of the total ichthyofauna) endemic to the Western Ghats (EN-WG). The remaining endemic species belonged to the Southern Western Ghats (EN-SWG), Kerala (EN-K), Peninsular India (EN-PI), India (EN-I), Nilgiri Hills (EN-NI), and Anamalai landscapes (EN-AL) (Fig. 2).

Biodiversity indices differed among sites (Table 2). Margalef's Species Richness Index was highest at Chorakakki (S4) (2.853) and lowest at Veluthodu (S3) (2.168). The Dominance Index was highest at Karimthookku (S2) (0.2864), whereas Buzas and Gibson's Evenness Index reached its highest value at Veluthodu (S3) (0.3733). The Shannon–Wiener diversity index ranged from 1.65 at Karimthookku (S2) to 1.92 at Chekuthanthodu (S5). Cluster analysis based on species composition revealed the highest similarity between Veluthodu (S3) and Chorakakki (S4) (>75%), followed by Nilackal–Kaduvappara (S1) and Karimthookku (S2) (>65%), whereas Chekuthanthodu (S5) exhibited lower similarity (Fig. 3).

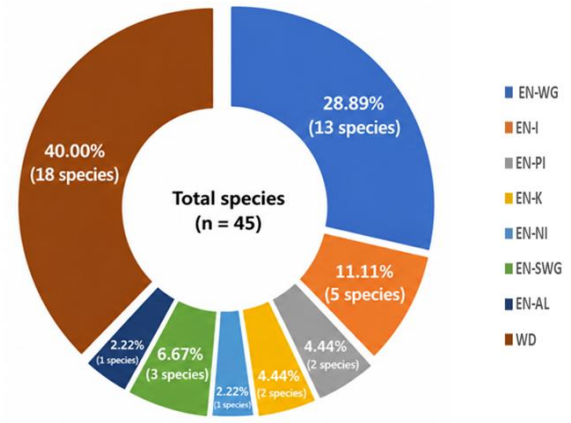

Figure 2: Endemism pattern of ichthyofauna recorded from the Pamba River headwater streams, Western Ghats of southern Kerala, India (based on published distributional records). EN-WG – Endemic to the Western Ghats; EN-I – Endemic to India; EN-PI – Endemic to Peninsular India; EN-K – Endemic to Kerala; EN-NI – Endemic to the Nilgiri Hills; EN-SWG – Endemic to the Southern Western Ghats; EN-AL – Endemic to the Anamalai landscape; WD – Widely Distributed.

Discussion

Previous studies on the Pamba River Basin have largely focused on the main river channels and major tributaries, with comparatively limited attention paid to upstream forested headwater streams (Radhakrishnan, 2006; Radhakrishnan and Kurup, 2010; Renjithkumar et al., 2011; Benno, 2018). The headwater streams of the Western Ghats are often characterized by unique environmental conditions and high levels of habitat heterogeneity, which can support specialized fish communities (Grubh and Winemiller, 2018). The present study demonstrates a distinct fish assemblage within these headwater streams, highlighting their ecological significance.

The dominance of Cyprinidae and the widespread occurrence of species such as *Haludaria melanampyx* (Day, 1865), *Opsarius bakeri* (Day, 1865), *Devario aequipinnatus* (McClelland, 1839), and *Garra mullya* Sykes, 1839 reflect their broad ecological tolerance and adaptability to varying stream conditions. In contrast, the restricted occurrence of several taxa suggests strong habitat specificity, likely associated with differences in flow velocity, substrate composition, and microhabitat availability. Similar patterns of cyprinid dominance have been reported from several hill streams of the Western Ghats, where these taxa occupy a wide range of microhabitats and food resources (Bijukumar and Sushama, 2001; Johnson and Arunachalam, 2009; Dahanukar et al., 2011).

Table 1: Occurrence and Conservation Status of Fishes in the Headwater Streams of the Pamba River Basin, Western Ghats of Southern Kerala, India.

Sl. No.	Order and Family	Scientific name	Species occurrence (in %)					IUCN Status
			S1	S2	S3	S4	S5	
1	**Cypriniformes** Cyprinidae	*Haludaria melanampyx* (Day, 1865)	33.04	44.08	39.66	5.12	31.73	LC
2		*Hypselobarbus curmuca* (Hamilton, 1807)	0	0.103	4.55	0	0	EN
3		*Hypselobarbus kurali* (Menon and Rema Devi, 1995)	0.048	0	2.62	0	0	LC
4		*Dawkinsia filamentosa* (Valenciennes,1844)	8.33	5.39	6.93	0	7.55	LC
5		*Pethia ticto* (Hamilton, 1822)	0	0	0.811	0	0	LC
6		*Salmophasia acinaces* (Valenciennes, 1844)	0	0	0.124	0	0	LC
7		*Salmophasia boopis* (Day, 1874)	0	0	0.749	0	0	LC
8		*Opsarius bakeri* (Day, 1865)	9.01	12.75	10.18	14.72	27.52	LC
9		*Opsarius barna* (Hamilton, 1822)	0.341	0.311	0.187	0.256	0.145	LC
10		*Opsarius bendelisis* (Hamilton, 1807)	0.73	0	0	0.896	0.944	LC
11		*Opsarius canarensis* Jerdon, 1849	0.53	0	0	0	0.363	EN
12		*Opsarius gatensis* (Valenciennes, 1844)	0	0	0	1.15	0.798	LC
13		*Devario aequipinnatus* (McClelland, 1839)	3.7	1.55	0.562	0.64	2.61	LC
14		*Devario malabaricus* (Jerdon, 1849)	1.99	0.622	0.499	0.256	1.59	LC
15		*Devario neilgherriensis* (Day, 1867)	0	0	0	0	0.363	EN
16		*Rasbora dandia* (Valenciennes, 1844)	16.03	26.76	20.04	4.35	8.71	LC
17		*Garra mullya* Sykes, 1839	21.49	1.14	10.36	42.63	9.07	LC
18		*Garra hughi* Silas, 1955	0	0	0	0	0.145	EN
19		*Garra mcclellandi* Jerdon, 1849	0	0	0	0	0.363	LC
20		*Garra menoni* (Rema Devi and Indra, 1984)	0	0	0	0.256	0.072	VU
21		*Amblypharyngodon* sp.	0	0	0	0.768	0	DD
22	Balitoridae	*Bhavania australis* (Jerdon, 1849)	0	0.829	0	1.28	0.29	LC
23		*Homaloptera montana* Herre, 1945	0	0	0	0.256	0	EN
24		*Travancoria jonesi* (Hora, 1941)	0	0.41	0	0.384	0.217	EN
25	Nemacheilidae	*Longischistura striatus* (Day, 1867)	0	0.311	0	0	0	EN
26		*Mesonoemacheilus triangularis* (Day, 1865)	3.55	1.55	0	25.48	7.04	LC
27		*Mesonoemacheilus guentheri* (Day, 1867)	0	0.311	0	0	0	LC
28		*Nemacheilus pulchellus* (Day, 1873)	0.048	0	0	0	0	EN
29		*Schistura denisonii* (Day, 1867)	0.243	0	0	0.64	0	LC
30		*Nemacheilus* sp.	0	0	0.062	0	0	DD
31	Cobitidae	*Lepidocephalichthys thermalis* (Valenciennes, 1846)	0	0	0	0	0.145	LC
32	**Siluriformes** Bagridae	*Batasio travancoria* (Hora and Law, 1941)	0.292	1.65	1.81	0	0	VU
33		*Mystus armatus* (Day, 1865)	0	0.207	0	0	0	LC
34		*Mystus keletius* (Valenciennes, 1840)	0.048	0	0	0	0	LC
35		*Mystus malabaricus* (Jerdon, 1849)	0.048	0	0	0.128	0	NT
36		*Mystus montanus* (Jerdon, 1849)	0	0	0	0.128	0	LC
37	Siluridae	*Ompok malabaricus* (Valenciennes, 1840)	0	0	0	0	0.072	LC
38	Sisoridae	*Glyptothorax* sp.	0	0	0	0.256	0	DD
39	**Beloniformes** Belonidae	*Xenentodon cancila* (Hamilton, 1822)	0.09	0	0.749	0	0	LC
40	**Synbranchiformes** Mastacembelidae	*Macrognathus guentheri* (Day, 1865)	0.146	0.726	0	0	0	LC
41		*Mastacembelus armatus* (Lacepede, 1800)	0	0	0.062	0	0.217	LC
42		*Mastacembelus alboguttatus* Boulenger, 1893	0	0.103	0	0	0	LC
43		*Mastacembelus* sp.	0.146	0.207	0	0	0	LC
44	**Anabantiformes** Channidae	*Channa marulius* (Hamilton, 1822)	0	0.933	0	0	0	LC
45		*Channa gachua* (Hamilton, 1822)	0	0	0	0.384	0	LC

EN – Endangered; VU – Vulnerable; NT – Near Threatened; LC – Least Concern; DD – Data Deficient.

Table 2: Comparison of biodiversity indices among the headwater streams of the Pamba River Basin, Western Ghats of southern Kerala, India.

Biodiversity parameters	S1	S2	S3	S4	S5
Individual Count	2050	964	1601	781	1377
Shannon–Wiener diversity index (H')	1.889	1.65	1.848	1.67	1.92
Margalef's Diversity Index (D_{Mg})	2.492	2.765	2.168	2.853	2.767
Dominance Index (D)	0.1997	0.2864	0.2268	0.2735	0.2041
Buzas and Gibson's Evenness	0.3308	0.2603	0.3733	0.2657	0.3247

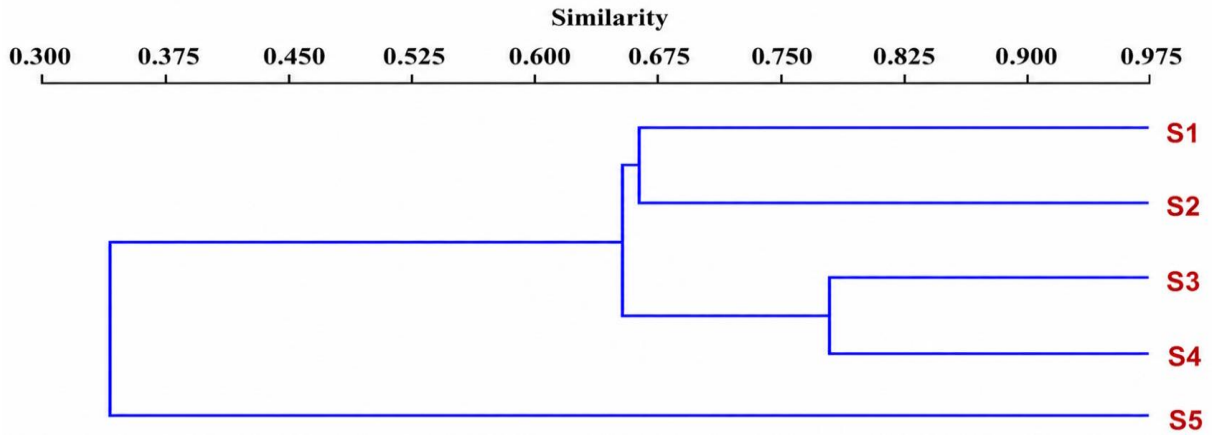

Figure 3: Dendrogram showing similarity in ichthyofaunal composition among the sampled streams of the Pamba River Basin in the Western Ghats of southern Kerala, India.

The high proportion of endemic species recorded from the study streams highlights their conservation value. Similar patterns of endemism and threatened taxa have been documented in other montane streams of the Western Ghats (Dahanukar et al., 2011; Bijukumar et al., 2013; Dencin et al., 2021). The absence of exotic species may indicate relatively limited influence from non-native species introduction, particularly in streams located within the Goodrical Reserve Forest. This pattern differs from observations in the Chalakudy River Basin, another Western Ghats river system in Kerala, where introduced species have been reported (Raghavan et al., 2008). Variation in biodiversity indices among sites reflects differences in habitat complexity and disturbance regimes. Higher species richness at Chorakakki (S4) and greater dominance at Karimthookku (S2) suggest contrasting ecological conditions, whereas the high similarity between Veluthodu (S3) and Chorakakki (S4) indicates comparable habitat characteristics. As biological diversity is a key indicator of ecosystem resilience (Sarkar et al., 2017), the diverse and endemism-rich ichthyofauna recorded in this study suggests that the headwater ecosystems of the Pamba River Basin retain substantial conservation value and warrant targeted management attention.

The present investigation provides a baseline description of fish assemblage composition across five headwater streams of the Pamba River Basin. The observed differences in species composition and diversity among streams provide a foundation for future studies integrating habitat characteristics, physicochemical variables, and advanced community analyses.

Conclusion

In conclusion, the upstream tributaries of the Pamba River Basin support a distinct ichthyofaunal assemblage comprising 45 fish species, with Cyprinidae representing the most species-rich family. The occurrence of endangered species and a high proportion of endemic fishes highlight the conservation significance of these headwater ecosystems. Variation in biodiversity indices among sites reflects differences in community structure and habitat characteristics. The dendrogram revealed patterns of similarity in species composition among streams, providing insights into the ecological relationships among study sites. These findings establish baseline information for future biodiversity assessments and conservation planning in the headwater streams of the Pamba River Basin.

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Author contributions

RT and RTK conceptualized the study. RT conducted the fieldwork, specimen collection and identification, data curation, and data analysis. RT conducted the literature search and prepared the initial draft of the manuscript. RTK provided research supervision, contributed to the interpretation of the results, and critically reviewed and edited the manuscript. Both authors approved the final version of the manuscript.

Conflicts of interest

The authors declare that there are no conflicting issues related to this research article.

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Appendix: Photographic plates of fish taxa recorded from the headwater streams of the Pamba River Basin, Western Ghats of southern Kerala, India.

Plate 1

Haludaria melanampyx **(Day, 1865)**

Pethia ticto **(Hamilton, 1822)**

Dawkinsia filamentosa **(Valenciennes,1844)**

Opsarius gatensis **(Valenciennes, 1844)**

Opsarius bakeri **(Day, 1865)**

Opsarius barna **(Hamilton, 1822)**

Opsarius bendelisis **(Hamilton, 1807)**

Opsarius canarensis **Jerdon, 1849**

Plate 2

Devario aequipinnatus **(McClelland, 1839)**

Devario malabaricus **(Jerdon, 1849)**

Devario neilgherriensis **(Day, 1867)**

Rasbora dandia **(Valenciennes, 1844)**

Longischistura striatus **(Day, 1867)**

Mesonoemacheilus triangularis **(Day, 1865)**

Mesonoemacheilus guentheri **(Day, 1867)**

Nemacheilus pulchellus **(Day, 1873)**

Plate 3

***Nemacheilus* sp.**

***Schistura denisonii* (Day, 1867)**

***Lepidocephalichthys thermalis* (Valenciennes, 1846)**

***Batasio travancoria* (Hora and Law, 1941)**

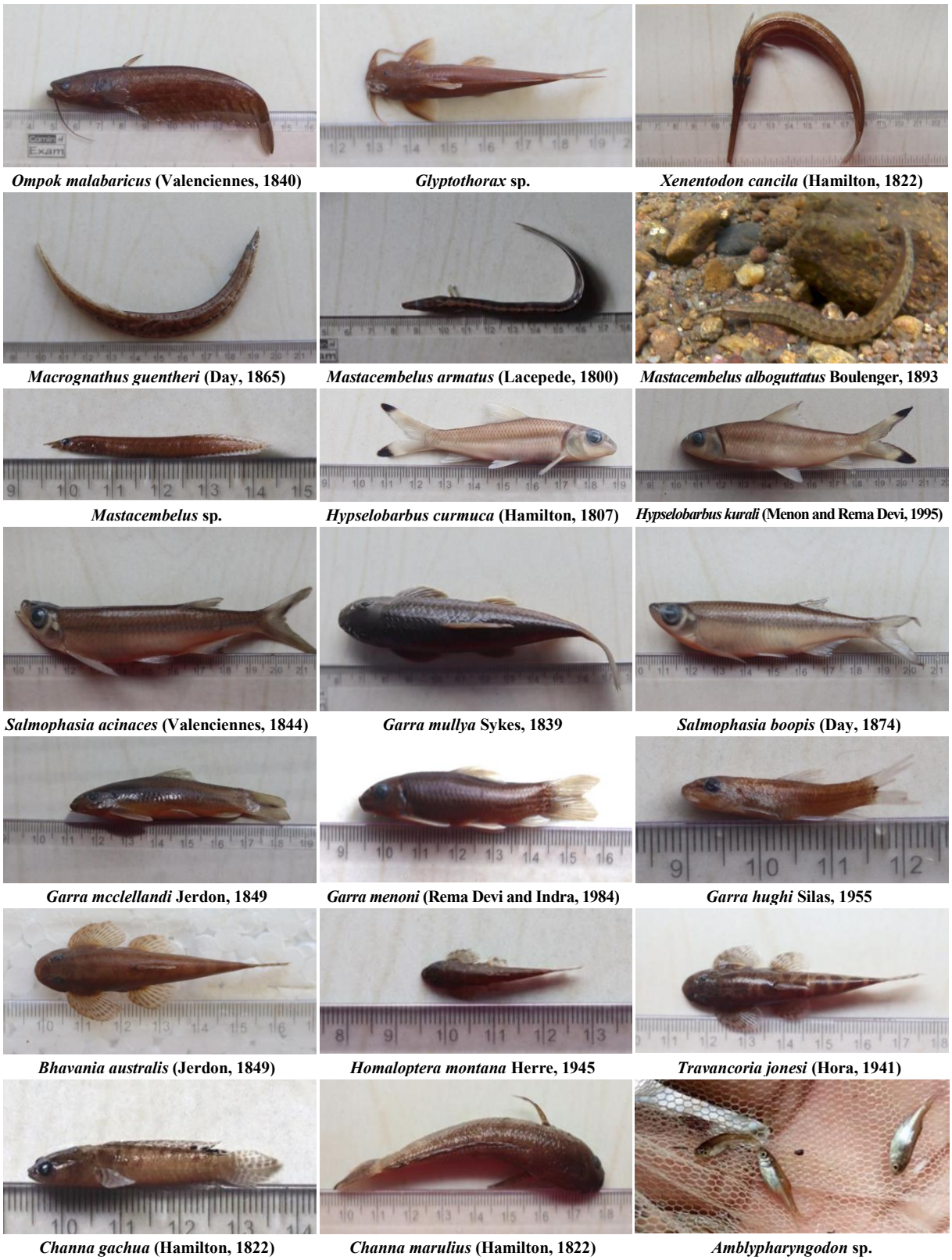
***Mystus armatus* (Day, 1865)**

***Mystus keletius* (Valenciennes, 1840)**

***Mystus malabaricus* (Jerdon, 1849)**

***Mystus montanus* (Jerdon, 1849)**

Plate 4



***Ompok malabaricus* (Valenciennes, 1840)** | ***Glyptothorax* sp.** | ***Xenentodon cancila* (Hamilton, 1822)**

***Macrognathus guentheri* (Day, 1865)** | ***Mastacembelus armatus* (Lacepede, 1800)** | ***Mastacembelus alboguttatus* Boulenger, 1893**

***Mastacembelus* sp.** | ***Hypselobarbus curmuca* (Hamilton, 1807)** | ***Hypselobarbus kurali* (Menon and Rema Devi, 1995)**

***Salmophasia acinaces* (Valenciennes, 1844)** | ***Garra mullya* Sykes, 1839** | ***Salmophasia boopis* (Day, 1874)**

***Garra mcclellandi* Jerdon, 1849** | ***Garra menoni* (Rema Devi and Indra, 1984)** | ***Garra hughi* Silas, 1955**

***Bhavania australis* (Jerdon, 1849)** | ***Homaloptera montana* Herre, 1945** | ***Travancoria jonesi* (Hora, 1941)**

***Channa gachua* (Hamilton, 1822)** | ***Channa marulius* (Hamilton, 1822)** | ***Amblypharyngodon* sp.**