

Fish Diversity Assessment in the Areethodu River of Kuttanad, Kerala, India

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Abstract

Kuttanad, a globally significant region in Kerala, India, characterised by its unique low-lying geography, harbours diverse aquatic fauna, notably fish species. This study focused on assessing fish diversity in the Areethodu River, a tributary of the Pampa-Manimala River System. Fish sampling was conducted across five sites using various fishing gear between December 2023 and February 2024. A total of 30 fish species were identified, with Cypriniformes dominating (35.8%), followed by Anabantiformes (23.8%) and Cichliformes (16.8%). Synbranchiformes, Elopiformes, Beloniformes, and Gobiiformes were less represented. Noteworthy were the endemic species to the Western Ghats and Kerala, including *Pristolepis marginata*, *Parambassis thommassi*, *Ompok malabaricus*, *Horabagrus brachysoma*, *Channa striata*, *Channa marulius*, *Mystus armatus*, and *Labeo dussumieri*, alongside the exotic species *Oreochromis niloticus*. According to the IUCN Red List, 25 species were of least concern, three were vulnerable, and two were data deficient. This study underscores the Areethodu River's rich biodiversity in Kuttanad, hosting data-deficient and vulnerable species. Thus, conservation efforts are imperative to safeguard the faunal diversity of the Areethodu River from human-induced and other disturbances.

Keywords: Areethodu River; Pampa-Manimala Riverine System; Kuttanad; Fish Taxonomy; Cypriniformes; Endemic Fish; Anabantiformes.

Introduction

India is renowned as a global biodiversity hotspot, boasting abundant taxonomic, genetic, and ecosystem diversity. Within this rich tapestry, the fisheries and aquaculture sectors emerge as crucial pillars, offering sustenance, nutrition, income, and livelihoods to millions throughout the nation (Renjithkumar *et al.*, 2021). Fish, prized for their affordability and protein content, play a pivotal role in combating hunger and malnutrition on a nationwide scale. With India ranking as the third-largest fish and aquaculture producer globally, regions such as Andhra Pradesh, West Bengal, Karnataka, Odisha, and Gujarat play pivotal roles in this sector (Romulo *et al.*, 2017).

Located in the southwest of peninsular India, Kerala encompasses rich marine and inland

aquatic resources within its 38,863 sq. km area, with a coastline extending over 589.5 km. The state's diverse inland water bodies significantly contribute to its fisheries sector, serving as a vital component of the economy and sustaining the livelihoods of its inhabitants (<https://fisheries.kerala.gov.in/en/marine-fisheries>).

Kerala's aquatic biodiversity is evident through its 44 rivers, numerous irrigation tanks, reservoirs, streams, ponds, and waterlogged paddy fields, with the Western Ghats acting as the source for 41 of these rivers, thus highlighting its importance as a biodiversity hotspot (Abdul Jaleel *et al.*, 2022).

Kuttanad, characterized as an ecologically fragile land mass, emerges as a pivotal hub of inland aquatic richness within Kerala's expansive territory. The profound significance of Kuttanad's fish diversity transcends geographical boundaries, resonating statewide,

particularly in the encompassing districts of Alappuzha, Pathanamthitta, and Kottayam. The diverse inland fisheries activities, spanning lakes, rivers, streams, ponds, canals, and dams, play a paramount role in furnishing essential nutrition and income, particularly to the local population (Bijukumar and Sushama, 1999).

The Kuttanadan landscape, encompassing rivers, backwaters, flood plains, and canal networks, is renowned for its abundant and diverse fish wealth. The freshwater environment, closely associated with rice fields, sustains thriving populations of pearl spots, perchlet, freshwater giant prawns, and freshwater catfishes throughout most of the year (Jacob *et al.*, 2018). Typically, migrant fisheries witness peak species counts from January to April, declining thereafter with the onset of monsoons. Notably, the region is home to several endangered fish species, including the endemic carp of central Travancore, *Labeo dussumieri* (Tooli/pullan), the esteemed golden catfish of Kuttanad, *Horabagrus brachysoma* (manjakoory), and *Wallago attu* (aattuvaala). *Etroplus suratensis*, *Puntius denisonii*, *Channa diplogramma*, *Mesonoemacheilus guentheri*, *Chela laubuca* and many others exhibit remarkable habitat specificity in this region (George *et al.*, 2016; Arunkumar and Manimekalan, 2018; Praveen *et al.*, 2022).

Taxonomic research is indispensable for identifying and conserving fish fauna, particularly in unique ecosystems like the Areethodu River of Kuttanad. This study aims to uncover the fish diversity in Kuttanad's Areethodu River, highlighting the urgent need for tailored conservation measures to preserve this invaluable natural asset.

Materials and methods

Study area

The study focused on the Areethodu River, a tributary of the Pampa-Manimala River, (Fig. 1) characterized by a length of 6 km and a depth of 5.5 m. Five distinct locations along the river, namely Neerettupram, Thalavady, Thottadi, Vattadi, and Edathuva, were selected for investigation. The study was conducted between December 2023 and February 2024

within a river basin encompassing residential and agricultural areas, characterized by a generally muddy riverbed with a notable presence of pebbles and cobbles.

Fish collection and preservation

Various fishing gear including spears, harpoons, hooks and lines, hand-drawn nets, dip nets, gill nets, drag nets, cast nets, basket traps, and cages were utilized for fish collection. Visual observations were conducted in clear water conditions to comprehend fish species distribution. Sampling occurred thrice weekly, primarily utilizing gill nets and cast nets. Live fishes were collected and subsequently released back into the river after identification, counting, and photography. Morphological and morphometric identification followed established protocols outlined in the fish identification manual.

Identification

Taxonomic identification of collected fish species was facilitated by the Aquaculture faculty at St. Aloysius College Edathua. The process relied heavily on meristic counts, such as fin ray count and scale counts, as well as morphometric measurements including total length (TL), snout length (SnL), caudal length (CL), preorbital length (PrOL), postorbital length (POL), head length (HL), pre-dorsal length (PdL), body depth (BD), and eye diameter (ED). Detailed scrutiny of fin ray counts, eye position, fin morphology, and mouth structure was conducted to confirm species identification (Swaminathan *et al.*, 2023).

Results

Upon analysis, a total of 30 species were identified during the study period, distributed across nine taxonomic orders: Cypriniformes, Anabantiformes, Cichliformes, Siluriformes, Perciformes, Synbranchiformes, Elopiformes, Beloniformes, and Gobiiformes. Table 1 presents the comprehensive list of these 30 fish species collected from the Areethodu River of Kuttanad during the study period, accompanied by their taxonomy, abundance, and pertinent details



Fig. 1: Site map of the study area: Areethodu River of Pampa-Manimala.

and Figs. 2 and 3 shows the photographs of the identified fishes. Fig. 4 represents the relative frequency of various Orders of fishes obtained during the study period.

Discussion

Inland fisheries are recognized as pivotal elements within ecosystems, often functioning as keystone species. Their influence extends significantly to the distribution and abundance of organisms, while concurrently serving as reliable indicators of water quality and overall ecosystem health. Kerala, known for its exceptional biodiversity, particularly within its rivers, hosts a plethora of fish species valued for their ornamental attributes. The inland fisheries sector in Kerala holds substantial potential, notably contributing to animal protein supplies in rural areas of the state. A considerable portion of inland fish production

is locally consumed and domestically marketed, emphasizing its vital role in sustaining local communities and bolstering regional economies (Jancy Rani and Jobiraj, 2017).

Previous research endeavours conducted across various rivers in the region have provided valuable insights into fish diversity and abundance. Renjithkumar *et al.* (2011) conducted a comprehensive study on the Pamba River, identifying the family Cyprinidae as the most abundant fish group, comprising 30 species. Similarly, Mathews Plamoottil (2015) investigated the Manimala River, reporting a prevalence of fish species belonging to the order Cypriniformes (Plamoottil, 2015). In the river system of Kuttanad, Vijayasree and Radhakrishnan (2014) found Cypriniformes to be the dominant order, comprising 6 species, followed by Perciformes and Siluriformes (Vijayasree and Radhakrishnan, 2014). Further studies on the Meenachil River revealed *Labeo dussumieri* as the most dominant

Table 1: Taxonomic position and IUCN status of 30 species of fishes identified from the Areethodu River of Kuttanad from December 2023 to February 2024.

| S. No. | Name of species | Order | Family | Number of Species | | IUCN | |
|--------|--------------------------------|------------------|-------------------|-------------------|--------------|--------|----------|
| | | | | Obtained | Significance | Status | Endemism |
| 1 | <i>Megalops cyprinoides</i> | Elopiformes | Megalopidae | 6 | FF | DD | |
| 2 | <i>Xenentodon cancila</i> | Beloniformes | Belonidae | 2 | FF | LC | |
| 3 | <i>Glossogobius giruris</i> | Gobiiformes | Gobiidae | 2 | FF, OF | LC | |
| 4 | <i>Macragnathus fasciatus</i> | Synbranchiformes | Mastacembelidae | 8 | FF | DD | |
| 5 | <i>Pristolepis marginata</i> | Perciformes | Pristolepididae | 8 | FF, OF | LC | EN-WG |
| 6 | <i>Parambassis thomassi</i> | Perciformes | Ambassidae | 15 | FF, OF | LC | EN-WG |
| 7 | <i>Ambassis nalua</i> | Perciformes | Ambassidae | 3 | FF | LC | |
| 8 | <i>Mystus armatus</i> | Siluriformes | Bagridae | 2 | FF | LC | EN-K |
| 9 | <i>Ompok malabaricus</i> | Siluriformes | Siluridae | 2 | FF, OF | LC | EN-WG |
| 10 | <i>Heteropneustes fossilis</i> | Siluriformes | Heteropneustridae | 20 | FF | LC | |
| 11 | <i>Wallago attu</i> | Siluriformes | Siluridae | 25 | FF | VU | |
| 12 | <i>Horabagrus brachysoma</i> | Siluriformes | Bagridae | 21 | FF, OF | VU | EN-WG |
| 13 | <i>Eetroplus suratensis</i> | Cichliformes | Cichlidae | 29 | FF | LC | |
| 14 | <i>Oreochromis niloticus</i> | Cichliformes | Channidae | 30 | FF | LC | EX |
| 15 | <i>Eetroplus maculatus</i> | Cichliformes | Cichlidae | 18 | FF, OF | LC | |
| 16 | <i>Pseudotroplus maculatus</i> | Cichliformes | Cichlidae | 5 | FF, OF | LC | |
| 17 | <i>Channa micropeltes</i> | Anabantiformes | Channidae | 5 | FF, OF | LC | |
| 18 | <i>Channa diplogramma</i> | Anabantiformes | Channidae | 18 | FF | VU | |
| 19 | <i>Channa striata</i> | Anabantiformes | Channidae | 30 | FF | LC | EN-WG |
| 20 | <i>Channa marulius</i> | Anabantiformes | Channidae | 20 | FF, OF | LC | EN-WG |
| 21 | <i>Nandus nandus</i> | Anabantiformes | Nandidae | 11 | FF | LC | |
| 22 | <i>Anabas testudineus</i> | Anabantiformes | Anabantidae | 32 | FF | LC | |
| 23 | <i>Dawkinsia filamentosa</i> | Cypriniformes | Cyprinidae | 25 | FF, OF | LC | |
| 24 | <i>Amblypharyngodon mola</i> | Cypriniformes | Cyprinidae | 35 | FF | LC | |
| 25 | <i>Puntius chola</i> | Cypriniformes | Cyprinidae | 20 | FF | LC | |
| 26 | <i>Labeo dussumieri</i> | Cypriniformes | Cyprinidae | 50 | FF | LC | EN-K |
| 27 | <i>Puntius sophore</i> | Cypriniformes | Cyprinidae | 20 | FF | LC | |
| 28 | <i>Cirrhinus mrigala</i> | Cypriniformes | Cyprinidae | 3 | FF | LC | |
| 29 | <i>Systemus sarana</i> | Cypriniformes | Cyprinidae | 20 | FF, OF | LC | |
| 30 | <i>Labeo rohita</i> | Cypriniformes | Cyprinidae | 1 | FF | LC | |

FF – Food fish, OF – Ornamental fish, LC – Least Concern, VU – Vulnerable, DD – Data Deficient, EN-WG – Endemic to Western Ghats, EN-K – Endemic to Kerala, EX – Exotic.

species, followed by *Puntius punctatus* (Radhika *et al.*, 2023; Cheriyan *et al.*, 20123). These findings underscore the significance of comprehending the distribution and composition of fish populations within the region's river systems.

The present study unveils the rich and diverse fish fauna inhabiting the 'Areethodu River,' a tributary of the Pampa-Manimala River System. Remarkably, no prior investigations have documented the aquatic life within the Areethodu

River. Out of the thirty species documented in this study, the order Cypriniformes comprised the highest relative frequency at 35.8%, followed by Anabantiformes with 23.8% and Cichliformes with 16.8%. Additionally, moderate occurrences were observed for Siluriformes at 14.4% and Perciformes at 5.3%. Conversely, species belonging to Synbranchiformes, Elopiformes, Beloniformes, and Gobiiformes exhibited the least recorded occurrences during the study



Fig. 2: 30 species of fishes identified from the Areethodu River of Kuttanad from December 2023 to February 2024.

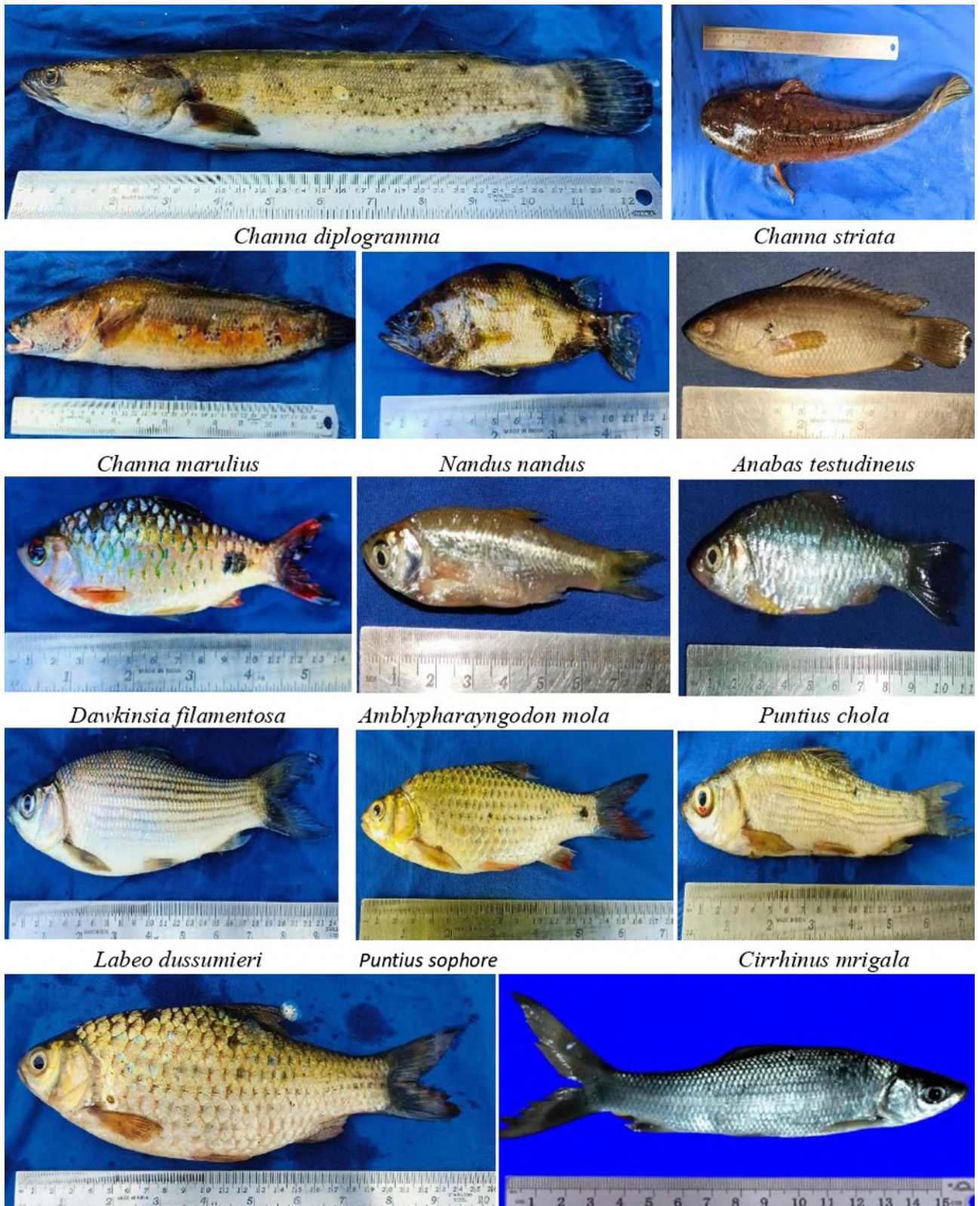


Fig. 3: 30 species of fishes identified from the Areethodu River of Kuttanad from December 2023 to February 2024.

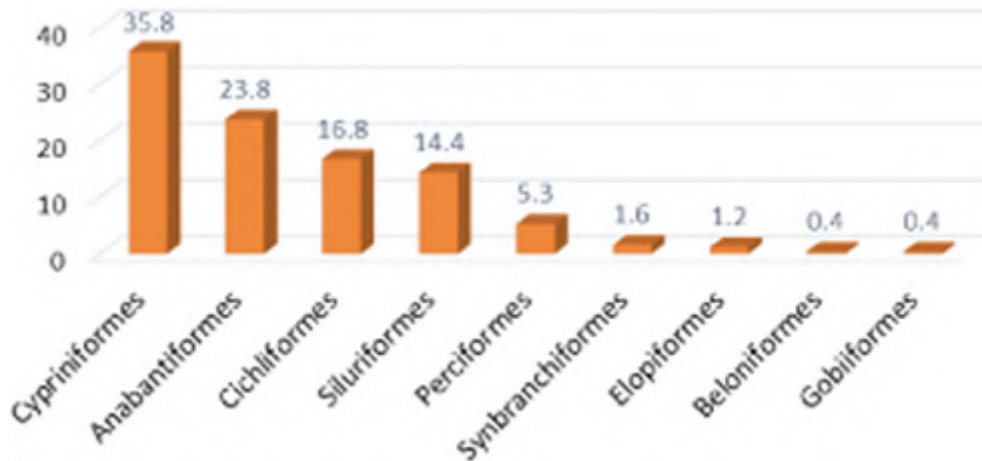


Fig. 4: Relative frequency of fish Orders identified from Areethodu River of Kuttanad during the study period from December 2023 to February 2024.

period, each accounting for less than 2% of the total species diversity.

Several notable species encountered in the Areethodu River exhibit endemism, particularly within the Western Ghats and the state of Kerala. These species include *Pristolepis marginata*, *Parambassis thommassi*, *Ompok malabaricus*, *Horabagrus brachysoma*, *Channa striata*, *Channa marulius*, *Mystus armatus*, and *Labeo dussumieri*. Notably, *Oreochromis niloticus* was the sole exotic species identified during the study.

Furthermore, the assessment of the edible and ornamental value of the recorded species revealed that the majority of them hold significance in both domains, further highlighting their socio-economic importance to local communities.

In terms of conservation significance, the IUCN classification identifies 25 species as of least concern, while three species (*Channa diplogramma*, *Wallago attu*, and *Horabagrus brachysoma*) are categorized as vulnerable. Additionally, two species (*Megalops cyprinoides* and *Macrogathus fasciatus*) were classified as data deficient. The presence of these vulnerable and data-deficient species underscores the critical importance of conservation efforts aimed at preserving the biodiversity of the Areethodu River ecosystem.

Conclusion

In summary, our preliminary investigation into the fish diversity of the Areethodu River in

Kuttanad underscores its taxonomic significance. Our study reveals that Cypriniformes dominate the fish fauna, comprising 35.8% of the observed species, followed by Anabantiformes (23.8%) and Cichliformes (16.8%). Conversely, Synbranchiformes, Beloniformes, Elopiformes, and Gobiiformes exhibited lower representation. Notably, the presence of endemic species to the Western Ghats such as *Pristolepis marginata*, *Parambassis thommassi*, *Ompok malabaricus*, *Horabagrus brachysoma*, *Channa striata*, and *Channa marulius*, along with species endemic to the State of Kerala such as *Mystus armatus* and *Labeo dussumieri*, signifies the ecological significance of the Areethodu River. Furthermore, the detection of the exotic species *Oreochromis niloticus* emphasizes the need for comprehensive taxonomic studies and conservation efforts in this region. Thus, our findings advocate for further research focusing on the taxonomy and ecology of fishes and other fauna, which is imperative to recognize the Areethodu River as a crucial ecological and economically significant area within Kuttanadu.

Conflict of interest

The author declares that they have no conflict of interest in this study.

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