

Ichthyofauna of Puthanar, a Confluent Zone of Pampa and Manimala River of Upper Kuttanad, Kerala, India

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Abstract

Pampa and Manimala are two major rivers of Kerala. The present study was conducted to analyze the taxonomy of fishes occurring in Puthanar, a branch of the Pampa-Manimala River of Upper Kuttanad. Fishes were collected from four different sites of the river from 5th December 2019 to 22nd March 2020. Different gears such as gill net, cast net, hook and line, traditional bamboo traps were used for collecting samples. The fishes were examined for various metric meristic characters and the samples were preserved for the further studies. Total of 31 fish species were collected and identified during the investigation period. The analysis of result showed that the dominant orders of the study area were Cypriniformes followed by Siluriformes. Out of the 31 species identified, 10 species were endemic. Species belonging to vulnerable, near threatened and data deficient category were also present in the study area. This investigation shows that the Puthanar, a branch of Pampa-Manimala River of Upper Kuttanad is rich in fish diversity. Therefore, the Puthanar area of Pampa-Manimala River of Upper Kuttanad shall be treated as a river with conservation importance.

Key words: Puthanar River; Fish Taxonomy; Hotspot; Freshwater fish; Cypriniformes.

Introduction

River systems are India's most dynamic ecosystems and the lifeblood of nearly all civilizations. Rivers are defined as a relatively large volume of water moving within a visible channel, which includes subsurface water moving in the same direction as well as the associated floodplain and riparian vegetation. Streams and rivers, as ecological systems, exhibit high degrees of connectivity between systems longitudinally, laterally, and vertically (Naiman *et al.*, 1998). Rivers and tributaries provide domestic, agricultural, and industrial water supply, as well as hydroelectricity, inland water transport, inland fishing, and the formation of fertile deltas (Nagabhatla and Jain, 2013). India is unique to have access to huge and diverse fish germplasm resources, which are dispersed extensively in vibrant aquatic environments.

The State of Kerala, located in the southwest of peninsular India, has a geographical region

of 33867 sq. km. People from various ethnic groups have been exposed to fishing owing to the state's huge inland waters and lengthy coastline. Kerala is a country of rivers, and these rivers are home to a diverse fish fauna that is rich in rare and uncommon species. The state is blessed with 44 rivers, countless irrigation tanks, reservoirs, streams, waterfalls, private and public ponds, and soggy paddy fields.

The Western Ghats have been designated as one of the world's 21 biodiversity hotspots (Euphrasia and Madhusoodana, 2004). The Western Ghats are the source of 41 of Kerala's 44 rivers. Kerala has Anamudi the highest point in Western Ghats. Inland fish production contributes significantly to animal protein supplies in rural areas of the state. The majority of inland production is consumed locally and sold domestically. The species distribution was discovered to vary within and between river systems and some of the species exhibited a high degree of habitat specificity.

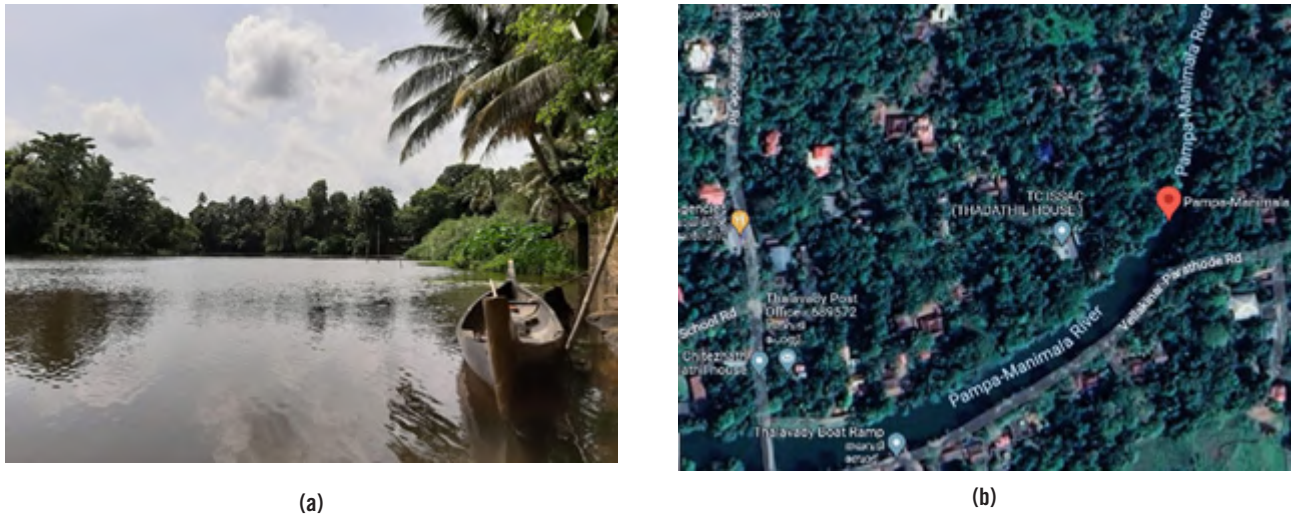


Fig. 1: (a) Study location - Puthanar, Upper Kuttanad; (b) Satellite view the Study location.

The distribution of these species tends to vary both within and between river systems, and many of these fishes have a very limited range.

Taxonomy is the study of the hierarchical relationships between organisms. Taxonomy provides a fundamental understanding of the components of biodiversity, which is required for effective conservation and sustainable use decision-making. In ichthyology, fish taxonomy reveals a plethora of fascinating facts. This paper is a pioneer attempt in this direction and includes information on fishery resources of the river “Puthanar”.

Puthanar refers to a branch of the Pampa-Manimala River that flows to Edathua. Puthanar is 5 km long and 4.5 m deep. This river is located in Alappuzha’s Kuttanad region. The district is interconnected by rivers, canals, and backwaters. The major rivers are the Manimala, Pampa, and Achankovil. The Manimala River is a small mountainous river that emerges from the Thattamalai hills of the Western Ghats Mountain ranges at an elevation of 1156 m above sea level. It has a length of about 90 km and a catchment area of about 847 square kilometers. The river flows through the Kerala districts of Pathanamthitta and Kottayam; a small portion of the river in the highlands flows through the Idukki district; and the river enters Alappuzha at Thalavady village in Kuttanadtaluk, passes through Edathua and Champakkulam villages, and joins the Pampa

River at Muttar in the Alappuzha district (Fig. 1). The ichthyofaunal resources of the Manimala River are well-known (Plamoottil, 2015a,b). River Pampa forms one of the longest river basins in Kerala formed by several streams (Raghavan *et al.*, 2008) originating from the Peerumedu plateau in the Idukki district, entering Alappuzha at Chegannur, and flows through Pandanad, Veeyapuram, Thakazhy, and Champakkulam through a distance 177.08 km and plugged into Vembanadu Lake through several branches such as Pallathuruthi, Nedumudi, Neerattupuram, and Muttar. The river’s annual average landings were calculated to be 394.22t. The pre-monsoon season saw the most landings. The river Pampa runs as an arterial network through Kuttanad, the state’s vast low-lying land (Renjithkumar *et al.*, 2011).

Kuttanad is a village in Kerala’s Alappuzha district that is 2–4 feet below sea level. Kuttanad is also the confluence of several rivers, including the Pampa, Manimala, Meenachil (Sojomon, 2022; Vincy *et al.*, 2015) and Achankovil. These rivers join to form Vembanad Lake, which completely encircles Kuttanad. Upper Kuttanad, Lower Kuttanad, and North Kuttanad are the three geographical divisions of the Kuttanad region. The Kuttanad region, with its unique wetlands ecosystem, has the potential to play a critical role in the development of the state’s inland fisheries sector (Vijayasree and Radhakrishnan, 2014). The aquatic biodiversity

of Kuttanad is rapidly dwindling due to a variety of factors such as habitat loss, pollution, exotic species introduction, over-exploitation, and anthropogenic activities (Bijukumar *et al.*, 2013). Because the variety of fish in the Kuttanad River is an excellent indicator of water quality (Abraham *et al.*, 2011; Raghavan *et al.*, 2007).

Comprehensive studies, integrating species details, taxonomic classification, and endemism and IUCN status of fishes of Puthanar are not available in the literature. Therefore, this study aims to investigate the species composition, IUCN status, and endemism of Puthanar, which is located at the confluence of the rivers Pampa and Manimala. The outcomes of the study would help suggest strategies for the conservation and management of this river (Raphael *et al.*, 2022).

Materials and methods

Study area

The river selected for the study was 'Puthanar,' a branch of the Pampa-Manimala River having about 5 km long and 4.5 m depth. Four different locations of the river such as Vyasapuram, Manathara, Thalavady, and PuthnarKadavu were selected for the study. The studies were carried out between December 2019 and March 2020. The river basin is made up of residential areas and agricultural lands. In general, the river bed is muddy. There are significant amounts of pebbles and cobbles in the selected area during the study period.

Fish collection and preservation

For fish collection, various types of gear are used. For this purpose, dip nets, gill nets, drag nets, cast nets, and cages are used. If the water is clear, visual observations were also made to better understand the distribution of fish species. The samples were taken for a period of three times per week. 10% formalin was used to preserve the collected fish specimens. Smaller specimens were immersed as such in the formalin solution. A longitudinal incision was made along the abdomen without damaging the alimentary canal to fix medium-sized fish.

To fix large forms, ten percent formalin was injected into the muscles and abdomen.

Identification

The collected specimens were kept at the museum of the Department of Zoology, St. Aloysius College, Edathua, Alappuzha-Kerala. Taxonomic identification was primarily based on meristic counts or countable body characteristics such as fin ray count and scale counts that are precisely counted. Morphometric characteristics are those that can be quantified. The head length, standard length, and total length are all measured in centimeters (cm). A detailed study on fin ray counts, the position of the eyes, fins, the shape of the mouth, lips, etc. was made to prove the identity of the collected fishes. The unidentified specimens collected were identified with the help of keys provided by Datta-Munshi *et al.* (1988); Talwar and Jhingram (1991); Jayram (1981) and Das *et al.* (2010), and Fish base website identification (Froese and Pauly, 2010).

Result

The identified fish species were arranged according to their taxonomic order, family, genus, and species. The economic importance and their conservation status were taken into consideration while doing so. The study recorded 31 species belonging to 28 genera, 18 families, and 12 orders (Table 1). The study showed that Cypriniformes was the most abundant order contributing 23% of the total identified species which is dominated by the family Cyprinidae, and followed by the order Siluriformes with 16% of the total identified species of the Puthanar River, Kuttanad (Figs. 2–3).

Among the 31 species identified, twenty-six species were found to be under the least concerned status, three species belonged to a vulnerable category, one of them with not evaluated status, and another one species with data deficient status (Fig. 4).

Discussion

The present study reveals that the Puthanar, a branch of the Pampa-Manimla River harbors

Table 1: Taxonomic position and IUCN status of 31 species of fishes identified from the Puthanar, a branch of Pampa-Manimala River of Upper Kuttanad.

S. No.	Name of species	Order	Family	Number of Species Obtained	Iucn Status	Endemism
1	<i>Megalops cyprinoides</i> (Broussonet, 1782)	Elopiformes	Megalopidae	4	DD	
2	<i>Amblypharyngodon melettinus</i> (Val, 1844)	Cypriniformes	Cyprinidae	50	LC	
3	<i>Hyselobarbus kurali</i> (Menon and RemaDevi, 1995)	Cypriniformes	Cyprinidae	1	LC	WG
4	<i>Dawkinsia filamentosa</i> (Val, 1844)	Cypriniformes	Cyprinidae	64	LC	WG
5	<i>Puntius parrah</i> (Day, 1865)	Cypriniformes	Cyprinidae	43	LC	KL
6	<i>Puntius ticto</i> (Hamilton, 1822)	Cypriniformes	Cyprinidae	26	LC	
7	<i>Rasbora daniconius</i> (Hamilton, 1822)	Cypriniformes	Cyprinidae	9	LC	
8	<i>Labeo dussumieri</i> (Val, 1842)	Cypriniformes	Cyprinidae	35	LC	
9	<i>Horabagrus brachysoma</i> (Günther, 1864)	Siluriformes	Bagridae	16	VU	WG
10	<i>Mystus armatus</i> (Day, 1865)	Siluriformes	Bagridae	9	LC	WG
11	<i>Ompok malabaricus</i> (Val, 1840)	Siluriformes	Siluridae	1	LC	WG
12	<i>Wallogo attu</i> (Bloch & Schneider, 1801)	Siluriformes	Siluridae	4	VU	
13	<i>Heteroneustis fossilis</i> (Bloch, 1794)	Siluriformes	Heteroneustidae	22	LC	
14	<i>Xenentodon cancila</i> (Hamilton, 1822)	Beloniformes	Belonidae	18	LC	
15	<i>Macrogathus guentheri</i> (Day, 1865)	Synbranchyformes	Mastacembelidae	6	LC	WG
16	<i>Mastacembalus armatus</i> (Lacepède, 1800)	Synbranchyformes	Mastacembelidae	3	LC	
17	<i>Parambassis thomassi</i> (Day, 1870)	Perciformes	Ambassidae	23	LC	WG
18	<i>Parambassis dayi</i> (Bleeker, 1874)	Perciformes	Ambassidae	5	LC	
19	<i>Nandus nandus</i> (Hamilton, 1822)	Perciformes	Nandidae	43	LC	
20	<i>Pristolepis marginata</i> (Jerdon, 1849)	Perciformes	Pristolepidae	16	LC	WG
21	<i>Oreochromis niloticus</i> (Linnaeus, 1758)	Cichliformes	Cichlidae	7	LC	EX
22	<i>Etroplus suratensis</i> (Bloch, 1790)	Cichliformes	Cichlidae	17	LC	
23	<i>Pseudetroplus maculatus</i> (Bloch, 1795)	Cichliformes	Cichlidae	54	LC	
24	<i>Glossogobius giuris</i> (Hamilton, 1822)	Gobiiformes	Gobiidae	7	LC	
25	<i>Anabas testudineus</i> (Bloch, 1792)	Anabantiformes	Anabantidae	48	LC	
26	<i>Pseudosphromenus cupanus</i> (Cuvier, 1831)	Anabantiformes	Osphronemidae	1	LC	
27	<i>Channa marulius</i> (Hamilton, 1822)	Anabantiformes	Channidae	16	LC	
28	<i>Channa striata</i> (Bloch, 1793)	Anabantiformes	Channidae	7	LC	
29	<i>Brachirus orientalis</i> (Bloch and Schneider, 1801)	Pleuronectiformes	Solleidae	1	LC	
30	<i>Carinotetradon travancoricus</i> (Hora and Nair, 1941)	Tetradotiformes	Tetradontidae	13	VU	WG
31	<i>Piaractus brachypomus</i> (Cuvier, 1818)	Characiformes	Serrasalminidae	7	NE	EX

Note: LC: Least Concern, NE: not evaluated, DD: data deficient, NT: nearly threatened and Endemism- EX: Exotic, WG: Western Ghats.

rich and diverse fish fauna. No previous studies have been reported about the fish diversity of Puthanar. Nevertheless, a previous study about the Manimala River by Mathew revealed the abundance of fish species of the order Cypriniformes (2022). Renjithkumar with his co-workers, previously reported the abundance of the Cyprinidae family in the Pampa River (Renjithkumar *et al.*, 2011). The present study

shows that the Cypriniformes are the dominant Order of fish fauna of Puthanar and are outnumbered by the family Cyprinidae. Only one sole fish *Brachirus orientalis* was identified from the study area. Perhaps, it might be ascended from the brackish water (2022). About 32% of the fish species obtained from Puthanar were endemic, nine of them are endemic to Western Ghats and one is Endemic to the state of Kerala.

(a) ELOPHIFORMES



Megalops cyprinoides

(b) CYPRINIFORMES



Hypselobarbus kurali



Dwakinsia filamentosa



Puntius parrah



Rasbora daniconius



Puntius ticto

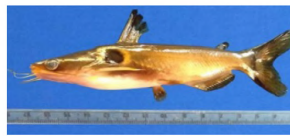


Labeo dussumeri

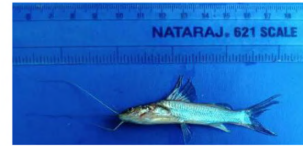


Amblypharyngodon melettinus

(c) SILURIFORMES



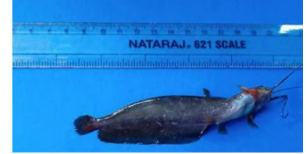
Horabagrus brachysoma



Mystus armatus



Ompok malabaricus



Heteronuestus fossilus



Wallago attu

(d) BELONIFORMES



Xenentodon cancila

(e) SYNBRANCHIFORMES



Mastacembulus armatus



Macrognathus guntheri

Fig. 2: 31 species of fishes identified from the Puthanar, a branch of Pampa-Manimala River of Upper Kuttanad.

(f) PERCIFORMES



Parambassis dayi



Parambassis thomassi



Nandus nandus



Pristolepis marginata

(g) CICHLIFORMES



Oreochromis niloticus



Etroplus suratensis



Pseudoetropus maculatus

(h) GOBIIFORMES



Glossogobius giuris

(i) ANABANTIFORMES



Anabus testudineus



Psuedosphromenus cupanus



Channa marulius



Channa striata

(j) PLEURONECTIFORMES



Brachirus orientalis

(k) TETRADOTIFORMES



Carinatetradon travancoricus

(l) CHARACIFORMES



Piractus brachypomus

Fig. 2: (Continued)

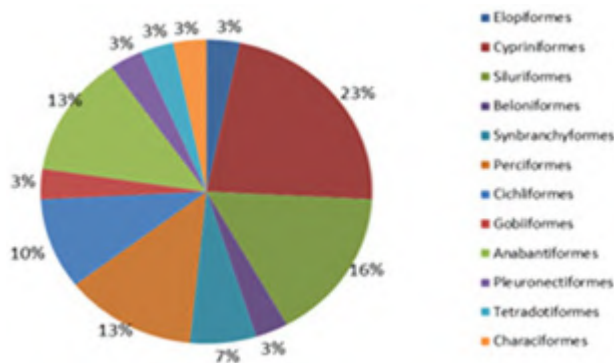


Fig. 3: Percentage of different Orders of fishes identified from the Puthanar, a branch of Pampa-Manimala River of Upper Kuttanad.

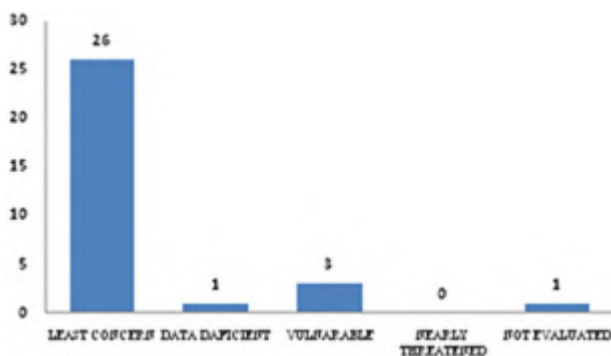


Fig. 4: IUCN Status of fishes identified from the Puthanar, a branch of Pampa-Manimala River of Upper Kuttanad.

Conclusion

The fish diversity of Puthanar, a branch of the Pampa-Manimala River of Upper Kuttanad was studied during the period from 5th December 2019 to 22nd March 2020. Out of the 31 species identified, seven species (23%) belong to the order Cypriniformes suggests that it is the most dominant Order of fishes in this river and five species (16%) belong to the order Siluriformes suggests that it is the second dominant Order in Puthanar. Species belonging to the order Belaniformes, Gobiformes, Plueronectiformes, Carachiformes, Tetradoctiformes, and Elopiformes were also recorded during the study period but with the least number. About 32% of the fish species obtained from Puthanar were endemic, nine of them are endemic to Western Ghats and one among them is Endemic to the state of Kerala. The presence of two species, *Oreochromis niloticus* and *Piaractus brachypomus* indicates the occurrence of exotic species in the Puthanar River. There

are 26 species of fish coming under the least concern category as per the IUCN list and three vulnerable species (*Carinotetradon travancoricus*, *Wallago attu*, and *Horabagrus brachysoma*), one not evaluated species (*Piaractus brachypomus*) and one data deficient species (*Megalops cyprinoides*). The presence of data-deficient, vulnerable, and exotic species indicates the importance of conservation and the need of implementing management strategies in the Puthanar River.

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Conflict of interest

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

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