



Freshwater Fish Diversity of Meenachil River, Kottayam, Kerala, South India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.56557/UPJOZ/2023/v44i113518

Editor(s):

(1) Prof. Telat Yanik, Atatürk University, Turkey.

Reviewers:

(1) Ricardo da Silva Gomes, Brazil.

(2) A. Agus Tjahjono, Semarang Merchant Marine Polytechnic, Indonesia.

Original Research Article

Received: 08/04/2023

Accepted: 11/06/2023

Published: 12/06/2023

ABSTRACT

The present study was conducted to gain a better understanding of the variety of freshwater fishes found in the Meenachil River. The Meenachil river is one of Kerala's major rivers. The Meenachil River has an abundance of indigenous fishery resources as well as a high level of biodiversity. The current study was carried out to identify the fishes of the five Meenachil river stations. Poonjar (station 1), Erattupetta (station 2), Pala (station 3), Ettumanoor (station 4) and Kottayam (station 5) are the stations. The study was conducted at 15-day intervals for six months, from January 2021 to June 2021. Fish for the study were collected from various locations along the Meenachil River by local fishermen. Fish morphological and morphometric identification was accomplished using standard text. The current study identified 20 species from the Meenachil river, divided into 8 orders and 11 families. The order Cypriniformes dominated with seven, followed by Siluriformes with four species. Two species were identified in the Meenachil river that were endemic to the Western Ghats, and two were endangered. Station 4 Ettumanoor recorded the most fish diversity, while station 5 Kottayam recorded the least. According to this research, the Meenachil River has a diverse fish population.

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Keywords: Cast net; Cypriniformes; drag net; fish diversity; Meenachil River; Siluriformes.

1. INTRODUCTION

Knowledge of species inhabiting natural freshwater ecosystems is a fundamental requirement for the management of any Riverine ecosystem. Many of the Indian rivers experiencing serious gaps in the biodiversity composition due to the lack of robust documentation efforts as reflected in the minor contributions to the international literature on conservation and freshwater biology. Declines in the biodiversity are far greater in fresh water other than the most affected terrestrial ecosystems [1]. Fresh water is home to over 10,000 fish species, accounting for roughly 40% of global fish biodiversity and one-quarter of global vertebrate biodiversity [2]. Because estimates of species richness in individual rivers are unreliable, it is almost certain that regional national inventories, museum collections, and taxonomic knowledge in many tropics are insufficient to document extinctions, and thus widespread undetected extinctions of inconspicuous species have already occurred [3]. The Meenachil River is located in the district of Kottayam. The streams from the Western Ghats combine to form this river. This river flows through Poonjar, Teekoy, Erattupetta, Palai, Ettumanoor, and Kottayam, among other places. This 78-kilometer-long river flows into Kumarakom's Vembanad Lake. This river's water is used for drinking and irrigation purposes. Meenachil river water enters Vembanad Lake before reaching the sea and plays a significant role in shaping the water bodies in and around Kottayam towards the western coast and backwaters [4]. During the monsoon season, the river can become overflowing and flood the nearby low-lying areas. People who live near the river and its tributaries are deeply concerned about the river's declining water retention capacity as a result of loss of tree cover, top soil loss, and excessive legal and illegal sand mining, as well as serious water pollution issues caused by garbage disposal into the river along its banks. Summer water is currently in short supply. In the summer, the massive rain-fed river becomes almost completely dry. Many of these aquatic communities are on the verge of extinction. Furthermore, human alteration of many fish habitats has resulted in their extinction. There is an urgent need to comprehend this perilous situation and devise mitigation strategies to avoid the extinction of entire groups of organisms [5].

The Meenachil river, which originates in the Western Ghats, is an important river in the Kottayam district. The river is 78 kilometres long and has a catchment area of 1272 square kilometres. It is also referred to as Kavanar. It divides into several tributaries before reaching Vembanad Lake. The Meenachil watershed is located between 9.025' N and 9.055' N latitude and 76.030' E and 77.000' E longitude. The overall elevation of the river basin ranges from 77 metres to 1156 metres in the highlands and less than 2 metres in the lowlands. The annual total yield of the river is 2349 million cubic metres, with an annual utilisable yield of 1110 million cubic metres. The river is divided into 47 sub watersheds and 114 micro watersheds. The river had 38 tributaries, both major and minor. The Meenachil river basin has a tropical climate with high relief variations from the west coast to the hilly regions of the Western Ghats in the east, and proximity to the sea influences the climatic parameters. Throughout the year, the temperature ranges from 240 C to 320 C. Rubber trees are extensively cultivated throughout the river basin.. In addition to rubber, other crops such as spices and paddies are grown in the river basin [6]. The world's aquatic biodiversity is rapidly dwindling due to a variety of factors such as habitat loss, pollution, alien species introduction, overexploitation, and other anthropogenic activities. Freshwater ecosystems, which account for 0.1% of the hydrosphere but house 40% of the fish species reported thus far, are particularly vulnerable. As a result, a thorough assessment of aquatic habitats and a national fish inventory would be beneficial in the development of a database. The diversity of fish in the Illikkal Region of the Meenachil River is an excellent indicator of water quality. As a result, to protect this vital environment, a conservation and management strategy is required [7].

2. MATERIALS AND METHODS

2.1 Study Area

The study area Meenachil river flows through Kottayam district of Kerala state, India. The river has 78 kilometers long and flows through Poonjar, Teekoy, Erattupetta, Pala, Ettumanoor and Kottayam. To carry out the present study of water quality of Meenachil river, total five sampling stations (Table 1) were chosen within the river basin.

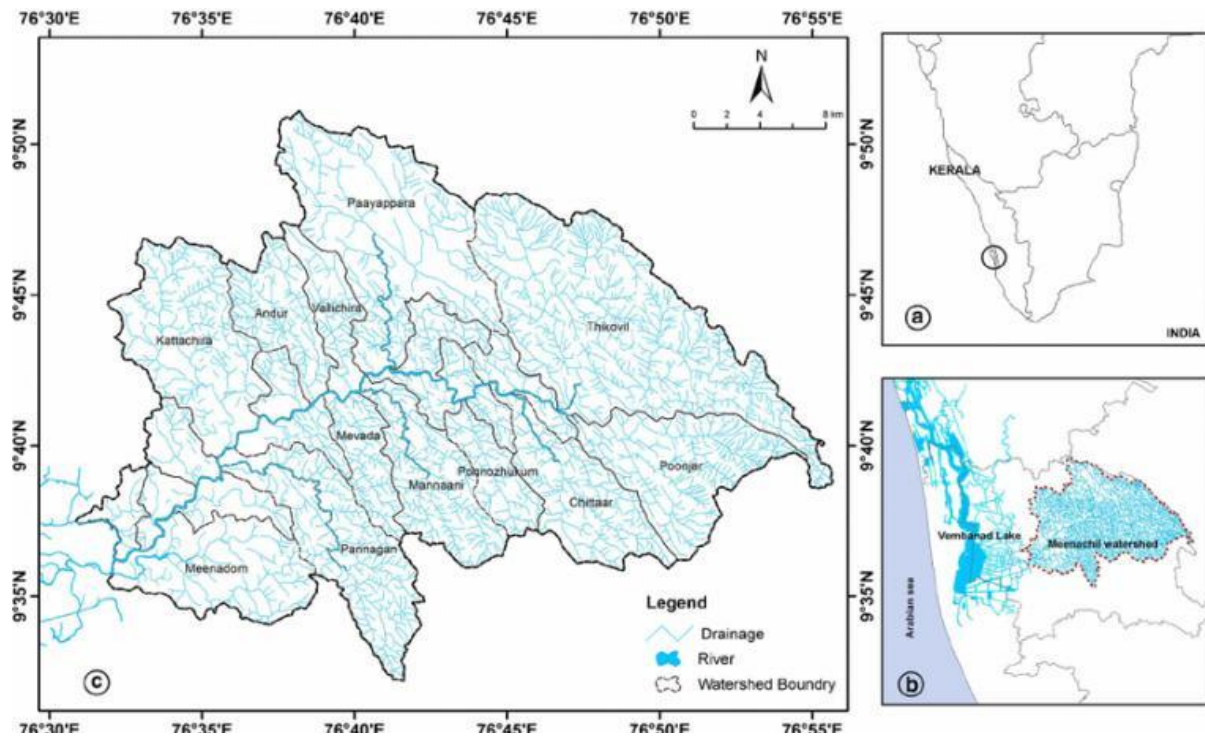


Fig. 1. Map of Meenachil River

2.2 Sampling

The current work is an attempt to investigate the fish fauna of the Meenachil River. Fish were collected from various locations with the assistance of local fishermen using various types of nets, including gill nets, cast nets, and dragnets. Because formalin decolorizes the fish colour after long preservation, photographs were taken immediately prior to preservation with 10% formalin. Fish brought to the laboratory were fixed in formalin solution in separate jars based on species size; small fish were placed directly in formalin solution, while larger fish were fixed after an incision on the abdomen. The fish that were collected and fixed were labelled with a serial number and the exact location from which the data was collected. Each jar containing the

fish was labelled with the common local name of the fish used in this region. Identifications were made using keys to Indian subcontinent fishes. The species were identified primarily based on the colour pattern, specific spots or marks on the surface of the body shape of the body structure of various fins, and so on [8-10].

2.3 Fish Diversity Assessment

Fish for the study were collected from various locations along the Meenachil River by local fishermen using various types of nets, including cast nets, gill nets, sweeping nets, and drag nets. After counting and photographing the collected fish, they were released back into the river. Fish morphological and morphometric identification was accomplished using standard text.

Table 1. Sampling stations

Station No.	Station Name	Location	
		Latitude(N)	Longitude(E)
Station 1	Poonjar	9.67266215	76.80434951
Station 2	Erattupetta	9.68827275	76.77816444
Station 3	Pala	9.70730511	76.67326924
Station 4	Ettumanoor	9.63116532	76.56605529
Station 5	Kottayam	9.59846837	76.52823115



Fig. 2. Location map of sampling stations

3. OBSERVATIONS AND RESULTS

The fishes recorded from the Meenachil river during the study was given in Table 2.

Table 2. Fishes recorded from Meenachil river

Sl. No	Species	Common name	Station				
			1	2	3	4	5
1	<i>Anguilla bengalensis</i>	Indian Mottled Eel	√	√	√	√	-
2	<i>Xenentodon cancila</i>	Freshwater Garfish	-	√	-	√	√
3	<i>Etroplus suratensis</i>	Pearl spot	-	-		√	√
4	<i>Etroplus maculatus</i>	Orange chromide			√	√	√
5	<i>Hypseleobarbus curmuca</i>	Red Tailed Barb	√	√	√	√	√
6	<i>Rasbora daniconius</i>	Slender Rasbora	√	√	√		√
7	<i>Labeo dussumieri</i>	Malabar Labeo	-	-	√	√	-
8	<i>Labeo rohita</i>	Rohu	√	√	√	-	-
9	<i>Cyprinus carpio</i>	Common Carp	√	√	√	√	√
10	<i>Sahyadria denisonii</i>	Denison barb	-	-	-	-	-
11	<i>Dawkinsia filamentosa</i>	Blackspot barb	√		√		√
12	<i>Apocheilus lineatus</i>	Tiger Panchax	√	√	√	√	√
13	<i>Macrogathus guentheri</i>	Malabar Spinyeel	√	-	√		√
14	<i>Mystus oculatus</i>	Malabar Mystus	√	-	√		√
15	<i>Clarius batrachus</i>	Walking Catfish	-	√	√	√	√
16	<i>Wallago attu</i>	Wallago Catfish	-	-	√	√	√
17	<i>Heteropneustes fossilis</i>	Stinging Catfish		√	√	√	√
18	<i>Channa marulius</i>	Great snakehead fish	√	√	√	√	-
19	<i>Channa striata</i>	Striped Snakeheaded	√		√	√	-
20	<i>Anabas testudineus</i>	Climbing perch	-	-	√	√	√

Table 3. Fishes observed with their family and order with IUCN status

Scientific name and order	Family	Common name	IUCN Status	Endemism
Order: Anguilliformes <i>Anguilla bengalensis</i>	Anguillidae	Indian Mottled Eel	NT	
Order: Beloniformes <i>Xenentodon cancila</i>	Belonidae	Freshwater Garfish	LC	
Order: Cichliformes <i>Etroplus suratensis</i>	Cichlidae	Pearl spot	LC	
<i>Etroplus maculatus</i>	Cichlidae	Orange chromide	LC	
Order: Cypriniformes <i>Hypseleobarbus curmuca</i>	Cyprinidae	Red Tailed Barb	EN	WG
<i>Rasbora daniconius</i>	Cyprinidae	Slender	NE	WG
<i>Labeo dussumieri</i>	Cyprinidae	Rasbora Malabar	LC	
<i>Labeo rohita</i>	Cyprinidae	Labeo Rohu	LC	
<i>Cyprinus carpio</i>	Cyprinidae	Common Carp	VU	
<i>Sahyadria denisonii</i>	Cyprinidae	Filament barb	EN	
<i>Dawkinsia filamentosa</i>	Cyprinidae	Denison barb or Miss Kerala	VU	
Order: Cyprinodontiformes <i>Apocheilus lineatus</i>	Aplocheilidae	Tiger Panchax	LC	
Order: Synbranchiformes <i>Macrogathus guentheri</i>	Mastacembelidae	Malabar Spinyeel	LC	
Order: Siluriformes <i>Mystus oculatus</i>	Bagridae	Malabar Mystus	LC	
<i>Clarius batrachus</i>	Clariidae	Walking Catfish	LC	
<i>Wallago attu</i>	Siluridae	Wallago Catfish	NT	
<i>Heteropneustes fossilis</i>	Heteropneustidae	Stinging Catfish	LC	
Order: Perciformes <i>Channa marulius</i>	Channidae	Great snakehead fish	LC	
<i>Channa striata</i>	Channidae	Striped Snakeheaded	LC	
<i>Anabas testudineus</i>	Anabantidae	Climbing perch	LC	

Fish are keystone species that determine the distribution and abundance of other organisms in the ecosystems they represent, and they are good indicators of water quality and ecosystem health [11]. The current study recorded 20 species from the Meenachil river, divided into 8 orders and 11 families (Table 2). The order's dominant group was Cypriniformes (7 species), followed by Siluriformes (4 species). Three new species have been identified in the order Perciformes. Two new species have been

identified in the order Cichliformes.. There were 1 species of fish identified from the orders Anguilliformes, Beloniformes, Cyprinodontiformes, and Synbranchiformes. Cyprinidae had the most species (7), followed by Cichlidae (2 species) and Channidae (2 species). In the current study, two species endemic to the Western Ghats were identified in the Meenachil river: *Sahyadria denisonii* and *Dawkinsia filamentosa*. Food fishes were the most numerous species identified.



Fig. 3. *Anguilla bengalensis*



Fig. 4. *Xenentodon cancila*



Fig. 5. *Etroplus suratensis*



Fig. 6. *Etroplus maculatus*



Fig. 7. *Hypselobarbus curmuca*



Fig. 8. *Rasbora daniconius*



Fig. 9. *Sahyadria denisonii*



Fig. 10. *Mystus oculatus*

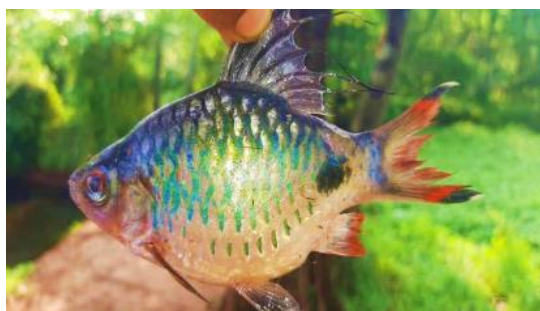


Fig. 11. *Dawkinsia filamentosa*



Fig. 12. *Apocheilus lineatus*



Fig. 13. *Clarius batrachus*



Fig. 14. *Channa marulius*



Fig. 15. *Heteropneustes fossilis*



Fig.16. *Wallago attu*



Fig. 17. *Cyprinus carpio*



Fig. 18. *Anabas testudineus*



Fig. 19. *Labeo rohita*



Fig. 20. *Channa striata*



Fig. 21. *Labeo dussumieri*



Fig. 22. *Macrognathus guentheri*

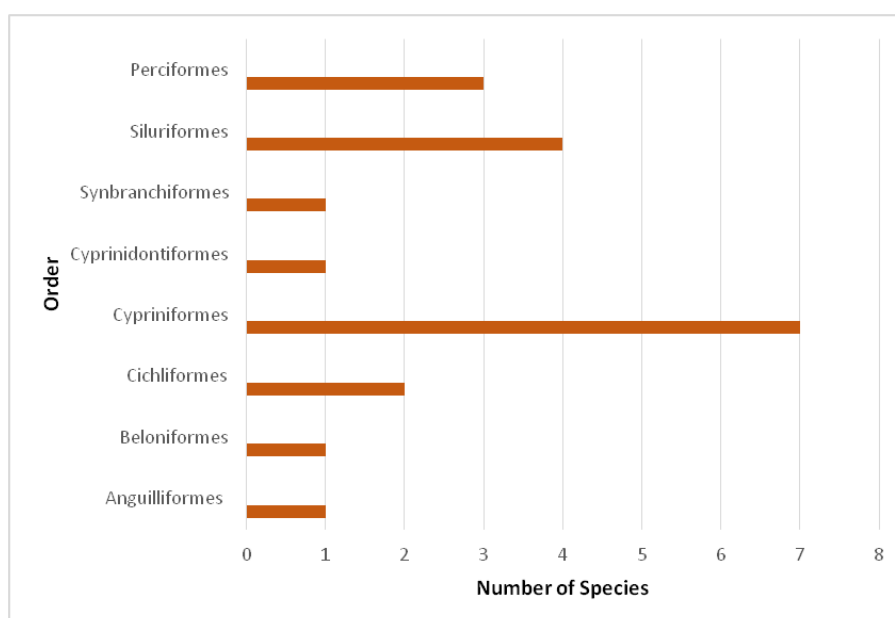


Fig. 23. Bar diagram showing species belongs to different Orders

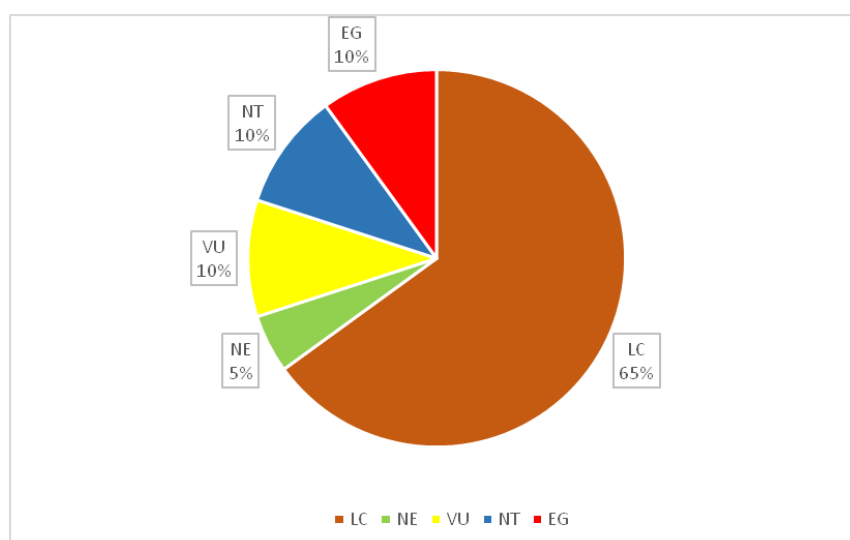


Fig. 24. Pie diagram showing species belong to different IUCN catagories

Concerning the IUCN status of Meenachil River fish species. Two species are endangered (*Hypselobarbus curmuca* and *Sahyadria denisonii*), two are threatened (*Anguilla bengalensis* and *Wallago attu*), one is threatened (*Rasbora daniconius*), two are vulnerable, and 13 are least concern. The loss of in-stream vegetation, sand, and gravel in the river bed not only affects the feeding and hiding grounds of fish and other freshwater animals, but also causes spawning problems in phytophilic and psammophilic fishes in the aquatic environment [12]. Because of the ever-increasing demand for fish as food, aquatic ecosystems are constantly under pressure, resulting in fish fauna depletion [13].

4. DISCUSSION

According to the findings of the present study, the fish diversity of the Meenachil River was extremely high. Meristic counts of species members never change. As a result, these distinguishing characteristics are more important than morphometric features, which may change in fishes living in different environmental conditions. A non-overlapping morphometric difference in more than ten variables between members of a species, on the other hand, almost never occurs.

In India, especially in Kerala, great number of fish species are described by Hamilton-

Buchanan, Valenciennes, Jerdon T.C and Francis Day [14-16]. Hamilton described many freshwater fishes from the Ganges, Valenciennes from various parts of Peninsular India, Jerdon from Southern India, primarily from the Manantavady and Kabani rivers in Wayanad, and the Kavery River in Karnataka. Francis Day described a variety of fish from the Karavannoor River in Thrissur as well as Wayanad. He could also describe many of the fish collected by Rev. Henry Baker from central Travancore [17]. Many of the fish collected by Day were described by Guenther. Later workers never attempted to delve deeply into the taxonomy of the fishes they collected, instead attempting to synonymize their specimens with previously described specimens. Some scientists, such as Hora and Menon, thoroughly examined and studied specimens [18]. As a result, they could describe a plethora of new fish. Jayaram and Rema Devi also contributed significantly to taxonomic research [19,20]. As a result, if we carefully examine more specimens with detailed studies on morphometric

and Meristic counts of fishes, we will have hope in taxonomy. This ichthyofaunal study found 20 species of fish in 8 orders and 11 families in the Meenachil River, with the Family Cyprinidae being the most numerous. Two species were identified as being endemic to the Western Ghats, and two species were classified as endangered by the IUCN.

The Meenachil River is slowly becoming extinct. The current study reveals various aspects of the river basin for conservation and sustainable use of the river ecosystem. Polluting the river are solid and liquid wastes from various sources, such as the basin townships [21].

Recent efforts have been made to bring together studies of fish diversity from various parts of the southern Western Ghats. The Western Ghats, despite being extremely rich in fish biodiversity, have been studied in terms of species distribution [22].

5. CONCLUSION

As part of Nature's resilience, the undammed Meenachil River experienced a natural extreme flash flood and landslides, which re-figured the channel morphology and re-stored the deteriorated riverine ecosystem. Even though the flood and landslides reshaped the main channel, tributaries, and backwaters, the change in habitat complexity did not harm the structurally resistant fish community [23]. Station 4 Ettumanoor recorded the most fish diversity, while station 5 Kottayam recorded the least. The Meenachil River has a diverse fish population, according to this study.

More research is needed to determine the long-term effects and ecological implications of floods on Kerala Rivers, which is critical for the implementation of restoration plans aimed at protecting our nation's riverine ecology and its unique and endemic fauna. Seasonal studies on the fish fauna, as well as the addition of more sampling stations, are also welcome.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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