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Fish Diversity of Kuttanad's River System, Kerala State, India

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Abstract
India is known for its inland fishery resources and once with rich indigenous fishery resources with great biodiversity. The poor inland fishers and rural community depended for their livelihood and food security on these indigenous species. The present investigation has been conducted to identify the fishes of the Kuttanad's river system from January to May 2014 at weekly intervals. A total of 62 freshwater species from 17 families were found during our survey. The fishes were divided into three groups' *viz.,* cultivable fishes, food fishes and ornamental fishes. Among cultivable fishes order Cypriniformes were dominated by 6 species, followed by Perciformes (3 species) and Siluriformes (2 species). The order Anguilliformes and Beloniformes were represented by 1 species each. A total of 11 species were identified as cultivable fishes. The number of food fishes identified were 22 species under investigation. The dominant group belongs to the family Siluridae (7 species) followed by Cyprinidae (6 species). 5 species were identified under the order Perciformes. Synbranchiformes and Beloniformes by 3 and 1 species respectively. Maximum fish species identified were ornamental fishes (28 species). The order Cypriniformes alone represented 22 species. The identified fishes of the order Beloniformes were 3, Siluriformes by 2 and Tetraodontiformes by 1 species. The results of the present study clearly showed that the fish fauna of the River is highly diverse and proper management is essential for the conservation of the fish biodiversity.

Keywords: Kuttanad's river system, fish, biodiversity, conservation, management, Vembanad lake.

1. Introduction
There is a global concern about the status of the bio resources in which human life depends and their loss affects food security, vulnerability to natural disasters, energy security, etc… Fish account for the highest species diversity among all vertebrates and they live in almost all conceivable aquatic habitats [1]. Fisheries that exploit a range of species may have more stable catches than fisheries that exploit a single species. Conservation of biodiversity is important in environmental management programs [2, 3]. The environmentally sustainable use of fish resources is central to fisheries management, given the long-term importance of this sector in terms of nutrition and employment. But today's major concern relates to the unsustainable levels of exploiting fishes with such practices that lead to the depletion of fish stocks, disruption of ecological equilibrium and reduction in diversity [4]. Measuring biodiversity is one of the central issues in ecology because of its importance in devising conservation strategies. Moreover, fisheries sector occupies a very important place in the socio-economic development of the country. It has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries, and is a source of cheap and nutritious food besides being a foreign exchange earner. Most importantly, it is the source of livelihood for a large section of the economically backward population of the country. There is, therefore, need to throw light on sustainable use of small indigenous fish species and conservation of biodiversity. In this context, in the present study an attempt has been made to collect and identify the available fish species of Kuttanad's river system.

2. Materials and Methods
2.1 Study Area
Kuttanad's river system (formed by four major rivers, Meenachil, Pamba, Manimala and Achencovil) located in the fertile low-lying areas of Vembanad Lake (9°17' to 9°40' N and 76°19' to 76°33'E). The Kuttanad region comprised of 79 revenue villages, 10 Taluks and 3 Districts [5]. Cherthala, Ambalapuzha, Chengannur, Kuttanad, Karthikappally and Mavelikara Taluks in

Alappuzha Districts, Thiruvalla taluk in Pathanamthitta District and Changanassery, Vaikom and Kottayam taluks in Kottayam districts covering an area of 870 Sq. km [6]. Two areas were selected for the present study. They were:

a. Veeyapuram: In this station the Achencovil River meets and merges with Pampa river in Alappuzha district and 6 km East of Harippad town. It is located at latitude 9º 19' 29.07' N and longitude 76o 27' 54.31' E with an elevation of 6 ft above MSL.

b. Thiruvanvandur: In this station the Manimala River meets and merges with Pampa river in Alappuzha district. It is located at latitude. Coordinates: 9º 20′ 35.56″ N and longitude 76º 34′ 43.47″ E with an elevation of 6 ft. above MSL.

2.2 Specimen collection

Fish specimens were collected from Kuttanad's river system at weekly intervals for a period of five months from January to May 2014. Sampling was carried out using drag net of having mesh size 2 mm with mesh size 3 m x 1m size and also with cast net of standard size and identification of fishes was done [7-11].

3. Results: In the present investigation a total of 62 freshwater species from 17 families were found during our survey (Table 1). The fishes were divided into three groups' viz., cultivable fishes, food fishes and ornamental fishes. Among cultivable fishes order Cypriniformes were dominated by 6 species, followed by Perciformes (3 species) and Siluriformes (2 species). The order Anguilliformes and Beloniformes were represented by 1 species each.

Table 1: Fishes of Kuttanad's river system and their biodiversity status

Fish Type	Genus and Species	Family	Order	Status
Cultivable fishes	*Anguilla bengalensis*	Angullidae	Angulliformes	**
	Catla catla	Cyprinidae	Cypriniformes	**
	Cirrhinus mrigala	Cyprinidae	Cypriniformes	**
	Cyprinus carpio	Cyprinidae	Cypriniformes	**
	Labeo dussumieri	Cyprinidae	Cypriniformes	**
	Labeo fimbriatus	Cyprinidae	Cypriniformes	**
	Tor khudree	Cyprinidae	Cypriniformes	-
	Tilapia mossambica	Cichlidae	Perciformes	**
	Channa marulius	Channidae	Perciformes	*
	Etroplus suratensis	Cichlidae	Beloniformes	**
	Heteropneustes fossilis	*Heteropneustidae*	Siluriformes	**
	Horabagrus brachysoma	Bagridae	Siluriformes	-
Food Fishes	*Anabas testudineus*	Anabantidae	Synbranchiformes	**
	Batasio travancoria	Bagridae	Siluriformes	**
	Channa diplogramma	Channidae	Perciformes	**
	Channa orientalis	Channidae	Perciformes	**
	Channa striatus	Channidae	Perciformes	**
	Clarias dussumieri	Claridae	Siluriformes	*
	Clarias gariepinus	Claridae	Siluriformes	*
	Clarias batrachus	Claridae	Siluriformes	**
	Garra ceylonensis	Cyprinidae	Cypriniformes	*
	Glossogobius giuris	Gobiidae	Perciformes	*
	Gonoproktopterus curmuca	Cyprinidae	Cypriniformes	**
	Macrognathus aral	Mastacembelidae	Synbranchiformes	**
	Mastacembelus armatus	Mastacembelidae	Synbranchiformes	**
	Mystus armatus	Bagridae	Siluriformes	**
	Mystus gulio	Bagridae	Siluriformes	**
	Mystus menoda	Bagridae	Siluriformes	*
	Parambassis dayi	Ambassidae	Beloniformes	**
	Puntius chola	Cyprinidae	Cypriniformes	**
	Puntius sarana subnasutus	Cyprinidae	Cypriniformes	**
	Salmostoma acinaces	Cyprinidae	Cypriniformes	**
	Salmostoma boopis	Cyprinidae	Cypriniformes	**
	Xenentodon cancila	Belonidae	Perciformes	**
Ornamental fishes	*Amblypharyngodon microlepis*	Cyprinidae	Cypriniformes	**
	Barilius bakeri	Cyprinidae	Cypriniformes	**
	Barilius gatensis	Cyprinidae	Cypriniformes	**
	Bhavania australis	Balitoridae	Cypriniformes	**
	Carinotetraodon travancorius	Tetraodontidae	Tetraodontiformes	*
	Danio aequipinnatus	Cyprinidae	Cypriniformes	*
	Danio malabaricus	Cyprinidae	Cypriniformes	**
	Etroplus maculatus	Cichlidae	Beloniformes	**
	Garra hughi	Cyprinidae	Cypriniformes	-
	Garra mullya	Cyprinidae	Cypriniformes	**
	Garra surendranathanii	Cyprinidae	Cypriniformes	-
	Lepidocephalus thermalis	Cobitidae	Cypriniformes	**
	Mesonoemacheilus guentheri	Balitoridae	Cypriniformes	**
	Mesonoemacheilus triangularis	Balitoridae	Cypriniformes	**
	Nandus nandus	Nandidae	Beloniformes	**
	Ompok bimaculatus	Siluridae	Siluriformes	-
	Osteobrama bakeri	Cyprinidae	Cypriniformes	**
	Parambassis thomassi	Ambassidae	Beloniformes	**
	Pristolepis marginata	Cyprinidae	Cypriniformes	**

	Puntius amphibious	Cyprinidae	Cypriniformes	-
	Puntius bimaculatus	Cyprinidae	Cypriniformes	**
	Puntius denisonii	Cyprinidae	Cypriniformes	-
	Puntius fasciatus	Cyprinidae	Cypriniformes	**
	Puntius filamentosus	Cyprinidae	Cypriniformes	**
	Puntius ticto	Cyprinidae	Cypriniformes	**
	Puntius vittatus	Cyprinidae	Cypriniformes	**
	Rasbora daniconius	Cyprinidae	Cypriniformes	**
	Wallago attu	Siluridae	Siluriformes	*

*** Most Abundant ; * Abundant; - Rare*

A total of 11 species were identified as cultivable fishes (Table 1). The number of food fishes identified were 22 species under investigation. The dominant group belong to the family was siluridae (7 species) followed by Cyprinidae (6 species). 5 species were identified under the order Perciformes. Synbranchiformes and Beloniformes by 3 and 1 species respectively (Table 1). Maximum fish species identified were ornamental fishes (28 species). The order Cypriniformes alone represented 22 species. The identified fishes of the order Beloniformes were 3, Siluriformes by 2 and Tetraodontiformes by 1 species. More details were given in table 1.

4. Discussion

Fishes are the keystone species which determine the distribution as well as an abundance of other organisms in the ecosystems they represent and are good indicators of the water quality and health of the ecosystem [12]. India has vast inland fishery resources in the form of rivers and canals (195210 km), reservoirs (2-94 million ha), tanks and ponds (2.41 million ha), floodplain. Lakes and derelict waters (0.79 million ha), offering tremendous scope for fish production [13]. The capture fisheries in the rivers, lakes, channels, flood plain water bodies, tanks and ponds, were always the rural livelihoods and food security base. Considering the extent to which small indigenous species of freshwater fish play a role in providing nutrition to the rural poor and in maintaining biodiversity, it is important to consider promoting sustainable use of small indigenous species in both capture and culture fishery systems [14]. Though the Indian major carps and other exotic carps would have gone up in production and found its way to distant markets, the indigenous variety remained the income source of traditional fishers in the rural area mainly catering to subsistence, or local markets. It is, however, important to locate these efforts within specific cultural and socioeconomic contexts, looking also at critical issues of ownership and access rights over water bodies, and to formulate relevant strategies, as appropriate. If such factors are taken into consideration, the objectives of nutritional security, promotion of employment and conservation of biodiversity can be better met especially in some of the most disadvantaged areas of rain fed agriculture area, showing poor human development indicators [15]. Information regarding estimates of fish production from river stretches in India is scarce [14, 16], though many reports on estuarine, lacustrine or reservoir fisheries are available [17, 18]. Riverine fisheries are highly dispersed and unorganized, making collection of data on fishing and fish yield difficult [19]. The Central Inland Capture Fisheries Institute (CIFRI), Barrackpore has collected data from selected stretches of rivers Ganga, Brahmaputra, Narmada, Tapti, Godavari and Krishna. These rivers harbour a rich and varied fish fauna, of which the Gangetic system alone has 265 species, followed by the Brahmaputra system with 126 species and the peninsular rivers harbouring 76 species [19]. Hora and Law [20] did not mention the presence of any introduced species in their list of the freshwater fishes of Travancore. Gopalakrishnan and Basheer [21] reported the introduction of Indian major carps in Kuttanad rivers. Studies on fish diversity of Bharathapuzha, showed abundance of Tilapia population, replacing native fish fauna in many areas [22]. The alien invasive species are the major threat to biodiversity conservation and second major cause of extinction of native and endemic species around the world [23]. Non-native fish are introduced around the world mainly for improving fisheries, sport, ornamental fish trade and for bio control of mosquito [12]. Introduced fish frequently alter the aquatic ecology by changing water quality and also cause the extinction of native fish by predation and resource competition [24]. Loss of in stream vegetation, sand and gravel in the river bed not only affect the feeding and hiding grounds of fishes and other freshwater animals but also induce spawning disorders to phytophilic and psammophilic fishes in the aquatic environment [25]. The fishes of Kuttanad's river system are subjected to severe overfishing leading to killing of spawner fish population. Over exploitation of fishery resources due to its extra ordinary economic value has been a causative factor exacerbating the vulnerability of the population in different ecosystems [26]. Owing to ever increasing demand of fish as food, the aquatic ecosystems are under constant pressure which lead to the depletion fish fauna [14].

5. Conclusion and Recommendation

The aquatic biodiversity of the world is getting depleted alarmingly as a result of various factors like habitat loss, pollution, introduction of exotic species, overexploitation and other anthropogenic activities [27, 28]. The loss is severe in freshwater ecosystem and accounts for 0.1% of hydrosphere, but harbour 40% of the fish species so far recorded [29]. Hence a thorough survey of the aquatic ecosystems and a national fish inventory would help to make a database. The diversity of fish in Kuttanad's river system are excellent indicators of water quality. In order to maintain a healthy biodiversity and abundance of fish, we recommend the following activities / conservation measures be put in place; (i) do not harvest the fish during the spawning period, (ii) do not harvest juveniles, (iii) do not allow the introduction of invasive species such as tilapia, mosquito fish and guppies into the river and (iv) educate locals about the life cycles of freshwater fish and the negative impact of pollution with sewage, fertilizers, pesticides and other chemicals as Anthropogenic activities have led to the degradation of Kuttanad at a faster pace. Hence, conservation and management strategy is needed to conserve this important ecosystem.

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