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Exploited Fishery Resources in the Kallada River, Kerala, India

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Abstract

Kallada is one of the significant Western Ghats river systems of Kerala with a total length of 121 km and a catchment area of 1654 km^2. The present study assessed the exploited fisheries resources of the Kallada River during 2009-2010. A total of 21 fish species belonging six orders and 17 genera were recorded from the fishery. Family Cyprinidae dominated with six species followed by Cichlidae and Channidae (three species each). The landings were represented by one Critically Endangered (*Hypselobarbus thomassi*), and three vulnerable (*Hypselobarbus kolus*, *Horabagrus brachysoma* and *Channa diplogramma*) species. The average annual fish production from Kallada River was estimated to be 16.58 t. Highest landings were recorded during the pre-monsoon season (9.3 t) and the lowest during monsoon (1.88 t). *Hypselobarbus kurali* (4.75 t), *H. thomassi* (1.12 t) and *H. kolus* (0.42 t) were the abundant species in the landings. Between the landing centres, Kunnathoor contributed 52.36% to the total landing followed by Neduvannorkadavu (46.84%). Gill net was the major gear used in the river accounting for 99% of the total catch. Catch per unit effort (CPUE) recorded in the gill net for *H. kurali* (0.28 kg h^{-1}), *Chanos chanos* (0.10 kg h^{-1}), *H. thomassi* (0.07 kg h^{1}) and *Tor khudree* (0.06 kg h^{-1}).

Keywords: Fish landing, Cyprinidae, Pre-monsoon, CPUE, Inland fisheries

1. Introduction

Riverine fisheries form an important environmental resource providing food security and livelihoods to millions of people around the world (Welcomme, 2008; Romulo *et al.*, 2017). Nearly 56 million people are engaged in inland fisheries worldwide (BNP, 2009). Being undervalued and unappreciated, the social, economic and ecological values of riverine fisheries are often difficult to estimate (Cooke *et al.*, 2016). Data related to riverine fisheries are difficult to obtain due to various factors such as high diversity of exploited species and fishing gears, variable fishing effort, lack of multiple landing centres and remoteness of fish landing sites (Bayley and Petrere, 1989; Ticheler *et al.*, 1998). Over the last few decades, the riverine fisheries have shown substantial declines due to habitat destruction, introduction of exotic species, overexploitation, water abstraction, dam construction, pollution of natural waters and climate change (Bhatt *et al.*, 2016).

Kallada River (8°40' to 9°15' N and 76° 30' to 77°20' E) is one of the major rivers in Southern Kerala, India originating from the Kulathupuzha ranges of the Western Ghats at an elevation of 1500 m msl having a total length of 121 km and a basin area of 1654 km^2. Kallada River is formed by three tributaries, Kulathupuzha, Shendurney and Kalthuruthy, which merged together and drains into the Ashtamudi estuary. The diversity of fish fauna of Kallada River has been studied by Radhakrishnan (2006) and Abraham *et al.* (2011). The present study was carried to fill this knowledge gap.

2. Materials and Methods

The three most important fish landing centres along the Kallada River in the upstream-downstream gradient were selected for the study, which includes Neduvanoorkadavu, Mukkadavu and Kunnathoor (Fig 1). Seasonal sampling was conducted during monsoon (June-September), post-monsoon (October-January) and pre-monsoon (February-May) seasons from June 2009 to May 2010. Fishers were interviewed in the morning (6-8 am), and gear-wise landing of each fish species in every landing centre was collected. All the fishes landed were included in the study, and fish species were identified with the help of standard literature (Talwar and Jhingran, 1991; Jayaram, 2009). Biodiversity status of fish species was assessed following IUCN criteria. Catch per unit effort (CPUE) of each type of fishing gear was also calculated. Daily landings from each type of gears were computed following Kurup *et al.* (1992) using the formula.

$$W = (w/n) \times N$$

Where W = total weight of fish, w = total weight of fish from gear sampled, n = number of gears sampled, N = total number of similar gears operated

The monthly catch was then estimated by multiplying daily catch with the total number of fishing days in a month. The seasonal fish landing was quantified by multiplying the catch of each month with the number of months in the season. By summarizing the total landing of three seasons, the annual fish production was estimated.

3. Results and Discussion

Twenty-one fish species belonging to six orders and 17 genera were represented in the exploited fishery of Kallada River (Table 1) which is on a lower side compared to 26 species from Pampa River and 23 species from Muvattupuzha River (Renjithkumar *et al.*, 2011, 2016). Radhakrishnan (2006) collected 41 fish species from

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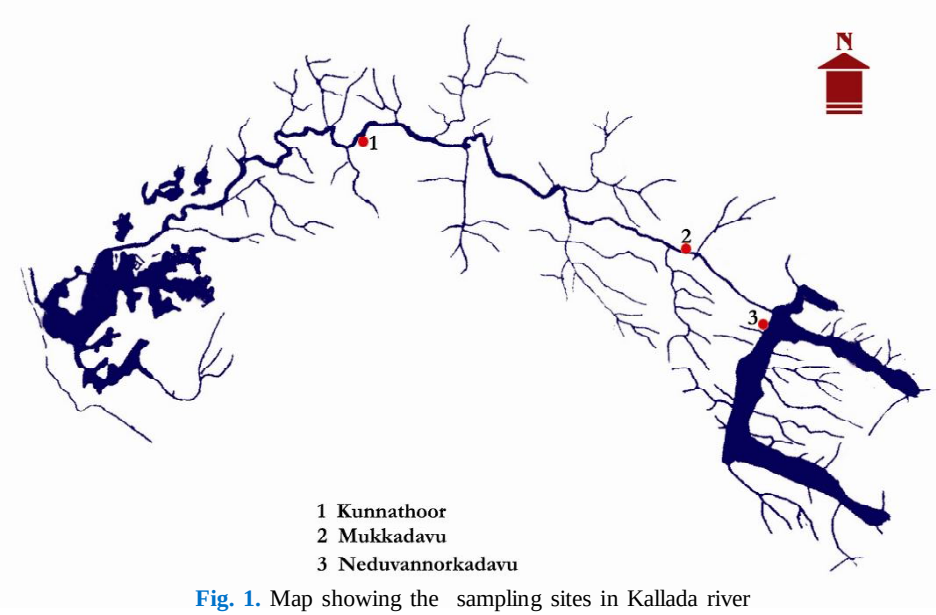

Fig. 1. Map showing the sampling sites in Kallada river

Kallada River, which includes 5 threatened fish species. At the same time, Abraham *et al.* (2011) reported 45 fish species from the Ashambu hill ranges of the Kallada River. Family Cyprinidae (Fig. 2) dominated among different fish groups with a numerical strength of six species (28%) followed Cichlidae and Channidae (14% each). The predominance of family Cyprinidae is reported in most of the South East Asian rivers (Nguyen and De Silva, 2006). The landings of Kallada river were represented by one Critically Endangered (*Hypselobarbus thomassi*), and three Vulnerable (*Hypselobarbus kolus, Horabagrus brachysoma* and *Channa diplogramma*) species. The only exotic fish species reported in the catch was *Oreochromis mossambicus.*

River fisheries are highly dispersed, unorganized and small-scale in nature and lacking essential infrastructure facilities, so the collection of landing data is difficult compared to marine and estuarine sectors (Sinha *et al.*, 1999; Bartley *et al.*, 2015). Understanding the fishery trends and forecast of riverine fisheries harvests is critical for the future of fisher communities who depend on these systems for food and livelihoods, but these fisheries harvests have not yet been quantitatively assessed at the global level in the ways that of marine fisheries (Martell and Froese, 2013; Romulo *et al.*, 2017). The annual exploited fishery of the Kallada River (16.58 t) which is lower than that in Pampa and Muvattupuzha Rivers, 394.22 t and 45.01t (Renjithkumar *et al.*, 2011, 2016) may be due to the lower fishing activity and low biological productivity. Highest landings were recorded during the pre-monsoon season (9.3t) and the lowest during monsoon (1.88 t). The landing of fish is low during the monsoon season in both Pampa and Muvattupuzha River (Renjithkumar *et al.*, 2011, 2016).

Table 1. Species composition and their landing in the exploited fishery of Kallada River

Sl No	Order	Family	Scientific name	Common name	Landing (tonnes)	Size range(mm)
1	Elopiformes	Megalopidae	*Megalops cyprinoides*	Indo Pacific tarpons	1.01	112-290
2	Cypriniformes	Cyprinidae	*Hypselobarbus kurali*	Kurali barb	4.75	98-270
3			*Hypselobarbus thomassi*	Red Canarese barb	1.12	107-604
4			*Hypselobarbus kolus*	Kolus	0.42	115-267
5			*Tor khudree*	Deccan mahseer	0.36	113-324
6			*Dawkinisia filamentosa*	Black spot barb	0.61	67-199
7			*Systomus sarana*	Peninsular olive barb	0.12	106-234
8	Siluriformes	Bagridae	*Horabagrus brachysoma*	Yellow catfish	0.06	103-212
9			*Mystus seengtee*	Gangetic mystus	0.14	67-100
10		Siluridae	*Ompok malabaricus*	Indian butter catfish	0.32	134-224
11		Heteropneustidae	*Heteropneustes fossilis*	Stinging catfish	0.12	132-205
12	Perciformes	Ambassidae	*Parambassis dayi*	Day's glass fish	0.18	66-134
13		Cichlidae	*Pseudetroplus maculatus*	Orange chromide	0.02	55-78
14			*Etroplus suratensis*	Banded pearlspot	1.28	123-280
15			*Oreochromis mossambicus*	Tilapia	0.19	130-231
16		Gobiidae	*Glossogobius giuris*	Tank goby	0.2	104-167
17		Channidae	*Channa striata*	Banded snakehead	1.61	145-407
18			*Channa pseudomarulius*	Giant snakehead	0.19	160-308
19			*Channa diplogramma*	Malabar snakehead	0.87	215-346
20	Gonorhynchiformes	Chanidae	*Chanos chanos*	Milk fish	2.09	145-302
21	Mugiliformes	Mugilidae	*Mugil cephalus*	Flat head mullet	0.94	123-245
Total						**16.58**

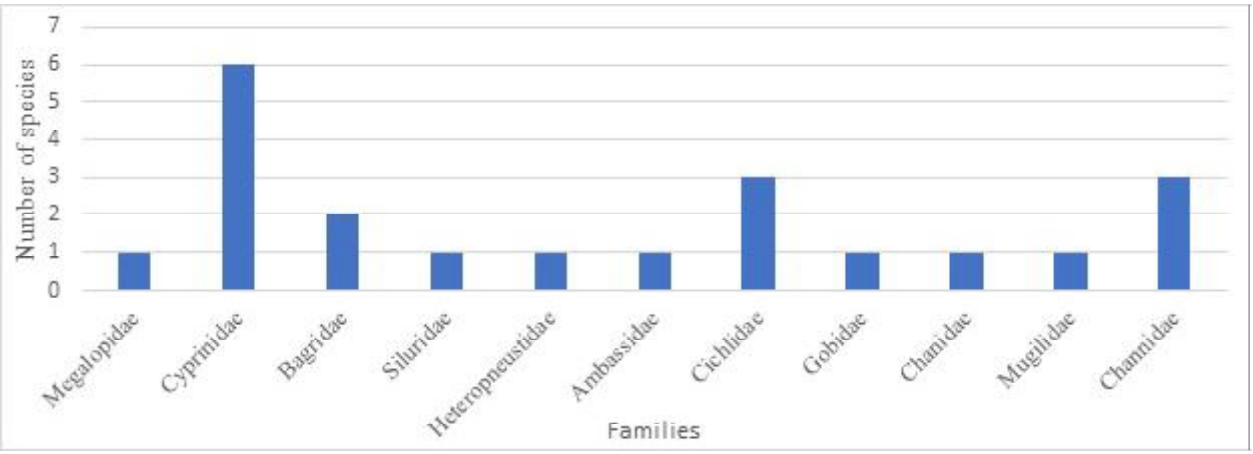

Fig. 2. Numerical strength of various fish families contributing to the exploited fishery in Kallada River

Gill net, locally know as '*Thandadivala*', is the predominant fishing gear operated along the river and accounting for 99% of catch followed by cast net (1%). Renjithkumar *et al.* (2011, 2016) reported that gill net was the major gear used for exploitation in Pampa and Muvattupuzha Rivers, accounting for 77% and 88% of the total catch. Gill net was the major gear used for fishery exploitation by inland fishermen in Kerala (Baiju and Hridayananthan, 2003). Gill nets are relatively inexpensive and easy to use, even in difficult environmental conditions. The main species caught in gill-net comprised *Hypselobarbus kurali* (28.86%), *Chanos chanos* (12.17%), *Channa striata* (9.81%), *Etroplus suratensis* (7.77%) and *Hypselobarbus thomassi* (6.79%) (Fig.3). Highest catch per unit effort (CPUE) was recorded for *H. kurali* (0.28 kg h^{-1}) followed by *Chanos chanos* (0.10 kg h^{-1}), *H. thomassi* (0.07 kg h^{-1}) and *Tor khudree* (0.06 kg h^{-1}). (Fig. 3). Cast nets contributed only a negligible fishery in Kallada River. The main species caught in cast net included *Dawkinsia filamentosa* (47.74%) and *Systomus sarana* (27%) and the Highest catch per unit was recorded in cast nets for *S. sarana* (0.15 kg h^{-1}).

The major fish species reported in the landing were *Hypselobarbus kurali, H. thomassi, Chanos chanos, Megalops cyprinoides, Channa striata* and *Etroplus suratensis. Hypselobarbus* was the dominant genus in the landing, and they contributed to 37.9 % of fishery in the river. *Hypselobarbus kurali* (4.75 t), *H. kolus* (0.42 t) and *H. thomassi* (1.12 t) were the species reported in the present study. They are endemic to rivers of Western Ghats occur-ring in rivers, streams, and reservoirs or even in lower reaches of rivers in the range (Arunachalam *et al.*, 2012). Secondary freshwater fishes, viz., *C. chanos* (2.09 t), *M. cyprinoides* (1.01 t) and *Mugil cephalus* (0.94 t) accounted for 24.32% in the landing. Bijukumar and Sushama (2001) reported that these estuarine fishes migrate from saline areas to the upstream area of the river for feeding and breeding. Marine-spawned fish migrating into freshwater do so to access increased feeding opportunities, due to reduced competition and predation in freshwater environments (Bruton *et al.*, 1987). Migratory fishes are a prominent ichthyofaunal constituent of tropical rivers, and these species exploit seasonal variation in the channel and floodplain habitats for feeding and breeding worldwide (Lowe-McConnell, 1987; Winemiller 1989; Winemiller and Jepsen, 1998).

Oreochromis mossambicus, commonly known as Mozambique tilapia, was the only exotic species reported in the study. The successful introduction of *O. mossambicus* in natural waters may cause negative impact on the inland fish diversity in India (Bijukumar, 2000).

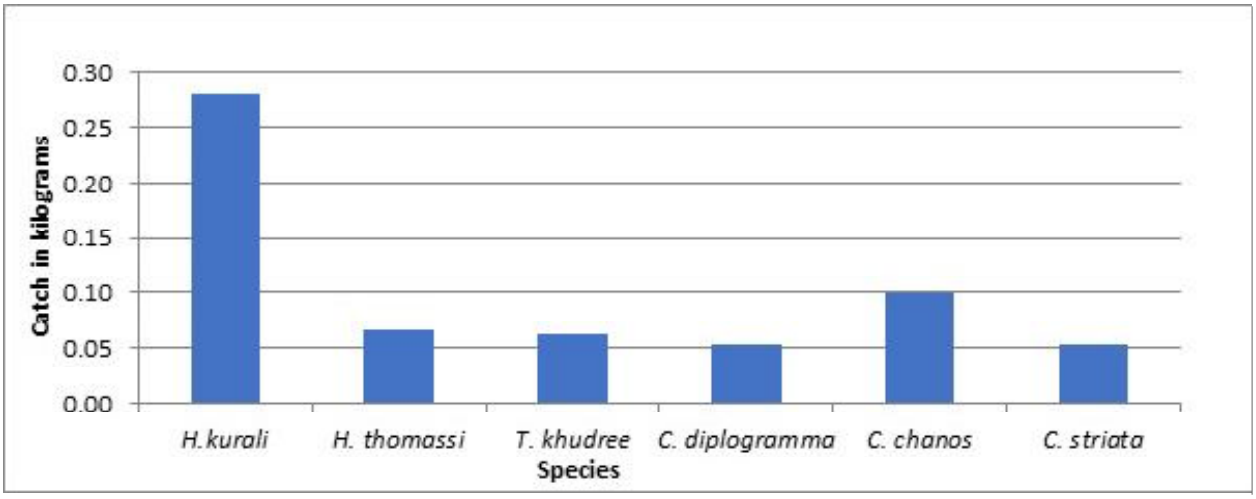

Fig. 3. Catch per unit hour of major fish species exploited by gill nets in Kallada River

Several reports are available on native fish species decline in India including from reservoirs and rivers due to the proliferation and establishment of tilapia (Sreenivasan and Sundarajan, 1967; Murthy *et al*., 1986; Sreenivasan, 1996, Lakra *et al*., 2008, Singh and Lakra, 2011). The established population of *O. mossambicus* will cause negative effects on native fish fauna especially to *Pseudetroplus maculatus* (Orange chromide) in the Chalakudy River, Kerala because it shares more or less similar ecological niche as that of orange chromide (Raghavan *et al*., 2008).

The fish fauna in Kallada River is under threats due to various causes like habitat depletion, pollution and over-exploitation of threatened fishes. Aquatic sanctuaries and non-fishing season should be declared in fishing areas of the river for the conservation of native fishes in the river. Strict enforcement is needed to prohibit the use of destructive fishing practices such as dynamiting, plant poison and use of small mesh size nets for fish collection.

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