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RESEARCH ARTICLE

ICTHYOFAUNAL DIVERSITY OF PUZHAKKAL RIVER- AN EVIDENCE CASE STUDY OF RICH BIODIVERSITY OF WESTERN GHATS

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ABSTRACT

The Indian rivers are proven to be significant sites of cyprinid diversity. Kerala is a state with 44 rivers flowing through the land, forty one west flowing and three east flowing. The streams of Kerala included in the Southern and central division of Western Ghats are considered unique for their exceptional biodiversity with respect to freshwater fishes. Puzhakkal is one of the 41 west flowing rivers of Kerala originating in the Machad hill range and flowing terminally into the Kol fields. It flows along northern part of Thrissur and drains into the Enamakal lake and then to Arabian Sea. The present work investigates the icthyofaunal diversity of Puzhakkal river. collections of live fishes were made during January 2009 to December 2012. 71 species belonging to 48 genus and 26 family and eleven orderswere collected from the present survey. The river exhibited rich endemism with respect to icthyofaunal diversity and is also subjected to severe stress.

INTRODUCTION

Rivers are the cradle of human civilization, the river resources of India comprises of Ganga, Brahmaputra, Indus, East coast and West coast system. Of the 34 hot spots of biodiversity identified in the world Western Ghats is one with rich endemism (Bhatt, 2003). Possessing a variety of vegetation types, climate zones it is considered to be one of the hot spot areas for biodiversity conservation (Easa *et al*., 1997). Still, the ecosystems bears imprints of human action through history (Chandran, 1997) and a great number of fishes are listed endangered. In being uniquely positioned between the Western Ghats and Arabian Sea, Kerala is exceptionally blessed with abundant water resources. There are 44 rivers and they are monsoon fed, small in length, breadth and annual stream flow. Puzhakkal river is one of the west flowing rivers. It is estimated that 27,977 valid species of fishes exist in the word today (Nelson, 2006). The Indian subcontinent harbours about 2500 fishes, of this 930 are fresh water inhabitats (Rema devi and Indra, 2009). Significant study oriented towards the fish diversity in rivers of Kerala were those of Thomas 2004, Khadar 1993, Varghese 1994, Sheebha 1999, Roy 1995, Ajithkumar (1999), lalmohan 2000. Thobias (1973) studied the fishes inhabiting in paddy fields and rivers in Thrissur District. While Antony (1977) studied the hill stream fishes of Thrissur District. Inasu (1991) studied the systematics and bionomics of inland fishes in Thrissur District. Though the different habitats in the watershed of the river has been studied, the river has long been ignored as a minor river contributing miserably to biodiversity. This is the first report on the river as an independent entity

MATERIALS AND METHODS

a) Study area

The Puzhakkal river of Thrissur district originates from the Killanoor hills of Machad mala at an elevation of 150m (Thomas, 2004). It is a minor river with a length of 29Km. The river is formed of the confluence of four tributaries the Parathodu, Poomalathodu, Naduthodu and Kattachirathodu flowing through Puzhakkal, Killanoor, Mudikotti villages. It flows along northern part of Thrissur and fall into swamps, the river first drains through Kottachal along with Chiyaram, Kokkala and Chettupuzha canals into the Enamakal lake and then finally to Chettuva and Arabian Sea. At Enamakkal in 1969 a regulator was constructed. This regulator was constructed as flood control structure but it also serve as salt barriers and divert flood water to the back water Kanoli canal and then to sea through Chettuva from the paddy fields.

b) Methodology

Seven equidistantly stations were identified all along the course of the river. Extensive collections of live fishes were made during January 2009 to December 2012 using gillnets, cast nets and scoop nets. The fishes were sorted out, washed and dried using blotting paper, the coloration of the fish in general and at various parts were noted down. Some live, whole fish, without mutilations were separated and dropped into 7% formalin for preservation. They were brought to the laboratory and fixed in freshly prepared formalin. The rest of the live fishes were kept in aquarium and photographs were taken to aid in identification as live specimens maintain colour and is of great assist in taxonomic identifications. The details of date of collection, locality, stream, substratum and vegetation were recorded as it is considered a very important data because of the widespread disappearance of many species (Jayaram, 1981). The preserved specimens were labelled and identified according to Day (1878) Jayaram (1999) Talwar and Jhingran (1991) Tekriwal and Rao (1999) Shaji (2003). All species name are in accordance with fishbase Froese and Pauly (2007). Based on the relative abundance the species status was assigned as very common, common, moderate, rare and very rare Radhakrishnan (2010) Threats existing in the study area was analysed by collecting primary information through observation and interviews with local community, secondary data was collected from reports, internet and journals and government publications.

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Table 1. Systematic of icthyofaunal diversity of Puzhakkal River

Order	Family	Species
Anguilliformes	Anguillidae	*Anguilla bicolor* (McClelland)
		Anguilla bengalensis bengalensis (Gray)
Elopiformes	Megalopidae	*Megalops cyprinoides* (Broussonet)
Clupeiformes	Clupeidae	*Dayella malabarica(* Day)
Cypriniformes	Cyprinidae	*Amblypharyngodon melettinus* (Valenciennes)
		Amblypharyngodon microlepis (Bleeker)
		Cirrhinus mrigala (Hamilton 1822)
		Danio aequipinnatus (McClelland)
		*Danio malabaricus (*Jerdon)
		Esomus danricus (Hamilton-Buchnnan)
		Hordandia attukorali(Deraniyagala)
		Parluciosma daniconius (Hamilton-Buchnnan)
		Gonoprokopterus curmuca (Hamilton-Buchnnan)
		Laubuca laubuca (Hamilton-Buchnnan)
		*Puntius amphibius (*Valenciennes)
		Puntius assimilis (Jerdon)
		Puntius chola (Hamilton-Buchnnan)
		Puntius dorsalis (Jerdon)
		Puntius filamentosus (Valenciennes)
		Puntius parrah Day
		Puntius sarana subnasutus(Valenciennes)
		Puntius punctatus Day
		Puntius vittatus (Day)
		Catla catla (Hamilton-Buchnnan)
		Labeo rohita (Hamilton-Buchnnan)
		Ctenopharyngodon idella (Valenciennes, 1844)
		Cyprinous carpio Linnaeus
		Garra mullya (Sykes)
	Cobitidae	*Lepidocephalus thermalis*(Valenciennes)
Siluriformes	Bagridae	*Mystus gulio* (Hamilton-Buchnnan)
		Mystus montanus (Jerdon)
		Mystus ocutatus (Valenciennes)
		Mystus malabaricus(Jerdon)
	Siluridae	*Ompok bimaculatus* (Bloch)
		Ompok malabaricus (Valenciennes)
		Wallago attu (Bloch& Schneider)
	Bagridae	*Horabagrus brachysoma (gunther)*
	Heteropneustidae	*Heteropneustes fossilis* (Bloch)
		*Heteropneustes microps(G*unther)
Cyprinodontiformes	Belonidae	*Xenentodon cancila* (Hamilton)
	Hemiramphidae	*Hyporhamphus limbatus* (Valenciennes)
		Hyporhamphus xanthopterus(Valenciennes)
Cyprinodontiformes	Aplocheilidae	*Aplocheilus lineatus* (Valenciennes)
Synbranchiformes	Mastacembelidae	*Macrognathus guentheri(Day)*
		Mastacembelus armatus (Lacepede)

The threat status was assigned according to Iucn Kurup (2004), Radhakrishnan (2010), IUCN (2012). The endemism of fish species was determined following Gopi (2000).

RESULT AND DISCUSSION

The survey results indicate that the fish diversity of Puzhakkal river is diverse, enriched and endemic. The taxonomic composition of the river consists of 71 species belonging to 48 genus and 26 family and eleven orders. Thobias (1973) recorded 58 species of freshwater fishes from Thrissur district and Inasu (1991) recorded 57 species, the present survey of the river, the smallest river of the district and the ninth smallest river of the state records a ever time high of Icthyofaunal diversity with 71 species. While the longest rivers of Kerala, the Periyar, Bharathapuzha, Pampa recorded a fish species diversity of 68 (Pramod 2006), 88(Bijukumar and Sushama, 2006) and 60 (Renjithkumar 2011) respectively, the recorded fish diversity of a river having a meager length of 29km requires special mention in conservation strategies. The role of the river in the biodiversity programmes can on no account be ruled out for it has to be considered a hot spot of icthyofaunal diversity. The result is in accordance with the studies of Radhakrishnan (2002) that the rivers of central Kerala abounds in fish species but in contradiction to the statement that greater the length of the river greater the biodiversity. Of the 207 freshwater fishes of Kerala (Gopi, 2000) the Puzhakkal river contributes 64 species. This exceptional high diversity is proposed to be due to the occurrence of diverse microhabitat within the flow regime of the river, harbouring rich fauna unique to each. The presence of the Kol wet lands in the downstream multiplicates the diversity making the river a hotspot of icthofaunal diversity. Of the total 71 fishes seven were brackish water fishes, the river opening into Enamakkal backwaters provides a habitat of annual transient ecotone. Fishes are the first victims of dams and diversions that drastically alter the hydrologic regime of the system (Ajithkumar 2001) it is worth mentioning that no collection sites were hampered by dams and thereby the river has provided ambient environment in the niches that were never ever troubled by checkdams. It's a clear evidence of faunal transformation occurring in rivers whose flow regime is disturbed by dams. The order with the highest number of species was cypriniformes, the family cyprinidae contributing 24 species, being the family with highest number of species with genus Puntius representing 9 species. Cyprinids rich diversity contribute to a long history of human use (Pamela 2005) they are dominant in the aquatic systems of north India (Kar 2006), south Kerala (Thomas, 2004) and western ghats. Perciformes with 10 families recorded 21 species and Siluriformes was represented by 10 species in 3 families. The list of fish species, order, family, genus are as shown in the Table 1. The present survey reports the occurrence of transplanted and exotic species. Raghavan (2008) recorded the presence of exotic species in chalakudy river and Bijukumar (2000) considered the introduction of exotic species as alarming to the freshwater aquatic biodiversity. Catla, rohu and mrigal though not exotic are non native

Table 2. Conservation status and endemicity of fishes of Puzhakkal river

Sl. No	*Scientific name*	Conservation status	Endemicity	Abundance
1.	*Ambassis gymnocephalus*	Least concern	-	Common
2.	*Amblypharyngodon melettinus*	Data deficient	Indian subregion	Common
3.	*Amblypharyngodon microlepis*	Near threatened	India	Moderate
4.	*Anabas testudineus*	Vulnerable	-	Common
5.	*Anguilla bengalensis bengalensis*	Endangered	-	Very rare
6.	*Anguilla bicolor bicolor*	Endangered	-	Rare
7.	*Aplocheilus lineatus*	Least concern	Indian subregion	Common
8.	*Awaous gutum*	Least concern	-	Rare
9.	*Carinotetraodon travancoricus*	Vulnerable	Western ghats	Common
10.	*Catla catla*	Transplanted	Transplanted	Rare
11.	*Channa gachua*	Data deficient	Indian subregion	Moderate
12.	*Channa marulius*	Near threatened	-	Rare
13.	*Channa punctatus*	Near threatened	-	Very rare
14.	*Channa striata*	Least concern	Indian subregion	Common
15.	*Cirrhinus mrigala*	Transplanted	Transplanted	Rare
16.	*Ctenopharyngodon idella*	Exotic	Exotic	Rare
17.	*Cyprinous carpio communis*	Exotic	Exotic	Rare
18.	*Dayella malabarica*	Critically endangered	Western ghats	Common
19.	*Devario aequipinnatus*	Least concern	Indian subregion	Common
20.	*Devario malabaricus*	Least concern	Indian subregion	Rare
21.	*Esomus danricus*	Least concern	Non endemic	Very rare
22.	*Etroplus maculatus*	Least concern	Indian subregion	very common
23.	*Etroplus suratensis*	Least concern	Indian subregion	Moderate
24.	*Garra mullya*	Least concern	India	Common
25.	*Gerres filamentosus*	Least concern	-	Rare
26.	*Gerres abbreviatus*	Not evaluated	-	Moderate
27.	*Glossogobius giurus*	Least concern	-	Moderate
28.	*Gonoprokopterus curmuca*	Endangered	Western ghats	Very rare
29.	*Heteropneustes fossilis*	Vulnerable	Indian subregion	Moderate
30.	*Heteropneustes microps*	Vulnerable	India	Very rare
31.	*Horabagrus brachysoma*	Endangered	Kerala	moderate
32.	*Hordandia attukorali Deraniyagala*	Endangered	Kerala	Very rare
33.	*Hyporhamphus limbatus*	Least concern	-	Moderate
34.	*Hyporhamphus xanthopterus*	Vulnerable	Kerala	Very rare
35.	*Labeo rohita*	Least concern	Transplanted	Moderate
36.	*Laubuca laubuca*	Least concern	-	Very rare
37.	*Leiognathus equulus*	Least concern	-	Rare
38.	*Lepidocephalus thermalis*	Least concern	Indian subregion	Common
39.	*Liza parsia*	Not evaluated	-	moderate
40.	*Liza tade*	Not evaluated	-	Rare
41.	*Lutjanus fluviflamma*	Not evaluated	-	Rare
42.	*Macrognathus guentheri*	Vulnerable	India	Moderate
43.	*Mastacembelus armatus*	Least concern	-	Rare
44.	*Megalops cyprinoides*	Data deficient	-	Very rare
45.	*Mugil cephalus*	Least concern	-	Rare
46.	*Mystus gulio*	Least concern	-	Rare
47.	*Mystus malabaricus*	Endangered	Western ghats	Rare
48.	*Mystus montanus*	Least concern	India	Common
49.	*Mystus oculatus*	Least concern	India	Common
50.	*Nandus nandus*	Near threatened	-	Common
51.	*Ompok bimaculatus*	Endangered	-	Very rare
52.	*Ompok malabaricus*	Endangered	India	Common
53.	*Oreochromis mossambicus*	Exotic	Exotic	Rare
54.	*Parambassis dayi*	Endangered	Kerala	Rare
55.	*Parambassis thomassi*	Vulnerable	Western ghats	Common
56.	*Parluciosma daniconius*	near threatened	-	Very common
57.	*Photopectoralis bindus*	Data deficient	-	Rare
58.	*Pseudosphromenus cupanus*	Least concern	-	Moderate
59.	*Puntius amphibius*	Least concern	Indian subregion	Very common
60.	*Puntius assimilis*	Vulnerable	Western ghats	Very rare
61.	*Puntius chola*	Vulnerable	Indian subregion	Rare
62.	*Puntius dorsalis*	Vulnerable	Indian subregion	Very rare
63.	*Puntius filamentosus*	Least concern	Indian subregion	very common
64.	*Puntius parrah*	Least concern	Western ghats	Very common
65.	*Puntius sarana subnasutus*	Vulnerable	Western ghats	Common
66.	*Puntius punctatus*	Least concern	Western ghats	Very common
67.	*Puntius vittatus*	Vulnerable	Indian subregion	Common
68.	*Scatophagus argus*	Least concern	-	Rare
69.	*Sicyopterus griseus*	Endangered	Kerala	Very rare
70.	*Wallago attu*	Low risk	-	Rare
71.	*Xenentodon cancila*	Low risk	Indian subregion	Very common

carps of peninsular India. These non native carps can compete, interbreed and contaminate the native fauna (Gopalakrishnan, 2000). The Thrissur district is a site of dynamic freshwater fish culture activities, the introduction of these carp though has increased the financial landings the threat posed by the escape of these fish to the wild creates ample pressure on the endemic icthyofauna and as according to Kottelet and Whitten (1996) the transfer of fishes to different habitats within the same country should be done cautiously. Over the last century riverine ecosystems have suffered from intense human interventions resulting in habitat loss and degradation (Sarkar and Lakra, 2010) the decline in the fishery of Wallago and Heteropneustes and the total disappearance of Calrias dussemeri from the district needs special mention and study in that direction. The study also records the occurrence of migratory fishes like Megalopsis cyprinoides and Lutjanus fluviflamma. Out of 71 fishes five fish were found to be exclusively endemic to Kerala, nine endemic to western ghats, seven endemic to India and sixteen endemic to Indian subregion. Three of the fishes were exotic and three are Indian major carps. Many endemic fish are exploited for commercial purpose aggravating their degree of endangerment (Kurup, 2004). Among Asian countries India possess maximum number of endemic fresh water fin fish (27.8%) (Lakra, 2010) and the statement, streams of west flowing rivers of Kerala encounter more endemic forms (Johnson 2009) is in accordance with the icthyofaunal diversity of Puzhakkal river. The UN convention on biological diversity endorses the rights of member nations over their genetic resources (Lakra 2009). It was observed that according to conservation status one fish is critically endangered, 11 endangered, 5 near threatened, 12 vulnerable, the data is provided in Table 2. Menon (1989) recorded 21 fish as vulnerable. The CAMP Workshop that evaluated the conservation status of fishes identified that many of the fishes which are commonly found were threatened. The abundance of the fishes in the river indicates that 22 were Rare and 13 very rare 12 were moderately found 17 common very common 7. This hot spot of biodiversity is however under severe threat. The pressure of globalization thrust upon the soul of the river. From the enquiry into the traditional knowledge of the fishermen the population and species of the rivers are declining day by day.

The reasons being Mining operation, Habitat destruction, industrialization, saline intrusion, overindulgence in fertilizer, pesticide, accidental fires along banks of the river, clay mining for Brick work, Increased sedimentation due to removal of riparian vegetation, entry of agricultural runoff, modification of channels, network of roads across the river and sand mining. These cause severe habitat change and loss of run and riffle habitat. This is the first time report on the occurrence of endemic fishes Puntius assimilis and Hordandia attukorali. It also provides a new record of heteropneustes microps. New species have been added to the taxonomic collection from the Thrissur district (Vincent, 2011), and the puzhakkal river records rich icthyofaunal diversity still, the river is stated as polluted according to the pollution status of CPCB 2000 recording a plea for conservation and management strategies, proving even minor rivers mean a lot as biodiversity hotspots. The Puzhakkal river was flowing amidst vast paddy fields in the past but today the place is rapidly developing. The fields have transformed to industries with the latest township and a tourist centre located on the bank of the river. The National quality assessment report state that the area has changed from subsistence oriented to commercial and contract based, the period 1981-2007 witnessed considerable land use changes (Sreenivasan, 2010). Therefore there is urgent need for biodiversity documentation of the fish species of this river as the rivers of Western ghats irrespective of their lengths are considered as hotspots of biodiversity and as sites of zero extinction.

Conclusion

The present study is illustrative of the status of Puzhakkal river. The rich icthyofaunal diversity in the diverse niches of the river gives it the status of a hot spot of biodiversity the occurrence of a number of endemic fish and the increasing urge of conservation of this valuable resource is to be immediately developed.

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