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Ichthyofaunal diversity of the Kattampally wetlands, Kannur and conservation challenges

R. Roshnath[1*], P. V. Nisha[2] and Anvar Ali[3]
[1]Malabar Awareness and Rescue Centre for Wildlife, Kannur-670 004, Kerala, India.
[2]Sree Narayana College, Kannur-670 007, Kerala, India.
[3]Kerala University of Fisheries and Ocean Studies, Kochi-682 506, Kerala, India.

*Correspondence email: roshnath.r@gmail.com

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Short communication

Abstract

Kattampally wetland is a large swamp located on floodplains of the Valapattanam River in the Kannur District of Kerala. Two systematic fish surveys were carried out in four sampling stations spread across the marine-to-freshwater gradient from March 2019 to March 2020. Experimental fishing operations were carried out using mosquito nets, scoop nets, cast nets and gill nets of various dimensions. A total of 75 fish species belonging to 45 families representing 16 orders were recorded. Fifty-six per cent of the species recorded were found to be migratory. The study also recorded the presence of threatened, endemic and exotic species. The conservation status of 49.3% of the species recorded was found to be 'Not Evaluated' category pointing to the need for urgent scientific studies. Along with the encroachment and reclamation of wetlands, illegal fishing practices, restricting the natural tidal actions using the regulator cum bridge and local check dams are found threatening to the fish fauna of Kattampally. Considering the diversity and migratory status of the fishes, we propose Kattampally wetlands be designated as a Ramsar site.

Keywords*: Fish diversity, migration, Ramsar site, threats, wetland conservation*

Introduction

Together with inland and coastal wetlands, the state of Kerala has 160,590 ha of wetlands, which are known for their diversity and ecosystem services (Kokkal *et al.,* 2008). Consisting of both natural and manmade systems, Inland waters hold the major share (73%) of the total wetlands in Kerala, while coastal wetlands cover 25% and the rest 2% are smaller wetlands (GoK, 2009). Kerala has three Ramsar designated wetlands located in south and central districts which are Vembanad–Kole wetlands (1,512.5 km^2)–the largest brackish wetland ecosystem on the southwest coast of India, Ashtamudi Lake (61.4 km^2)–the second largest wetland and deepest estuary in Kerala, and the Sasthamkotta Lake (12.69 km^2)–the largest freshwater lake in the state (GoK, 2019). Some of the major wetlands of North Kerala include Kadalundi estuary, Kavvayi wetlands and Kattampally wetlands.

Kattampally wetland is a large swamp on the flood plains of Valapattanam River in Kannur district of the North Malabar region of Kerala where, the estuarine fishes, shrimps and molluscs form a major source of income for the residents (Cheruvat, 2018). A previous study suggests that the Valapattanam backwaters (to which Kattampally wetlands also belong) have a yield of 246 kg per ha and a dependency of 19 fishermen per Km^2 (Unnithan *et al.,* 2005). Kattampally is also known for its salt/saline tolerant paddy cultivation called "Kaipad" (Leneesh, 2011). This unique ecosystem contributes to food security, livelihood security, water security, biodiversity and environmental protection (Vanaja, 2013). However, like any other wetlands, Kattampally is also facing threats from urban development, habitat degradation, and over-exploitation of resources (Prasad *et al.,* 2002; Sreejith, 2013). Though there exists information on the fish faunal diversity of most of the brackishwater wetlands in Kerala such as Veli (Unnithan *et al.,* 2005); Ashtamudi estuary (Raghunathan, 2007); Vembanad Lake (Kurup *et al.,* 1995); Ponnani estuary (Bijukumar and Sushama, 2000) information about this aspect is lacking for Kattampally wetlands. As the checklist of fauna is a basic inventory for the management of any biological landscape (Nameer *et al.,* 2015) and a better understanding of species diversity can help in strategizing the conservation plans (Bassi *et al.,* 2014) the current study aims

to document the fish faunal diversity, threats and conservation challenges of Kattampally wetlands.

Material and methods

Kattampally wetland (N 11°55´41" and E 75° 23´09"; 750 ha) having a water spread area of 750 Ha is spread over the Kolachery, Narath, Munderi, Kuttiyattur, Mayyil and Chirakkal Grama Panchayats and Puzhathi, Chelora, and Elayavoor divisions of Kannur Municipal Corporation, North Kerala, India (Fig. 1). Fish surveys were conducted in four sites, *viz.,* Pulluppikadavu, Valluvankadavu, Munderikadavu and Varamkadavu from March 2019 to March 2020. The sites were chosen based on salinity gradient ranging from the saline to the freshwater zone and at least two samplings were carried out in each site during the study period. Experimental fishing operations were performed in the morning (7:00 to 10:00 AM) and evening hours (4:00 to 7:00 PM) using local contrivances such as mosquito nets, handheld scoop nets, cast nets and gill nets of various dimensions (25.4mm and 50.8mm). Apart from the direct field surveys, fish were also obtained from fish landing centres in Kattampally and Pullupikadavu. All the fish species were photographed alive in a handheld aquarium, identified on-site, and released back, whereas the unidentified fishes were preserved in 5 – 10 % neutral buffered formalin for further investigation. Identification of finfishes and shellfish was done following Day (1865); Jayaram (1999) and Psomadakis *et al.* (2015). For the ecological guild classification of fishes, we followed Elliot *et al.* (2007), Potter *et al.* (2015) and Sreekanth *et al.* (2019). The conservation status of the species was determined following IUCN Red list 2020.

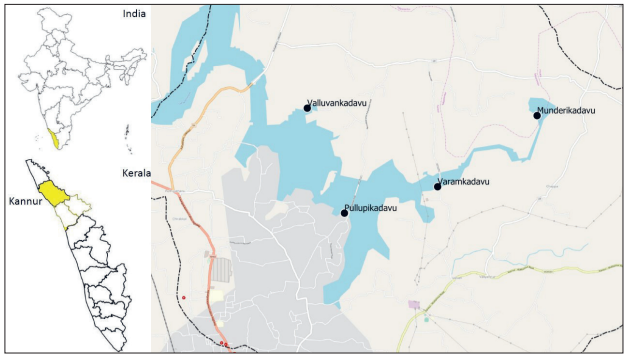

Fig. 1. Map showing the study sites at Kattampally wetlands in Kannur district, Kerala

Results

A total of 75 species of finfish belonging to 45 families and 16 orders were recorded during the present study (Table 1). The Perciformes were the most dominant order represented by 36 species belonging to 21 genera followed by Clupeiformes represented by six species in two genera. More than half (56%) of the species obtained during the study belonged to migratory types such as Marine Migrant (N= 33), Marine stragglers (N= 5), Catadromous (N= 2), and Anadromous (N= 2; Fig 2).

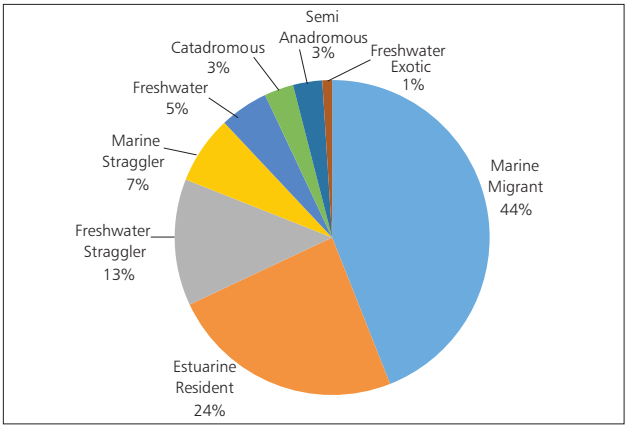

Fig. 2. Grouping of fishes according to ecological guilds

According to IUCN status, 49.3% of the species fall under the "Not Evaluated (NE)" category. The survey could record one vulnerable (VU) species (*Hyporhamphus xanthopterus*) and two Near Threatened (NT) species (*Anguilla bengalensis* and *Anguilla bicolor).* In addition, two exotic species of African origin, *viz., Oreochromis mossambicus* (Mozamibque tilapia) and *Clarias gariepinus* (African Sharptooth catfish) were recorded from the Kattampilly wetlands. Two species of fish endemic to the Kerala part of Western Ghats, *viz., Hyporhamphus xanthopterus* and *Puntius mahecola* and a species endemic to Western Ghats, *viz., Mystus armatus* were also recorded during the study.

Discussion

The number of species recorded during the study (n=75) is exceedingly higher than those reported from Kadinamkulam backwater (Nair *et al.,* 1983), Anchuthengu backwaters (Rajukumar, 2005), Thottappally backwater (Bhargavan *et al.,* 2008), Veli-Akkulam lake (Regi and Bijukumar, 2012), Kadalundi estuary (Rejina *et al.,* 2015), Varapuzha Wetlands of Vembanad Lake (Ajay, 2021).

Similar to other studies elsewhere in Kerala (Regi and Bijukumar, 2012; Remya and Amina, 2018), the order Perciformes was found to be well-dominated in Kattampally wetlands. Among the total species recorded in Kattampally, 53% of species were not evaluated according to IUCN. A huge number of fishes in Kerala are poorly known and thus need greater scientific attention for their future conservation (Nameer *et al.,* 2015).

According to Ramsar Criteria 1, if a wetland supports vulnerable, endangered, critically endangered species or threatened

Table 1. Checklist of fishes of Kattampally

Order		Family		Scientific name		Common name
I.	Mugiliformes	1.	Mugilidae	I.	*Ellochelon vaigiensis*	Squaretail mullet
				II.	*Liza subviridis*	Greenback mullet
				III.	*Mugil cephalus*	Flathead grey mullet
II.	Elopiformes	2.	Megalopidae	IV.	*Megalops cyprinoides*	Indo- Pacific tarpon
III.	Clupeiformes	3.	Clupeidae	V.	*Anadontostoma chacunda*	Chacunda gizzard shad
				VI.	*Nematolosa nasus*	Bloch's gizzard shad
		4.	Engraulidae	VII.	*Thryssa malabarica*	Malabar thryssa
				VIII.	*Thryssa mystax*	Moustached thryssa
				IX.	*Stolephorus commorsonnii*	Commerson's anchovy
				X.	*Ehirava fluviatilis*	Malabar sprat
IV.	Pleuronectiformes	5.	Cynoglossidae	XI.	*Cynoglossus macrostomus*	Malabar tonguesole
		6	. Soleidae	XII.	*Brachirus orientalis*	Oriental sole
V.	Perciformes	7.	Carangidae	XIII.	*Caranx ignobilis*	Giant trevally
				XIV.	*Trachinotus blochii*	Snubnose pompano
		8.	Lutjanidae	XV.	*Lutjanus argentimaculatus*	Mangrove red snapper
				XVI.	*Lutjanus johnii*	John's snapper
		9.	Cichlidae	XVII.	*Etroplus suratensis*	Green chromide
				XVIII.	*Pseudetroplus maculatus*	Orange chromide
				XIX.	*Oreochromis mossambicus*	Mozambique tilapia
		10.	Leognathidae	XX.	*Nuchequula nuchalis*	Spotnape ponyfish
				XXI.	*Leiognathus equulus*	Common ponyfish
				XXII.	*Secutor insidiator*	Pugnose ponyfish
		11.	Gobiidae	XXIII.	*Glossogobius giuris*	Tank goby
				XXIV.	*Stenogobius gymnopomus*	The Malabar goby
		12.	Eleotridae	XXV.	*Butis butis*	Duckbill sleeper
				XXVI.	*Eleotris fusca*	Dusky sleeper
				XXVII.	*Mugilogobius* spp.	Mullet goby
				XXVIII.	*Cryptocentrus lutheri*	Luther's prawn goby
				XXIX.	*Prionobutis koilomatodon*	Mud sleeper
		13.	Teraponidae	XXX.	*Terapon jarbua*	Crescent perch
		14.	Ambassidae	XXXI.	*Ambassis gymnocephalus*	Bald glassy perchlet
		15.	Scatophagidae	XXXII.	*Scatophagus argus*	Spotted scat
		16.	Gerreidae	XXXIII.	*Gerres filamentosus*	Whipfin silver- biddy
				XXXIV.	*Gerres oyena*	Common silver- biddy
		17.	Sillaginidae	XXXV.	*Sillago sihama*	The northern sandwhiting
		18.	Channidae	XXXVI.	*Channa striata*	Striped snakehead
				XXXVII.	*Channa pseudomarulius*	False giant murrel
		19.	Sparidae	XXXVIII.	*Acanthopagrus berda*	Goldsilk seabream
		20.	Sciaenidae	XXXIX.	*Johnius* spp.	Croaker
				XL.	*Otolithes* spp.	Tooth croaker
				XLI.	*Daysciaena albida*	Bengal corvina
		21.	Drepaneidae	XLII.	*Drepane punctata*	Spotted sicklefish
				XLIII.	*Monodactylus argenteus*	Silver moony
		22.	Siganidae	XLIV.	*Siganus vermiculatus*	Vermiculated spinefoot
		23.	Polynemidae	XLV.	*Eleutheronema tetradactylum*	Fourfin threadfin
		24.	Latidae	XLVI.	*Lates calcarifer*	Asian seabass
		25.	Osphronemidae	XLVII.	*Pseudosphromenus cupanus*	Spiketail paradisefish
		26.	Sphyraenidae	XLVIII.	*Sphyraena putnamae*	Sawtooth barracuda
		27.	Chaetodontidae	XLIX.	*Heniochus acuminatus*	Pennant coralfish

Order		Family		Scientific name		Common name
		28.	Haemulidae	L.	*Plectorhinchus gibbosus*	Harry hotlips
VI.	Beloniformes	29.	Belonidae	LI.	*Xenentodon cancila*	Freshwater garfish
		30.	Hemiramphidae	LII.	*Hyporhamphus xanthopterus*	Red- tipped halfbeak
		31.	Adrianichthyidae	LIII.	*Oryzias setnai*	Malabar ricefish
VII.	Siluriformes	32.	Bagridae	LIV.	*Mystus gulio*	Long whiskered catfish
		33.	Bagridae	LV.	*Mystus armatus*	Kerala mystus
		34.	Heteropneustidae	LVI.	*Heteropneustes fossilis*	Asian stinging catfish
		35.	Ariidae	LVII.	*Arius subrostratus*	Shovelnose sea catfish
VIII.	Athereniformes	36.	Atherinidae	LVIII.	*Atherinomorus* spp.	Silverside
IX.	Kurtiformes	37.	Apogonidae	LIX.	*Yarica hyalosoma*	Humpbacked cardinalfish
X.	Tetradontiformes	38.	Triacanthidae	LX.	*Triacanthus biaculeatus*	Short-nosed tripodfish
				LXI.	*Tetraodon fluviatilis*	Green pufferfish
XI.	Batrachoidiformes	39.	Batrachoididae	LXII.	*Colletteichthys dussumieri*	Flat toadfish
XII.	Cyprinodontiformes	40.	Aplochelidae	LXIII.	*Aplocheilus lineatus*	Striped panchax
				LXIV.	*Aplocheilus parvus*	Dwarf panchax
				LXV.	*Aplocheilus* spp.1	Panchax
				LXVI.	*Aplocheilus* spp.2	Panchax
XIII.	Cypriniformes	41.	Cyprinidae	LXVII.	*Systomus subnasutus*	Peninsular olivebarb
				LXVIII.	*Puntius mahecola*	Mahe barb
				LXIX.	*Puntius vittatus*	Greenstripe barb
		42.	Danionidae	LXX.	*Horadandia brittani*	Green carplet
				LXXI.	*Rasbora dandia*	Dandia rasbora
XIV.	Scorpaeniformes	43.	Platycephalidae	LXXII.	*Grammoplites scaber*	Rough flathead
XV.	Syngnathiformes	44.	Syngnathidae	LXXIII.	*Icthyocampus carce*	Indian freshwater pipefish
XVI.	Anguilliformes	45.	Anguillidae	LXXIV.	*Anguilla bengalensis*	Indian longfin eel
				LXXV.	*Anguilla bicolor*	Indonesian shortfin eel

ecological communities, the wetland should be considered internationally important (Secretariat, 2010). The study recorded vulnerable species like *Hyporhamphus xanthopterus* and Near Threatened species like *Anguilla bengalensis* and *Anguilla bicolor*. Similarly, according to Criterion 7 and 8, if a wetland supports a significant proportion of indigenous fish subspecies contributing to global biological diversity and if it is an important, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere it should be considered internationally important (Secretariat, 2010). The study reported Kerala endemics such as *Hyporhamphus xanthopterus* and *Puntius mahecola* and Western Ghats endemics such as *Mystus armatus*. As the aim of this work was to document the diversity of fishes, we did not attempt to study the abundance of the fishes. Anyhow, from the local fish catchment areas, we found Kattampally to host a good population of indigenous fish species like *Etroplus suratensis* and *Pseudetroplus maculatus*.

Moreover, 56% of the fish species recorded in Kattampally were either local or large-distance migrants. *Nematolosa nasus, Anadontostoma chacunda, Stolephorus commorsonnii, Brachirus orientalis*, *Ellochelon vaigiensis, Liza subviridis, Mugil cephalus, Terapon jarbua*, *Megalops cyprinoides, Thryssa malabarica, Leiognathus equulus, Secutor insidiator*, *Thryssa mystax, Lutjanus argentimaculatus* and *Lutjanus johnii* were some of the long-distance migratory species recorded during the study period. Thus, Kattampally is a critically important habitat for migratory species. Considering the fish diversity-related qualifying criteria, Kattampally wetlands should be designated as the next Ramsar site in the state.

The presence of exotic species such as *Clarias gariepinus* and *Oreochromis mossambicus* in this wetland observed during the study threw light into serious concerns on its effects on native fish faunal wealth. *Oreochromis mossambicus* is listed among the top 100 exotic species on the planet (Global invasive species database, 2013), and the instances of the dominance of this species over the native fish fauna in the aquatic water bodies of Kerala and subsequent replacement of the native cichlid, *Etroplus suratensis* have been reported in Veli Akkulam Lake, Kerala (Reji and Bijukumar, 2012). Parental care associated with continual spawning, attainment of maturity at an early age, female-biased sex ratio and hardiness to extreme environmental conditions have been identified as factors promoting the high recruitment of this African cichlid in Vembanad Lake, Kerala, India thereby

posing a severe threat to the survival of native cichlids in the Lake and adjoining rivers (Roshni and Renjithkumar, 2020). *Clarias gariepinus* is reported to be a ferocious and opportunistic predator (de Graff and Jansen, 1996) and their occurrence and associated negative impact on the native fish fauna of Kerala has long been reported (Gopi and Radhakrishnan, 2002; Kurup *et al.,* 2004). Rapid growth, high growth performance index, low fishing mortality and year-round recruitment significantly contribute to the successful invasion of *C. gariepinus* in Periyar Lake, Kerala, India and possibly throughout its invasive range (Roshini *et al.,* 2020).

Earlier noteworthy studies about the exploitation pattern and species wise quantification of fish faunal resources in estuaries and backwaters such as Vembanad Lake (Kurup *et al.,* 1995); Azhikode estuary (Harikrishnan *et al.,* 2011) and Ashtamudi estuary (Mohamed *et al.,* 2013) have recognised overfishing and illegal fishing practices as the key factors leading to the depletion of stock and the situation is not different for Kattampally wetlands. In Kattampally, over the years, local fisher folk have been protesting against the operations of the illegal nets such as the smaller meshed stake nets, a type of conical bag net fixed to stakes driven to the bottom, principally targeting shrimps that drift with water currents, in which the migratory fishes form either bycatches or discards. Though the usage of smaller meshed stake nets has been banned under the law (Unnithan *et al.,* 2005), several such stake nets are still operational in Kattampally wetlands.

During the late 1940's the huge demand for a bridge to connect both the banks of the estuary as well as to prevent salinity intrusion into the low-lying paddy fields resulted in the construction of a regulator cum bridge (Leneesh, 2011). The major regulator cum bridge along with numerous bunds created all across the wetlands for the sake of stopping saltwater intrusion has then and now turned out to be a great hindrance for the normal fish movement from the sea to the wetlands and vice versa. The occurrence level of migratory fish species utilising this pristine wetland to the tune of 56% makes this a matter of serious biodiversity concern and necessitates conducting scientific studies on species-specific larval and adult dispersal patterns of wetland-dependant fish species.

Encroachment and reclamation are observed to be the major prevailing threats affecting the diversity and sustainable use of the fish faunal resources of Kattampally wetlands. A drastic reduction of the Kaipad fields from an area of 2500 to 600 ha has been reported by Chandramohanan and Mohanan (2001). A proper scientific land-use change study in this regard is essential to understand the extent of natural wetland areas and the land accusations. Bringing back the indigenous agricultural practices as well as incorporating the salt-tolerant varieties of paddy will help in nourishing the ecosystem. In addition, the possibilities of reclaiming the existing lands for raising an additional crop of fish during the fallow period as suggested by Unnithan *et al.* (2005) to create alternate livelihood opportunities have to be explored. To ensure the tidal influx and outflow required for the migratory and brackishwater dependant fish species, regulators and the bunds build across the wetlands need to be kept open at least during the migratory periods. Strict and effective enforcement of the existing Kerala Inland Fisheries and Aquaculture Act 2010, Kerala Conservation of Paddy and Wetland Conservation Act, 2008 has to be ensured.

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