RESEARCH ARTICLE Indian Journal of Animal Research, Volume 60 Issue 2: 283-291 (February 2026)

An Annotated Checklist of Ichthyofaunal Diversity of the Potamon Zone of Thamirabarani River, South India

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10.18805/IJAR.B-4891

ABSTRACT

Background: Thamirabarani is a major east-flowing river originates from the Pothigai Hills of Southern Western Ghats (8°36′07.1"N 77°15′50.9"E) at an altitude of 2074 m with a catchment area of 5482 km^2 and meanders through a distance of 120 km (24 km in hilly terrain and 96 km in plains) in Tirunelveli and Tuticorin districts and drains into the Bay of Bengal. Present paper provides information on abundance, distribution, human utility, Trophic level, L_m and IUCN status of the Thamirabarani River.

Methods: The present study was conducted by monthly intervals on Ichythyofaunal diversity of the Potamon Zone of Thamirabarani River from November 2019 to October 2021, selecting seven sampling stations *viz* Cherenmahadevi, Vannarpettai, Murappanadu, Karungulam, Srivaikuntam, Eral and Authoor.

Result: In the present study, a total of 57 species comprising 11 orders, 19 families and 38 genera were documented from downstream stretch of Thamirabarani River, of which three fish species namely *Horadandia atukorali*; *Oreochromis mossambicus* and *Wallago attu* are under vulnerable category and three fish species namely are *Hypselobarbus dubius*; *Labeo fisheri* and *Dawkinsia tambraparniei* endangered listed in the International Union for Conservation of Nature red list. Among the 11 orders reported, the order Cypriniformes (52%) was observed to have the highest contribution to the Ichthyofaunal diversity and the family Cyprinidae (32%) was recorded the highest contribution to the finfish diversity. The trophic level community structure of recorded fish species revealed the dominance of mid-level carnivores (48%). The human utility of recorded finfishes was found to be the highest was observed as edible (72%) and IUCN status was the highest with least concern (72%).

Key words: Checklist, Ichthyofaunal diversity, Potamon zone, Thamirabarani river.

INTRODUCTION

The Thamirabarani River (Fig 1), which includes the sub-basins of Kodayar, Servalar, Gadana, Ramanadhi, Nambiar, Manimuthar, Pachaiyar, originates from the eastern slopes of the Western Ghats and has good evergreen forest cover in the upper parts (designated as Mundanthurai and Kalakkad Tiger Reserve). Unplanned development and sand mining over the period of year have destroyed several small rivers across the country (River bed Mining India 2021 overview: Destruction of Rivers, infrastructures, governance - SANDRP (South Asia Network on Dams, Rivers and People). Small rivers and tributaries help the Thamirabarani River system to maintain their flow throughout the year. The National Bureau of Fish Genetic Resources (NBFGR) situated at Lucknow concerned over the depleting freshwater fish biodiversity of Tamil Nadu and Kerala of Southern India and opined that more invasive species like the Pacu, African catfish, South American sucker mouth Armoured catfish, Mozambique tilapia and Genetically Improved Farmed Tilapia (GIFT) and *Pangassius* sp have made deep inroads into the country's fish market. As a result, the indigenous varieties like Kendaimeen (Carp), Aiyirameen (Spiny loaches) and Veralmeen (Murrel) are affected due invasion and face habitat destruction. For instance, the distribution range of *D. tambraparniei* is restricted to less than 100 km^2. Because of these threats and restricted distribution, the above mentioned species was assessed as endangered in the IUCN red list (Kannan *et al.,* 2014). Malarvizhi and Ravikumar (2021) reported that the study

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How to cite this article: Durairaja, R., Jawahar, P., Jayakumar, N., Das, S.K., Padmavathy, P., Santhakumar, R., Suresh, E., Kingston, S.D. and Venkataramani, V.K. (2026). An Annotated Checklist of Ichthyofaunal Diversity of the Potamon Zone of Thamirabarani River, South India. *Indian Journal of Animal Research*. **60(2):** 283-291. doi: 10.18805/IJAR.B-4891.

Submitted: 17-02-2022 **Accepted:** 07-07-2022 **Online:** 29-07-2022

for the period of 39 years (1980 - 2018) that the trend patterns as well as temporal and spatial variability of rainfall and its river discharge clearly shows that the Thamirabarani River basin is under climatic impacts over the period of time. There are two major water polluting industries situated near to Thamirabarani River namely M/s. Madura Coats Private Limited, Aladiyur, Ambasamudram Taluk, Tirunelveli District and M/s. Sun Paper Mill Limited, North Ariyanayagipuram, Cheranmadevi Taluk, Tirunelveli District. In addition, the physico chemical characteristics of river water in the study area suggested that Thamirabarani River is contaminated by various effluents (Sheebha Malar *et al.,* 2018) and categorized as polluted river stretch in Priority-V (Pappankulam to Arumuganeri Stretch) and gets contaminated due to discharge of untreated effluent and sewage dumping (https://tnpcb.gov.in/pdf-2019/PrsThamira barani24919.pdf). It is worthwhile to mention freshwater fishes are a poorly studied group regarding the distribution, stock assessment and threats. There are few detail studies available from a few pockets in the major riverine system of India. Further, the river is being worshiped as a cultural heritage, livelihood for inland fishers, recreation, irrigation and bathing purpose. This river receives both northeast and south west monsoon and often flooded during northeast monsoon. The present status of fish diversity is the key information to sound policy development, good decision making and conservation and management. Hence, an attempt has been made to update the status of finfish diversity of the river.



Fig 1: Thamirabarani river.

MATERIALS AND METHODS

A total of seven sampling stations (Fig 2) namely, Cherenmahadevi, Vannarpettai, Murappanadu, Karungulam, Srivaikuntam, Eral and Authoor with its GPS readings (Table 1) were selected along the downstream stretch of the river based on abundance of fish species and fishing activities. Sampling was carried out monthly from November 2019 to October 2021. The work was carried out in Fisheries College and Research Institute, Thoothukudi. Fish specimens were collected from the wild with the help of the local fishers using various fishing gears such as various mesh sizes of gill net, seine net, cast net, fish traps and pole and line. The specimens were brought to the laboratory, the samples were washed thoroughly and images were captured (Fig 3). Subsequently, the samples were identified up to species level using classical taxonomical methods such as morphometric characters, meristic counts and descriptive characters. Identification of fish species was confirmed using the guides developed by Talwar and Jhingran (1991), Jayaram (1994), Jhingran (1999), Menon (1999) and updated with FishBase (Froese and Pauly, 2020).

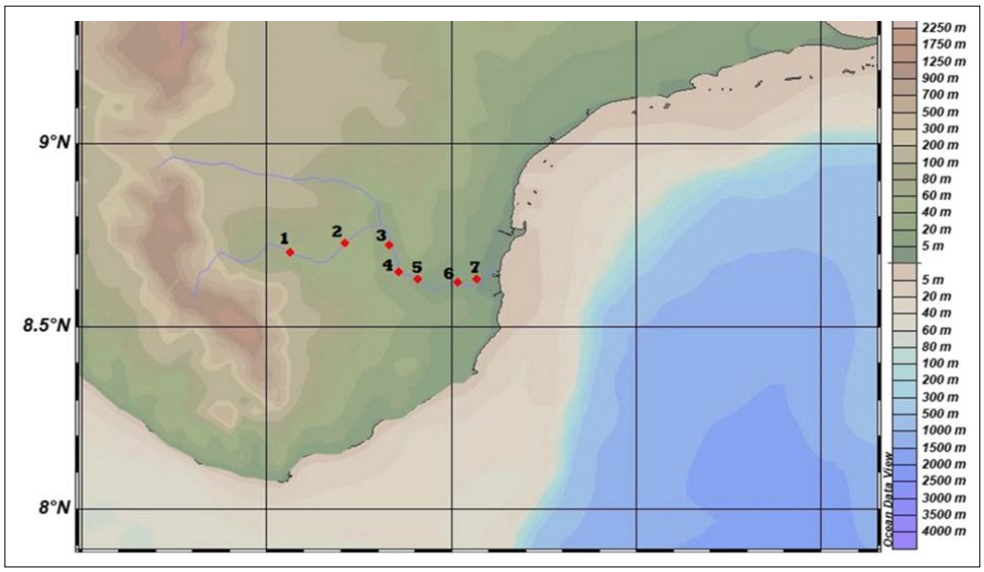

Fig 2: Map showing study area along the potamon zone of Thamirabarani river in Tirunelveli and Thoothukudi districts. Sampling stations - 1. Cheranmahadevi, 2. Vannarpettai, 3. Murappanadu 4. Karungulam, 5. Srivaikuntam, 6. Eral and 7. Authoor.

RESULTS AND DISCUSSION

The present study was documented a total of 57 species, comprising 11 orders, 19 families and 38 genera from the potamon zone of lower stretch of Thamirabarani River (Tabel 2). Among the recorded species of finfish during the present study, three fish species namely *Horadandia atukorali*; *Oreochromis mossambicus* and *Wallago attu* are categorized under vulnerable status and three fish species namely are *Hypselobarbus dubius*; *Labeo fisheri* and *Dawkinsia tambraparniei* are endangered as per listed in the International Union for Conservation of Nature red list. Among the 11 orders reported, the order Cypriniformes (52%) was observed to have the highest contribution to the Ichthyofaunal diversity followed by Anabantiformes (12%) and Cichliformes (9%) (Fig 4). Of 19 family reported, the family Cyprinidae (32%) recorded the highest contribution to the finfish diversity followed by Danionidae (16%) and Cichlidae (8%) (Fig 5). The trophic level community structure of fish species revealed the dominance of mid-level carnivores (48%) followed by herbivore (23%), omnivore (15%), carnivores (10%) and apex predators (2%) (Christensen and Pauly (1992)). The human utility of recorded finfish was found to be in the order of edible (72%), ornament (26%) and non-edible (2%). The IUCN status of recorded species was classified mostly as Least Concern (72%), Vulnerable (5%), Not Evaluated (9%), Near Threatened (5%), Endangered (5%) and Data Deficient (4%) (Fig 6).

Presently, a substantial difference was observed in the number of Ichthyofaunal diversity. Kannan *et al.* (2014) reported a low diversity among investigated populations of *D. tambraparniei* using mitochondrial DNA analysis and the only local population from the Thalayanai Stream exhibits

Table 1: Geographical coordinates of the sampling station of river Thamirabarani.

GPS reading	Elevation	Direction	Location	Distance in km
8°42′01.0″N 77°33′56.7″E	207ft	W	Cheranmahadevi	0
8°43′36.1″N 77°42′47.5″E	133 ft	W	Vannarpettai	16
8°43′020.9″N 77°49′59.0″E	2 ft	W	Murappanadu	18
8°38′55.3″N 77°51′24.7"E	59 ft	W	Karungulam	9
8°37′44.5″N 77°54′35.9″E	79 ft	SW	Srivaikuntam	18
8°37′10.0″N 78°01′04.6″E	32 ft	W	Eral	6
8°37′41.9″N 78°04′10.6″E	5 ft	W	Authoor	8
				75 km



Fig 3: Fish samples collected from selected sampling station using cast net.

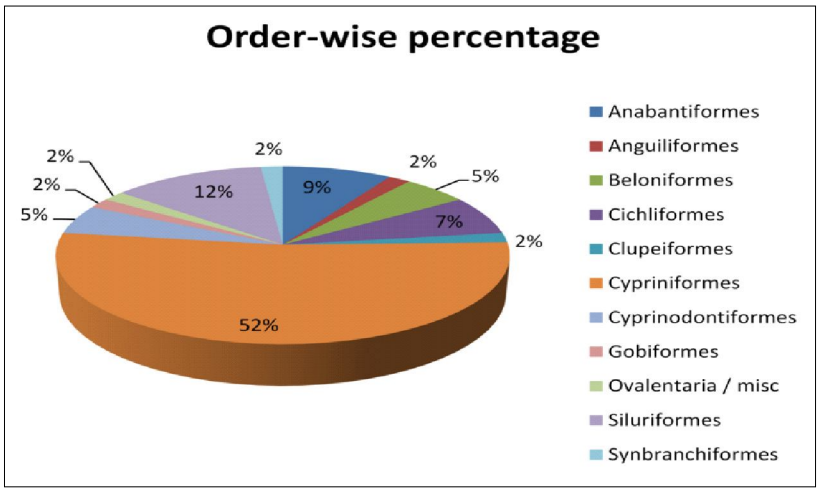

Fig 4: Order - wise finfish composition.

Table 2: Checklist of Ichthyofaunal diversity in the Potamon zone of the Thamirabarani river.

Name of the fish species	Common name	*L_m (cm)	*Trophic level	IUCN status	Human utility	Sampling stations*
			Order: Anabantiformes			
			Family: Channidae			
Channa gachua (Hamilton, 1822)	Dwarf snakehead	-	3.8±0.62 se	LC	Edible	1;5
C. pseudomarulius (Günther, 1861)	Great snakehead	-	3.2±0.6 se	LC	Edible	1;5;7
C. marulius (Hamilton, 1822)	Snakehead fish	-	4.5±0.80 se	NE	Edible	1;2
C. punctata (Bloch, 1793)	Spotted snakehead	-	3.8±0.70 se	LC	Edible	1;5;7
C. striata (Bloch, 1793)	Striped snakehead	18.0	3.6±0.47 se	LC	Edible	1;5;7
			Order: Anguilliformes			
			Family: Anguillidae			
Anguilla bengalensis (Gray, 1831)	Indian Mottle eel	-	3.8±0.7 se	NT	Edible	1;2;5
			Order: Beloniformes			
			Family: Belonidae			
Xenentodoncancila (Hamilton, 1822)	Fresh water gar fish	-	3.9±0.62 se	LC	Edible	1;6
			Order: Beloniformes			
			Family: Hemiramphidae			
Hyporhamphus quoyi (Valenciennes, 1847)	Quoy's farfish	-	3.0±0.0 se	NE	Edible	1;4;6
			Order: Beloniformes			
			Family: Adrianichthyidae			
Oryzias melastigma (McClelland, 1839)	--	-	3.3±0.4 se	LC	Ornamental	6
			Order: Cichliformes			
			Family: Cichlidae			
Etroplus suratensis (Bloch, 1790)	Pearl spot	15.0	2.9±0.26 se	LC	Edible	2;5;6;7
Oreochromis mossambicus (Peters, 1852)	Mozambique tilapia	15.4	2.2 ±0.0 se	VN	Edible	1;2;3;4;5;6;7
O. niloticus (Linnaeus, 1758)	Nile tilapia	18.6	2.0 ±0.0 se	LC	Edible	1;2;3;4;5;6;7
Pseudetroplus maculatus (Bloch, 1795)	Orange chromide	-	2.7 ±0.1 se	LC	Edible	1;2;6
			Order: Clupeiformes			
			Family: Clupeidae			
Ehirava fluviatilis (Deraniyagala, 1929)	Malabar sprat	-	3.1±0.26 se	DD	Edible	2;4;6
			Order: Cypriniformes			
			Family: Cobitidae			
Lepidocephalichthys thermalis (Valenciennes, 1846)	Common spiny loach	-	2.9±0.4 se	LC	Edible	1;2;5
			Order: Cypriniformes			
			Family: Cyprinidae			
Bangana dero	Labeospecies	-	2.0±0.00 se	LC	Edible	1;2

Table 2: Continue...

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(Hamilton, 1822)						
Gibelion catla (Hamilton, 1822)	Catla	-	2.8±0.22 se	LC	Edible	1;2;5;7
Cirrhinus mrigala (Hamilton, 1822)	Mrigal	-	2.3±0.2 se	LC	Edible	1;2;5;6;7
Ctenopharyngodon idella (Valenciennes, 1844)	Grass carp	-	2.0±0.00 se	LC	Edible	1;2;5;7
Cyprinus carpio (linnaeus, 1758)	Amur common carp	34.9	3.1±0.0 se	LC	Edible	1;2;5;6;7
Hypophthalmichthys molitrix (Valenciennes, 1844)	Silver carp	51.7	2.0±0.00 se	LC	Edible	1;2;5;7
Hypselobarbus dubius (Day, 1867)	Nilgiris barb	-	2.7±0.30 se	EN	Edible	1;2
Hypselobarbus tamiraparaniei (Arunachalam, Chinnaraja, Chandran and Mayden, 2014)	--	-	-	NE	Edible	1;2
Labeo calbasu (Hamilton, 1822)	Kalabanse/orange fin labeo	32.8	2.0±0.00 se	LC	Edible	1;2;3;5;6;7
L. dyocheilus (McClelland, 1839)	-	-	-	LC	Edible	3;6
L. fimbriatus (Bloch, 1795)	Fringe-lipped peninsula carp	-	2.0±0.00 se	LC	Edible	1;2;5;7
L. fisheri Jordan and Starks, 1917	Green labeo	-	2.0±0.00 se	EN	Edible	1;2
L. rohita (Hamilton, 1822)	Rohu	58.0	2.2±0.12 se	LC	Edible	1;2;3;4;5;6;7
L. pangusia (Hamilton, 1822)	Rohu	-	2.0±0.00 se	NT	Edible	
L. boggut (Sykes, 1839)	Rohu	-	-	LC	Edible	1;2
L. kontius (Jerdon, 1849)	Rohu	-	-	LC	Edible	1;2;5
Osteochilus longidorsalis (Pethiyagoda and Kottelat, 1994)	Hiffin carp	-	-	LC	Edible	1;2
Puntius amphibius (Valenciennes, 1842)	Scarlet banded barb	-	2.0±0.00 se	DD	Ornamental	1;2;3;5;6
Dawkinsia filamentosa (Valenciennes, 1844)	Black spot barb	-	2.6±0.0 se	LC	Ornamental	1;2;3;4;5;6;7
Systomus sarana (Hamilton, 1822)	Olive barb	-	2.9±0.2 se	LC	Edible	1;2;3;4;5;6;7
P. sophore (Hamilton, 1822)	Pool barb	5.0	2.6±0.1 se	LC	Ornamental	2;4;5
D. tambraparniei (Silas, 1954)	Tamiraparani barb	-	2.0±0.00 se	EN	Ornamental	2;6
P. vittatus Day, 1865	Green stripe barb	-	2.0±0.00 se	LC	Ornamental	1
			Order: Cypriniformes			
			Family: Danionidae			
Amblypharyngodon mola (Hamilton, 1822)	Indian carplet	-	3.3±0.4 se	LC	Ornamental	1;2
Devario malabaricus (Jerdon, 1839)	Malabar danio	-	3.2±0.2 se	LC	Ornamental	1;2;4;6
Esomus danrica (Hamilton, 1822)	Flying barb	-	2.4±0.1 se	LC	Ornamental	1;6

Table 2: Continue...

Table 2: Continue...

Horadandia atukorali Deraniyagala, 1943	Green carplet	-	3.2±0.40 se	VN	Ornament	6
Rasbora daniconius (Hamilton, 1822)	Slender rasbora	-	3.1±0.1 se	LC	Ornamental	1
Salmostoma bacaila (Hamilton, 1822)	Large razor belly	-	3.2±0.40 se	LC	Edible	3;4;5;6
			Order: Cyprinodontiformes			
			Family: Aplocheilidae			
Aplocheilus blockii Arnold, 1911	Green panchax	-	3.8±0.60 se	LC	Ornamental	6
A. lineatus (Valenciennes, 1846)	Striped pnachax	-	3.8±0.5 se	LC	Ornamental	6
A. panchax (Hamilton, 1822)	Killifish	-	3.2±0.40 se	LC	Ornamental	6
			Order: Gobiformes			
			Family: Gobiidae			
Glossogobius giuris (Hamilton, 1822)	Tank goby	-	3.7±0.2 se	LC	Edible	1;5;7
			Order: Ovalentaria/misc			
			Family: Ambassidae			
Chanda nama Hamilton, 1822	Elongate glassy perchlet	-	3.6±0.54 se	LC	Ornamental	2;3;4;6
			Order: Siluriformes			
			Family: Bagridae			
Mystus gulio (Hamilton, 1822)	Long whiskers catfish	-	4.0±0.50 se	LC	Edible	1;2;5;7
M. vittatus (Bloch, 1794)	Striped dwarf catfish	9.0	3.1±0.1 se	LC	Edible	1;2;5;7
			Order: Siluriformes			
			Family: Clariidae			
Clarias gariepinus (Burchell, 1822)	North African catfish	30.8	3.8±0.4 se	LC	Edible	1;2;3;4;5;6;7
			Order: Siluriformes			
			Family: Heteropneustidae			
Heteropneustes fossilis (Bloch, 1794)	Stinging catfish	-	3.6±0.3 se	LC	Edible	1;2;5
			Order: Siluriformes			
			Family: Loricariidae			
Pterygoplichthys pardalis (Castelnau, 1855)	Amazon sailfin catfish	-	2.0±0.00 se	NE	Non-edible	2;5;7
			Order: Siluriformes			
			Family: Siluridae			
Wallago attu (Bloch and Schneider, 1801)	Mulley	-	3.7±0.56 se	VN	Edible	1;2;5;7
Ompok bimaculatus (Bloch, 1794)	Butter catfish	22.3	3.9±0.4 se	NT	Edible	1;2;5;7
			Order: Synbranchiformes			
			Family: Mastacembelidae			
Mastacembelus armatus (Lacepède, 1800)	Zigzag eel / Spiny eel	-	2.8±0.27 se	LC	Edible	1;2;5

*Sampling station 1: Cheranmahadevi; 2: Vannarpettai; 3: Murappunadu; 4: Karungulam; 5: Srivaikuntam; 6: Eral; 7: Authoor; LC: Least concern; NE: Not Evaluated; NT: Near Threatened; VN: Vulnerable; DD: Data Deficient; EN: Endangered.
Source: *www.fishbase.org.

certain divergence. By spatial study, Martin (2000) has recorded a total of 36 fish species in Thamirabarani River. The highest diversity of species (18 nos) was observed at Vallanadu site with least human disturbance. The lowest diversity was recorded at Vickramasingapuram site, where textile-mill effluent was discharged into the river. In this study by a field survey, 57 fish species were recorded in the potamon zone of the Thamirabarani River basin of Tirunelveli and Thoothukudi districts. Johnson (2009) documented 73 species of fishes from fifteen study streams in Western Ghats, of which 48 species were recorded from streams of Kerala, 29 species from Tamil Nadu and 33 species from Karnataka. In addition, cyprinids members showed domination with 45.5 to 87.5%. Similar observations were made by Johnson and Arunachalam (2009) in southern Western Ghats. Similarly, in this present study, among 19 families and 11 orders reported, the order Cypriniformes (52%) and family Cyprinidae (32%) were observed to have the highest contribution to the Ichthyofaunal diversity. Beevi and Ramachandran (2009) reported 69 species were recorded in Ernakulam District, Kerala among them 17 were abundant species, 13 common species, 31 rare species and nine very rare species. Among the recorded fish species during this study, the IUCN status was observed as Least Concern (72%), Vulnerable (5%), Not Evaluated (9%), Nearly Threatened (5%), Endangered (5%) and Data Deficient (4%).

Hossain *et al*. (2012) found in Meghna river estuary of Bangladesh, 53 fish species of which observed *Oxyurichthys microlepis*, *Hemiarius sona*, *Arius thalassinus*,

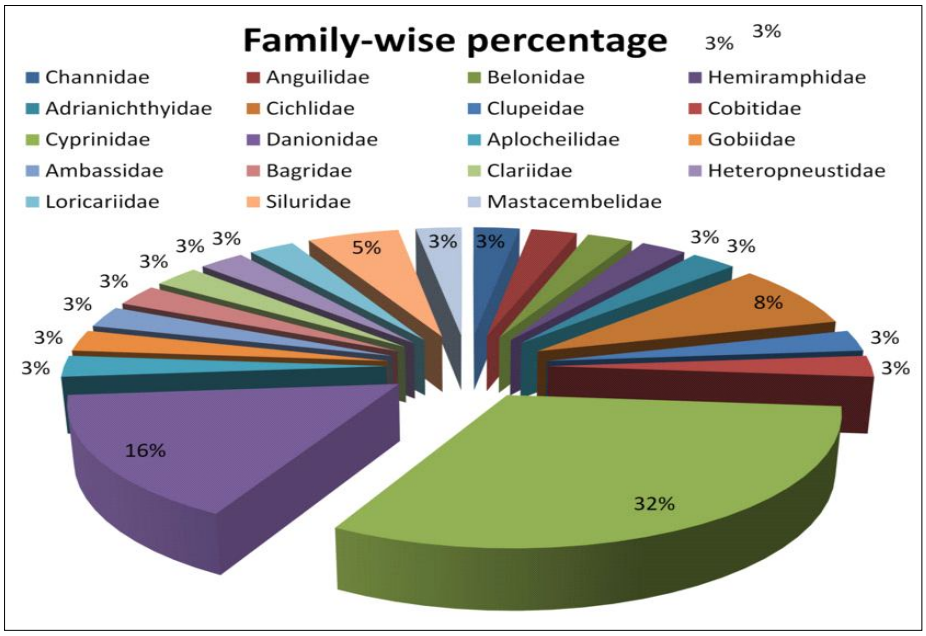

Fig 5: Family-wise representation of Ichthyofaunal diversity of Thamirabarani river.

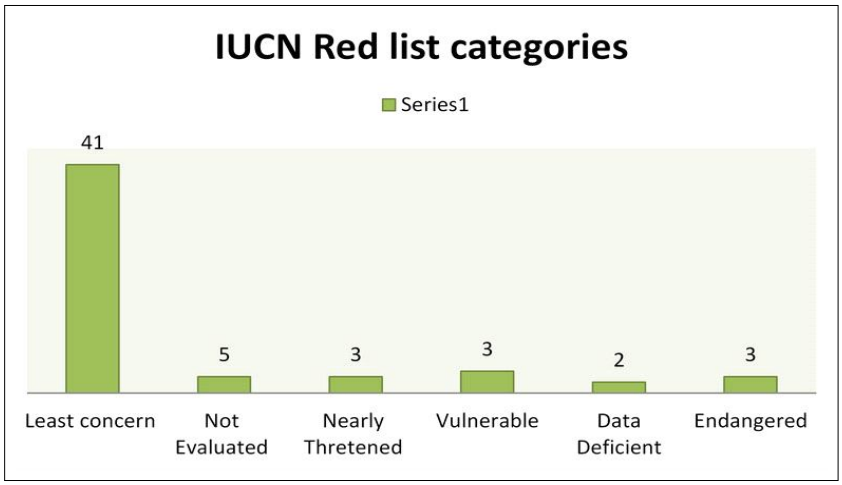

Fig 6: IUCN status of Ichtyofaunal diversity of Thamirabarani river.

Batrachocephalus mino and *Arius caelatus* and the major contributory species (> 6%) for both spatio - temporal scales. As far as riverine fisheries in India, Thamirabarani River is one of the oldest river systems in India and a perennial source in the southern part of Tamil Nadu and present study revealed a rich biodiversity which needs proper management and conservation of precious natural river ecosystem. Mogalekar and Jawahar (2015) reported that freshwater bodies of Tamil Nadu are endowed with diverse ornamental fish fauna comprising of 156 species (including three subspecies) belonging to 68 genera, 27 families and eight orders. Of these, l31 species are endemic to Indian sub-continent, 14 species are endemic to Tamil Nadu and 11are exotic species. In the present investigation three fish species namely *Horadandia atukorali*; *Oreochromis mossambicus* and *Wallago attu* are vulnerable and three fish species namely are *Hypselobarbus dubius*; *Labeo fisheri* and *Dawkinsia tambraparniei* are endangered in accordance to IUCN red list. Among the recorded fish species for human utility, this study reports fifteen ornamental fish species (26%). Murugan *et al*. (2015) recorded a total of 30 fish species in Periyakulam Riverine Wetland, Kanyakumari district belonging to 13 family with Cyprinidae having a numerical strength of 13 species (43%), followed by Aplocheilidae with three species (10%). The fish species, *Dawkinsia filamentosus* and *Dawkinsia rohani* were found highest distribution percentage 13.23% and 11.14% respectively. Four species, *viz. Devario malabaricus*, *Rasbora daniconius*, *Puntius amphibius* and *Puntius vittatus* were found to be in between 5-10%. Other twenty four species were found below 5%, of which six species were found less than 1%. The potamon zone is a part of the lower stretch of the river where the rich fish diversity showed 57 species. Tejas *et al*. (2015) recorded 23 species belonging to 7 families and 19 genera were reported. Of which 9 species are threatened and 20 species are endemic to Western Ghats and presently four species are vulnerable (5%) and three species are endangered (5%). In the context of massive loss of biodiversity, conservation of freshwater fauna has received increasing attention in recent times (Mishra *et al*. (2017). According to Water resources information system of Tamil Nadu (India - WRIS), the major rivers in Tamil Nadu are Cauvery, Palar, Thenpennai, Vaigai and Thamirabarani. Of these Thamirabarani originates and drains with in Tamil Nadu and rich in fish diversity and needs attention towards conservation. Mogalekar and Canciyal (2018) reported that Tamil Nadu has rich freshwater fish genetic resources constituting about 24.30% to the total freshwater fish diversity of India, about 43.11% to the endemic freshwater fishes of India and 40.09% to the total endemic fish diversity of Western Ghats of India. This study reports *Dawkinsia tambraparniei* is endemic to Thamirabarani River. Mercy and NavinaPriskilla (2020) recorded 10 species during 2018 in Thamirabarani River belonging to 7 families and also reported more fish species in Pottal and Vannarpettai sites. However, in Melapalayam and Cheranmahadevi less number of fish species was observed due to pollution. Kannan and Johnson (2020) reported fifty species of fishes belonging to 10 orders, 15 families and 32 genera in streams and rivers of Kalakad-Mundanthurai Tiger Reserve (KMTR), Tamil Nadu.

CONCLUSION

On the basis of our present research findings and other similar studies of recent times, it can be concluded that, Thamirabarani River has been losing its biological productivity under the influence of natural as well as human interference and hence it is recommended to invite more attention towards conservation and management of Ichthyofaunal diversity in the downstream of Thamirabarani River. At global scale, the freshwater fish diversity is under major threat due to various reasons particularly anthropogenic activity resulted in freshwater fish diversity is getting reduced at an alarming rate. It is evident that similar studies revealed the Ichthyofaunal diversity in Thamirabarani River with 36 species during the year 2000 (Martin *et al.* 2000) and 10 species recorded in Thamirabarani River during 2020 (Mercy and Navina Priskilla 2020). Fifty species were recorded during 2020 in streams and rivers of Kalakad-Mundanthurai Tiger Reserve (Kannan and Johnson 2020). Present study documented 57 species, which is the highest were recorded in the potamon zone (Lower stretch of the river, its flow rate is very low) of a perennial Thamirabarani River. Hence, intensive research would be needed in fish stock assessment and suitable management plan is of paramount importance for conservation of freshwater fish biodiversity and its ecosystem.

Conflict of interest

All authors declare that they have no conflict of interest.

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