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Ichthyofaunal diversity of Walayar Lake in Palakkad District, Kerala, South India

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Abstract
Fish diversity plays a crucial role in maintaining the stability and functioning of lake ecosystems by sustaining balanced food webs and regulating trophic interactions, thereby enhancing ecosystem resilience. A study was conducted for a period of three year (January 2018 to December 2020) and the fish species collected a total of 19 species of fishes belong to 18 genera under 12 different families were collected. Among the various families Cyprinidae recorded highest species diversity (5 species), followed by Cichlidae (3 species), Channidae (2 species) and other families were represented by a single species. As per the present study, the Lake is found good potential with variety of freshwater fish fauna.

Keywords: Freshwater fish, Walayar Lake, diversity, IUCN status, aquatic ecosystem

Introduction

Biodiversity is a key factor in ensuring the stability of the ecosystem and protecting the quality of the environment overall as it is the measurement of intrinsic value of each species on the planet [1]. Despite the fact that biodiversity is one of the most important natural resources, it is usually under-valued despite the fact that it is important in maintaining ecological balance and environmental health on the earth [2].

The diversity of the fishes in aquatic environments in terms of species and structure is known as ichthyofaunal and is crucial to the operation of the ecosystem. Fish are considered one of the most studied aquatic organisms and one of the biggest biological resources that have been taken out of the natural waters in terms of their utilization. They are ecologically very adaptable with impressive distribution in both freshwater and oceanic systems [3]. Fishery has more than fifty percent of all known vertebrate taxa and more than 27,977 of the 54,711 known living vertebrates are fish. It is estimated that the diversity of fish is various in the world, and it might be about 28,900 and might go up to almost 32,500 species with further taxonomic discovery of fish [4].

A large part of this diversity is only supported by freshwater ecosystems, where 18,000 species of fishes out of 207 families and 2513 genera have been recorded [5, 6]. Fish are very important in economy of most parts of the world as they are a regular and significant element of human diets across the world. Not only the species richness, but also ecological relationships with the trophic structure and physical nature of water body are manifested in the diversity of fish in lakes [7].

One out of every four species of fisheries is freshwater fishes and they are generally known to be sensitive to the health of aquatic ecosystems. Higher trophic levels mean that they are very sensitive to changes in the quality of habitat, the water chemistry, and food supply. Nutritionally, fish have long been playing a crucial role in human diet as sources of high-quality protein and other necessary nutrients. Fishes are also important in cycling nutrients, transfer of energy and community structure of ecosystems in aquatic environments ecologically [8]. Some species are also keystone taxa, which have an over-proportional role in the activity of the ecosystem, by controlling the abundance and distribution of other organisms. Consequently, the fish communities are usually regarded as the important elements of the environmental evaluation and control strategies [9].

The combination of biotic and abiotic processes leads to environmental degradation of aquatic environments and therefore, it is hard to measure the overall effects. The anthropogenic impacts that are involved in ecosystem degradation include release of domestic, agricultural and industrial wastes; enrichment of nutrients that results in eutrophication; acidification; erosion and sedimentation caused by land use changes; alteration of stream channels; draining of wetlands; construction of dams and water diversion; overexploitation of aquatic life; and introduction of non-native species. The measurement of ecological integrity and ecosystem health is an effective method of determining the overall impact of these stressors on water systems [10].

Materials and Methods

"Fish sample was collected from January 2018 to December 2020 from Walayar lake with the help of local fishermen using different type of nets namely gill nets, cast nets, and dragnets. Fishes brought to laboratory were preserved in 10% formalin solution in separate specimen jar according to the size of species. Small fishes were directly placed in the 10% formalin solution; while large fishes were given an incision in their abdomen. The fishes were labeled giving serial numbers and the local name of fish used in this region was used for identification. Fishes were identified up to the species level, with the help of standard keys given by Day [11-13]".

Table 1: Fish diversity in Walayar Lake

S. No	Name of fish species	Common name	Use	%	IUCN Stutes
I	Family-Anabantidae				
1	*Anabas testudineus* (Bloch, 1792)	Climbing Perch	Food Fish	3	LC
II	Family-Aplocheilidae				
2	Aplocheilus chrysostigmus	Tiger Panchax or Malabar killie	Pest	4	LC
III	Family-Cyprinidae				
3	*Gibelion catla* (Hamilton, 1822)	Catla	Food Fish	23	LC
4	*Cirrhinus cirrhosus* (Bloch, 1795)	Mrigal carp	Food Fish	17	VU
5	*Devarioa equipinnatus* (McClelland, 1839)	Giant Danio	Harmless	6	LC
6	*Systomus sarana* (Hamilton,1822)	Peninsular Olive Barb	Harmless	8	LC
7	*Labeo rohita* (Hamilton, 1822)	Roholabeo	Food Fish	18	LC
IV	Family- Cichlidae				
8	*Etroplus suratensis* (Bloch, 1790)	Pearl Spot	Harmless	6	LC
9	*Oreochro mismossambicus* (Peters, 1852)	Tilapia (Mozambique tilapia)	Pest	4	VU
10	*Pseudetroplus maculatus* (Bloch, 1795)	Orange chromide	Harmless	3	LC
V	Family-Channidae				
11	*Channa gachua* (F. Hamilton, 1822)	Dwarf snakehead	Food	3	LC
12	*Channa striatus* (Bloch, 1793)	Murrel or Striped snakehead	Pest	5	LC
VI	Family-Carangidae				
13	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Malabar Trevally	Pest	3	LC
VII	Family-Clariidae				
14	*Clarias brachysoma* (Günther,1864)	Walking Catfish	Pest	2	NT
VIII	Family-Bagridae				
15	*Mystus gulio* (Hamilton, 1822)	Long whiskered Catfish	Food Fish	2	LC
IX	Family-Gobiidae				
16	*Glossogobius giuris* (Hamilton, 1822)	Tank goby	Food Fish	4	LC
X	Family-Heteropneustidae				
17	*Heteropneustes fossilis* (Bloch, 1794)	Stinging Catfish	Threat	3	LC
XI	Family- Mastacembelidae				
18	*Mastacembelus favus* (Hora, 1924)	Tire track eel	Food Fish	6	LC
XII	Family-Siluridae				
19	*Wallago attu* (Bloch & Schneider, 1801)	Boal (Wallago)	Threat	7	VU

DD-Data Deficient; NT-Near Threatened; LC-Least Concern; VU-Vulnerable; NE-Not Evaluated

Fig 1: Fishing activity in Walayar Lake

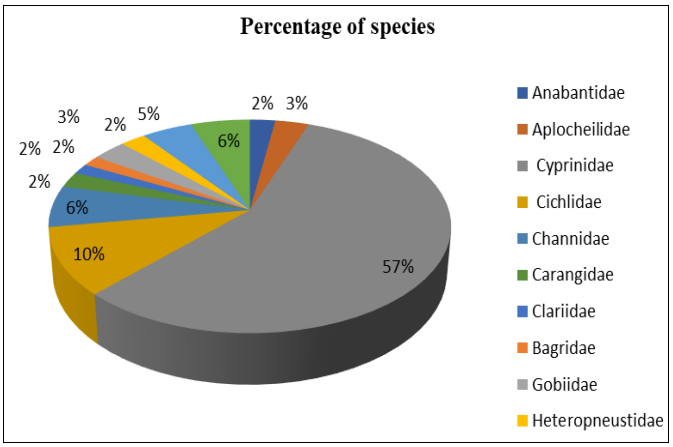

Fig 2: Fish diversity of Walayar Lake

Results

To record the fish biodiversity, a study was conducted for a period of three year and the fish species collected in the period of study are presented in table 1 and Figure 2. A total of 19 species of fishes belong to 18 genera under 12 different families were collected. Among the various families Cyprinidae recorded highest species diversity (5 species), followed by Cichlidae (3 species), Channidae (2 species) and other families were represented by a single species. They are Anabantidae, Aplocheilidae, Carangidae, Clariidae, Bagridae, Gobiidae, Heteropneustidae, Mastacembelidae and Siluridae.

In terms of percentage, Cyprinidae represented 72%, Cichlidae with 13%, Channidae with 8%, Siluridae with 7%, Mastacembelidae with 6%, Gobiidae with 4%, Aplocheilidae with 4%, Heteropneustidae with Carangidae, Anabantidae represent with 3 %, while Clariidae and Bagridae were represented by 2%. A species wise camparison reveals that Cyprinidae reported to have five species such as *Gibelioncatla, Cirrhinus cirrhosus, Devario aequipinnatus, Systomus sarana* and *Labeo rohita.* Among Cichlidae there are three species reported of these the most dominant species is *Clarias brachysoma*.

Discussion

"In the present study, 19 species of fishes belong to 12 different families were recorded in Walayar lake. Among the various families Cyprinidae recorded highest species diversity with 5 species, followed by Cichlidae with 3 species, Channidae with 2 species. The remaining 9 families, Anabantidae, Aplocheilidae, Carangidae, Clariidae, Bagridae, Gobiidae, Heteropneustidae, Mastacembelidae and Siluridae are represented by a single species each. A Similar study at Kuttanad River of Kerala showed rich fish biodiversity where 62 fish species belong to 17 families were reported [14]".

Seethalal *et al*., [15] recorded "a total of 22 species belonging to 17 families and 10 orders from the Vattakkayal, a part of Ashtamudi lake, Kollam district, Kerala state. Hiware and Pawer [16] recorded 43 fish species from Nathsagardam, Pathan in Aurangadbad district. Regi *et al.*, [17] had observed 35 species of freshwater fish species belong to 9 orders, 26 families and 30 genera from Velli Akkulam lake, Thiruvananthapuram district, Kerala. Reenamole [18] recorded 69 species under 49 genera comprising 30 families belonging to 13 Orders in Vellayani Kreshwater Lake, Kerala state. In a study at river cauvery from grand anaicut recorded 24 species of 18 genera [19]".

Muzamil Bashir *et al.* [20] studied "the fish diversity and reported the occurrence of 15 species belonging to 4 orders from Anchar Lake, Kashmir. A rich diversity of 80 species of fish under 9 orders and 24 families were reported in Padma River, Northwestern Bangladesh [21]. Fish diversity of in a lake at Kolhapur district, Maharashtra, India was made by Sheetal and Sathe [22]. They reported 28 species belong to 3 orders and 17 genera".

Azad and Shukla [23] "reported 23 fish species belonging to 16 different genera under 10 families in 6 orders from Narmada River of Jabalpur region Madya Pradesh. Vijayakumar *et al.*, [24] in Kabina river reported that the occurrence of 13 fish species belonging to 5 orders. Rumysa *et al.*, [25] observed 16 fish species belonging to 3 orders and 5 families in Wular Lake (rural lake) in the north-west of Kashmir. A study at Anjanapura reservoir in Shimoga district of Karnataka showed a total of 25 fish species belonging to 4 orders, 9 families and 18 genera [26]".

The fish biodiversity of Karamana river of Kerala was reported with a 40 species of fishes belong to 17 families [27]. Diversity of 69 species of fishes belonging to 49 genera, 24 families and 11 orders were recorded from Lake Sone in Assam, India [28]. Thirty-four fish species belonging to 15 families and 26 genera were collected from Devaha, Pilibhit district, Uttar Pradesh, India [29]. Govinda Rao *et al* [30] reported 19 species of fish from 5 orders, 10 families and 13 genera recorded Krishna River at Prakasam Barrage, Vijayawada (Krishna district), Andhra Pradesh, India. Tripathi *et al*, [31] reported 23 fish species which belong to 6 orders, 11 families, 15 genera at Seetadawar Lake of District Shravasti, Uttar Pradesh, India. Shukla *et al*, [32] were recorded 27 fish species under, 13 genera, 5 order and 9 families at Chittaura Jheel of District Bahraich, Uttar Pradesh State, India. An investigation at Varapuzha Wetlands of Vembanad Lake, Kerala, India, reported a total of 61 species belonging to 13 orders and 34 families [33]. Bharati *et al.* [34] revealed the occurrence of 55 fish species belonging to 39 genera, 21 families and 8 orders in Rudrasagar Lake, Tripura, India.

Ichthyofaunal diversity of Bhagar oxbow Lake, in Dumraon, District, Buxar was reported. In this study 44 freshwater fish species were collected. They belong to 30 genera, 16 families and 7 orders [35]. A total of 21 species of freshwater fishes grouped into 6 orders, 11 families and 17 genera were recorded from Sagar Lake, Madhya Pradesh, India [36]. Occurrence of 15 fish species belonging to 3 orders, 4 families and 12 genera in Sanjul Lake, Taluka Phulambri, District Aurangabad (M. S) India was reported by Gedam Ajit *et al*, [37]. Luharia *et al.* [38] recorded, 21 species of fishes in Gawrala and Vinjasan lake. of Bhadrawati district Chandrapur (M.S.), India. Yazdani and Singh [39] assessed the diversity of fish in Bhima River at Indapur, Ujani where they found 54 species of fishes belonging to 15 families. Wagh and Ghate [40] recorded 62 species from Mula and Mutha River in Pune.

Documentation of fish diversity of Anjarakandy River in Kannur District, Kerala, South India showed a fauna of 63 fish species belonging 40 genera and 28 families [41]. A total of 45 fish species, belonging to 7 orders, 17 families, and 32 genera were collected at Bakhira Lake, Uttar Pradesh, India by Verma, *et al*. [42]. To record the fish diversity in the Thazhathangady region which is a part of the Meenachil River a study was conducted and occurrence of 44 freshwater fish species were reported [43].

"Keshori Lake is situated in close vicinity of human habitation in Deori tahsil of Gondia district. In this lake a diversity investigation was carried out from July 2022 to December 2022 to report the fish diversity. Regular catches of the fishes from Keshori Lake, revealed that a total of 28 of species of fishes were found and they are included in 12 families and 8 orders. In this study, family Cyprinidae is the dominant among all the fish families [44]".

Fish diversity study in Bariya Talab of district Balrampur, Uttar Pradesh was carried out from January 2022 to June 2023. In this study, fourteen fish species belonging to 12 genera and 9 families were reported [45]. A total of 17 species were collected during the biodiversity study at the Borda dam. They belong to 7 orders, 9 families, and 16 genera. Among them, in Order Cypriniformes and Siluriformes were represented with 5 species each. This is followed by Perciformes with 3 species while the Orders Osteoglossiformes, Synbranchiformes, Beloniformes and Cichliformes comprises a single species [46].

The IUCN status of fishes was evaluated using fishbase and IUCN Red List. From this analysis, it is found that of the 19 species fish collected in this study, 15 species are in the category of least concern (LC), 3 species are vulnerable (V), *Clarias brachysoma* is the only species considered as Near threatened (NT). Though most of the fishes are used for human consumption six species are reported as pest.

Mrigal carp (*Cirrhinus cirrhosus)*

Roho (*Labeo rohita)*

Giant danio (*Devarioa equipinnatus)*

Peninsular Olive Barb (*Systomus sarana)*

Tilapia (*Oreochromis mossambicus*)

Orange chromide (*Pseudetroplus maculatus*)

Conclusions

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. This observation can be utilized for decision making for conservation and management in a scientific manner. Hence, the present study was undertaken to document the fish diversity of Walayar lake.

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