

## Fish diversity in fresh water Matturu lake of Shivamogga district, Karnataka

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### Abstract

Fish protein are essential for human health and national economy. The present study deals with ichthyofauna of Matturu lake, Shivamogga district, Karnataka. The study was undertaken for a period of one year and monthly collections were made from February 2022 to January-2023. During the study occurrence of 15 fish species belonging to 4 orders were identified. Order Cypriniformes order with 7 species *Labeo rohita*, *Catla Catla*, *Puntius sophore*, *Cyprinus carpio*, *Chela sp.*, *Salmophasia sp.*, *Amblypharyngodon mola*. However, Order Siluriformes was with 4 species, *Mystus cavasiuus*, *Mystus nigriceps*, *Ompak bimaculatus*, *Wallago attu*, Anabantiformes with 2 species viz., *Channa striatus*, *Channa marulius* followed by Osteoglossiformes with one species *Notopterus notopterus* and Cichliformes with 01 species *Oreochromis mossambicus*. As per the Biodiversity status of fishes is concerned, 09 species included under Lower risk-least concern; 02 belongs to Lower risk-near threatened; 03 included as vulnerable and 01 species is categorized as Not assessed. Significance of fishes are discussed in this article. Therefore, to properly manage and utilize this fish abundance, sustainable measures must be taken to fish health in this lake.

**Keywords:** Fish, fauna, Matturu lake, One Way ANOVA, abundance, Shivamogga district

### Introduction

Fish played a significant role in the socio-economic basics of South Asian nations and is a valuable protein source. According to Jayaram [1], of the 2,500 species of freshwater that have been recorded in the Indian Subcontinent, 1570 are marine and 930 are freshwater [2].

The variety of fish species based on context and scale is referred to as fish diversity; It could refer to alleles or genotypes of fish community members as well as species or aquatic life forms [3]. According to Mittermeier and Mitemeir [4], India ranks 9<sup>th</sup> in terms of freshwater mega biodiversity, making it one of the world's mega biodiversity nations. Investigations of spatial and worldly examples of variety, dispersion and species arrangement of freshwater fishes are valuable to inspect factors impacting the construction of the fish community [5]. The availability of food, breeding sites, water current, depth, topography, and the physic-chemical properties of the water were all strongly correlated with the fish species' distribution and composition in each habitat [6,7].

Fishes exhibits variety in terms of morphology, area and biology [8]. Fish can be used for ecological assessments at all

levels of biological organization, assessment procedures are available at the levels of ecosystem, populations, individuals, organs and at the cellular and molecular levels [6]. Besides these credits, fishes are considered as one of the important protein rich food source among the aquatic fauna [9,10].

In India, fish culture is practiced in lentic water bodies like ponds/tanks because pond is represented by a number of aquatic flora and fauna including bottoms dwelling forms. Freshwater ponds and reservoirs comprise a vital component of the ecosystem in developing countries since they provide a high level of public interface. Therefore, it is the need of the hour to study the fish diversity in order to increase our national economy on scientific basis. Keeping the above in view, in the present study, an attempt has been made to high light the fish fauna of Matturu lake of Shivamogga district. The work will provide future strategies for development of fish species conservation.

### Materials and Methods

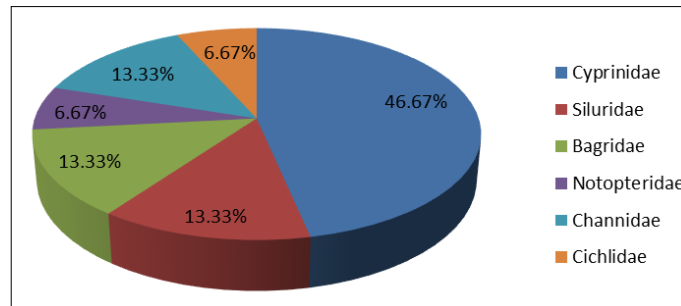
#### Study Area



**Fig 1:** Views of Matturu lake showing aquatic plants & fishing activity

**Table 1:** Family and orderwise occurrence of fishes in Matturu lake, Shivamogga district

Family	Order	Fish species
Cyprinidae	Cypriniformes	<i>Labeo rohita, Catla Catla, Puntius sophore, Cyprinus carpio, Chela sp., Salmophasia sp., Amblypharyngodon mola.</i>
Siluridae	Siluriformes	<i>Ompak bimaculatus, Wallago attu,</i>
Bagridae		<i>Mystus cavasiuus, Mystus griceps,</i>
Notopteridae	Osteoglossiformes	<i>Notopterus notopterus</i>
Cichlidae	Cichliformes	<i>Oreochromis mossambicus.</i>
Channidae	Anabantiformes	<i>Channa striatus, Channa marulius</i>

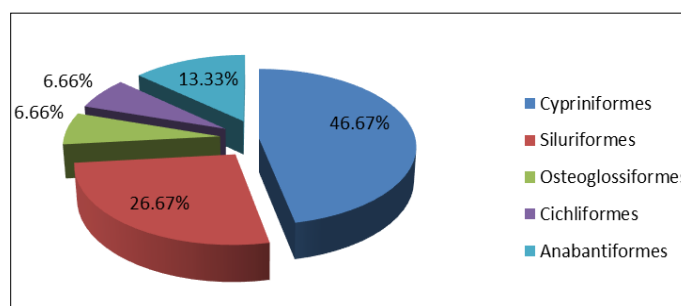


**Fig 2:** Familywise percentage occurrence of fishes in Matturu lake, Shivamogga district

**Table 2:** Biodiversity status & abundance of fishes in Matturu lake, Shivamogga district

SL. No	Species	Biodiversity status	Abundance
1.	<i>Catla catla</i>	LR-lc	A-2
2.	<i>Labeo rohita</i>	LR-lc	A-2
3.	<i>Amblypharyngodon mola</i>	LR-lc	A-1
4.	<i>Salmophasia sp</i>	LR-lc	A (3-4)
5.	<i>Chela sp</i>	NA	A-2
6.	<i>Cyprinus carpio</i>	VU	A-2
7.	<i>Wallago attu</i>	VU	A-1
8.	<i>Puntius sophore</i>	LR-lc	A-2
9.	<i>Channa striatus</i>	LR-lc	A-2
10.	<i>Channa marulius</i>	LR-lc	A-2
11.	<i>Oreochromis mossambica</i>	VU	A (3-4)
12.	<i>Ompok bimaculatus</i>	LR-nt	A-2
13.	<i>Notopterus notopterus</i>	LR-lc	A (3-4)
14.	<i>Mystus cavasiuus,</i>	LR-nt	A (3-4)
15.	<i>Mystus nigriceps</i>	LR-lc	A-1

A-1: Rare A-2: Common A (3-4): Most common



**Fig 3:** Order wise percentage occurrence of fishes in Matturu lake, Shivamogga district

**Table 3:** One-Way ANOVA for density of Fishes in Matturu lake, Shivamogga district

Source	DF	Sum of square	Mean square	F statistic	p- value
Groups (between fishes)	3	234.7686	78.9232	1.812	0.1655
Error (within fishes)	72	3033.2309	42.5123		
Total	75	3468.9865	45.8879		

**Sampling methods and data collection**

Fish samples were collected monthly from the Matturu lake and will be brought to the laboratory for analysis. For fish sample collection different mesh sized gill net will be used at selected sampling stations in the reservoir. After collection, fishes will be examined; number will be counted

and release to the system. Fish specimens were preserved in 10 % formaldehyde for laboratory analysis.

**Fish catch analysis**

The fish samples will be collected during experimental fishing using different mesh sized gill net and the

identification of fish will be done based on fresh or preserved specimens, according to FAO identification sheets [11], ITIS (Integrated Taxonomic Information System) standard report (<http://www.itis.gov/>), Fish Base [12-14] and other books/monographs.

**Statistical analysis**

One-Way ANOVA data for density of fishes in Matturu lake is carried out by using statskingdom.com software.

**Biodiversity Indices**

The fish data is used for the calculation of Shannon- Weiner index, Species evenness, Simpson’s index and Evenness indices [15].

**Species richness**

Species richness [16] is the number of different species present in an region The more species present in a sample the ‘richer’ the habitat. It is expressed by ‘S’.

The higher value of ‘S’ indicates the higher diversity.

$$\text{That is, Species Richness (S)} = \sum_i^S p_i^0$$

**Shannon-Wiener diversity index (H0)**

The formula for calculating the index is as follows:

$$H_0 = - \sum_{i=1}^S p_i \ln p_i$$

Where, H0= species diversity index, S= number of species, pi= proportion of individuals of each species belonging to the species of the total number of individuals [17].

**Species Abundance or Evenness**

Species Abundance or Evenness is the relative abundance of species. It is expressed by ‘E’ and was calculated using the following formula:

$$\text{Species Evenness(E)} = H_0/H_{max}$$

Here, H0=  $\sum p_i(\ln p_i)$ = Shannon Wiener’s Index. Hmx= Natural log(ln) of Species richness=ln(S)

The values ranged from 0 to 1.

**Simpson Diversity index**

Where, ni=number of individuals and N=total number of individuals for the site.

The value of ‘D’ ranges from 0 to 1. With this index, 0 represents infinite diversity and 1 no diversity. That is, the bigger ‘D’ value (within limit) indicates the lower diversity (Source: Internet; Biodiversity, measuring biodiversity,

$$\text{Simpson’s Diversity Index (D)} = \frac{\sum n_i(n_i - 1)}{N(N - 1)}$$

Simpson’s diversity index is less sensitive to species richness and heavily weighted towards the most abundant species. Generally, less sensitive than Shannon-Weiner index ‘H0’ (Source: Internet; Measuring Species Diversity).

**Results and Discussion**

In the present study, 14 fish species belonging to 4 orders were recorded. Order Cypriniformes was dominant with 6 species viz., *Labeo rohita*, *Catla Catla*, *Puntius sophore*, *Cyprinus carpio*, *Chela sp.*, *Amblypharyngodon mola*.

However, Order Siluriformes was with 4 species, *Mystus cavasiuus*, *Mystus griceps*, *Ompak bimaculatus*, *Wallago attu*, Anabantiformes with 2 species viz., *Channa striatus*, *Channa marulius* followed by Osteoglossiformes with one species *Notopterus notopterus* and Cichliformes with 01 species *Oreochromis mossambicus*.

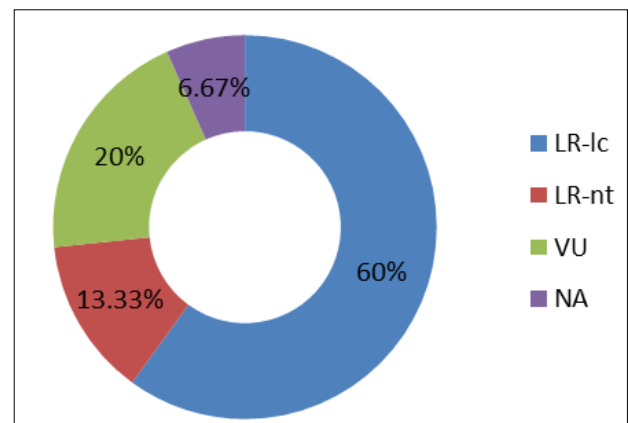
According to Biodiversity status of fishes is concerned; 09 species included under Lower risk-least concern; 02 belongs to Lower risk-near threatened; 03 included as vulnerable and 01 species is categorized as Not assessed.

This lake was home to a lot of Indian Major Carps, including *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigal*. Naik *et al.* [18, 19] findings were in line with this in their review. The cat fish which is viewed as the most horrendous fish in the wild [20] was kept in lesser numbers yet could rule in the supply in not so distant future.

The significant types of carps were found in this lake like Catla, Rohu, Mrigal and Cyprinus. The collected fish species can be divided into large, medium, and small groups based on their size. In the fish array the enormous fishes are *Cyprinus carpio*, (1kg or more), *Labeo rohita*, *catla*, *Wallago attu*, *Channa striatus*, *Channa marulius* and *Cirrhinus mrigala*. *Ompok bimaculatus*, *Mystus cavasiuus*, *Mystus griceps*, *Notopterus notopterus*, and *Oreochromis mossambicus* are examples of medium-sized fish, while *Puntius sophore*, *Chela sp.* And *Salmophasia* of size around 10-100 gm.

Fish species abundance and biodiversity status is shown in the Table-2. Out of 15 species recorded from this lake, 12 are indigenous and remaining 3 species are exotic including *Catla catla*, *Labeo rohita* and *Oreochromis mossambicus*. The fish species recorded so far were all economically important and having high commercial importance. Kumar [21] has reported 51 fish species in Govindsagar reservoir of Himachal Pradesh. Almost fishes were commercially significant and were voracious in nature.

Considerable landings of *Oreochromis mossambicus* was recorded in all the fish landing centers. Ecologically, these fishes have adverse effect on indigenous fish diversity of the reservoir [22].



**Fig 4:** Biodiversity status of fishes in Matturu lake, Shivamogga district

**Table 4:** Calculative value of Species richness, Shannon-Wiener diversity indices, Species evenness and Simpson’s diversity Index of fishes in Matturu lake

Sites	Species richness	Shannon-Weiner index	Evenness index	Simpson index
1	15	2.15	0.82	0.148
2	14	2.84	0.78	0.154
3	13	1.62	0.56	0.162

Species richness the higher value of 'S' indicates the higher diversity. Shannon Wiener index. The higher value indicates the higher diversity. Values ranged from 0 to 5, usually ranging from 1.5 to 3.5. Species evenness- the higher value of 'E' indicates the higher diversity. Values ranged from 0 to 1. Simpson's index. The lower value of 'D' indicates the higher diversity. The value of 'D' ranges from 0 to 1. With this index, 0 represents infinite diversity and, '1' represents no diversity. That is, the bigger the value the lower the diversity

### Physico-chemical profile

The physico-chemical variables of each of the water bodies showed effective correlation and this led to discount in water preserving capacity and reduce intensity of water in the lake. Therefore, it's far indicated that both the water bodies are suitable for fish way of life. Air temperature and water temperature ranged from 25-34°C respectively. Mean water temperature was lower than air temperature that's attributed to much less heating of the ponds. The pH values (7.1-8.4) didn't show a precise seasonal surge and excessive was recorded in the course of summer month and low in winter inside the lake. This can be because of turbidity of water which in flip reduce photosynthetic activity of algae leading to accumulation of CO<sub>2</sub> and subsequently reduction of pH [23].

Dissolved Oxygen (DO) suggests physical, chemical and organic contents in a water body. It is an crucial indicator of water great. DO affect the solubility and availability of many vitamins and consequently productiveness of aquatic ecosystems [24]. In the present study, DO values greater than 4.8 mg/l, which suggests that the wetlands are top-quality for aquatic life. The low values of BOD indicate the low levels of biodegradable substances and lack of non-biodegradable substances. The chloride ranged 12.16 -38.5 mg/l, which suggests that water seems to be appropriate for irrigation functions.

Phosphate fluctuated 1.6- 6.84 mg/l and displaying its maximum range throughout wet season indicating the influx of rain water containing fertilizers from the encompassing agricultural fields. Sulphate concentration of the lake became found to be beneath permissible limits and version in sulphate content in lake is probably due to variable natural enter. Total hardness (mg/l CaCO<sub>3</sub>) and total alkalinity were found to be low and ranged from 32 to 88 mg/l and 40 to 66.40 mg/l respectively and such water our bodies can be taken into consideration as smooth. Acidity varied from 8.05 to 28 mg/l all through the take a look at. The concentration of NO<sub>3</sub> fluctuated from 0.20 to 0.80 mg/l and variant.

Venkateshwarlu *et al* [25] have reported the fish diversity in two lentic water bodies of Shimoga district. Ashashree and Kiran [26] have studied the physico-chemical parameters and biotic communities of Hosahalli pond of Shivamogga district and they have revealed that Hosahalli pond was contaminated due to entry of domestic waste and agricultural runoff. Ashashree and Kiran [27] have assessed the physico-chemical and fish composition characteristics of water in in Tammadihalli tank (Bhadravathi taluk) and Sogane tank of Shivamogga district, Karnataka. Water quality in these tanks are influenced by hydrology, topography and other environmental factors, which cause variations in nutrients. The physico-chemical analysis of

water samples from this lake showed that the water is within the safe limits of drinking, irrigation and fisheries.

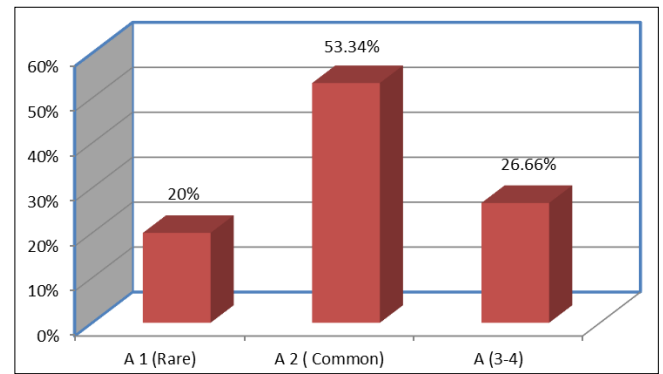


Fig 5: Percentage abundance status of fishes in Matturu lake, Shivamogga district

### Conclusion

As a result of this observation, 15 species of freshwater ichthyofauna belonging to 04 orders were recorded in the Matturu lake of Shivamogga district. This ichthyofauna appears to indicate a moderate number inhabiting in this water body, and sustainable strategies for discovering and conserving additional fish communities in this lake is detailed. Observation of physico-chemical parameters of this lake revealed that most of the water parameters were below the permissible limits. This water body is home to several ornamental fishes as well as economically important fishes that can be farmed. Conservation measures require restrict fishing in breeding season and identifying illegal fishing.

### Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this article.

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