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Ichthyofaunal Diversity and Present Status of Shankar Beel of Golaghat District, Assam, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors contributed equally. MKT collected the data and SS summarized the data and prepared the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Wetlands are one of the most productive ecosystems on the Earth that play a vital role as potential reservoirs of water, exhibiting coveted bioresources that sustain animal life. Every wetland has its own regional and global importance in terms of ecological and socioeconomic values and plays a unique role in the ecosystem and society. Shankar beel is considered to be one of the main wetlands of Golaghat district of Upper Assam, a perineal freshwater wetland covering an area of about 27 hectares at present. The beel has both biological and environmental importance harbouring a large number of floral and faunal diversity, providing a breeding ground for a variety of migratory birds, and home to amphibians, reptiles, micro and macrophytes, insects, fishes, micro and macrophytes and several other important taxa of ecological and economic importance. This study aims to investigate the present fish diversity of Shankar beel located in the Golaghat district

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of Upper Assam along with their conservation status. The present study recorded the presence of 60 species belonging to 8 orders, 20 families and 40 genera, in the study area classified with standard taxonomic protocol and IUCN status. Among the species, 24 belong to the order Cypriniformes of which 23 species are from the family Cyprinidae representing the most dominant group in the beel. On the other hand, 14 species belong to the order Perciformes of which 5 species belong to Channidae order.

Keywords: Fish diversity; wetland; conservation status; IUCN; cyprinidae; aquatic ecosystem.

ABBREVIATIONS

DO : Dissolved Oxygen
BOD : Biological Oxygen Demand
IUCN : International Union for Conservation of Nature
NE : Not-evaluated
DD : Data-deficient
LC : Least-concern
VU : Vulnerable
EN : Endangered

1. INTRODUCTION

Wetlands are one of the most productive ecosystems on the Earth that play a vital role as potential reservoirs of water, exhibiting coveted bioresources that sustain animal life [1,2]. India has a wealth of wetland ecosystems that support diverse flora, fauna and unique habitats [1]. Wetlands are ecologically sensitive and adaptive systems that provide different services to humans [2]. Wetlands exhibit a vast diversity of flora and fauna based on their genesis, geographical location, soil and sediment characteristics, water quality parameters, and other environmental factors [2–4]. The diversity of fish and their survivability are influenced by several water quality measurement parameters like pH, temperature, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), salinity, alkalinity, water depth, availability of freshwater natural habitat and other physical co-factors like climate change, rainfall, soil chemical constituent [1,3,5]. Wetlands play a key role in flood management, regulating biogeochemical cycles, and above all, they provide a rich network of habitats that supports diverse fish communities [3]. Physico-chemical parameters of water play a crucial role in the biology and physiology of fish species. Diversification of fish fauna has crucial importance as they directly or indirectly stabilize the aquatic ecosystem [6,7]. With the ever-increasing population, anthropogenic pressures, pollution from industry and households, rapid urbanization, industrialization, agricultural activities and overexploitation of natural resources disturb the hydrological, economic and ecological functions they perform [6]. As a consequence of social, economic and environmental factors many freshwater wetlands are threatened and many are already degraded which is a serious matter of concern globally [2,6,7]. Additionally, the deterioration of water quality is more alarming for small water bodies like lakes, tanks and ponds [2].

India is very rich in ichthyofaunal diversity. A total of 3231 fish species have been identified to date, of which 788 are recognized as freshwater fish in India which has contributed approximately 9.62% of the total 33,600 valid fish species of the world [2,4,6]. Northeast India is bestowed with a wide range of water resources with suitable physiography and climatic conditions because of which this region is glorified with 267 fish species, belonging to 114 genera, 38 families and 10 orders and thus considered as one of the hot spots of freshwater fish biodiversity in the world [3,4,8]. Assam exhibited a diversity of fish fauna and is gifted with about 3,513 wetlands, connected to Brahmaputra and Barak, the two prime drainage system and their tributaries, contributing to 25% of the total fish production of the state alone [3,5,8].

Shankar beel is considered to be one of the main wetlands of Golaghat district of Upper Assam, a perineal freshwater wetland covering an area of about 27 hectares at present [9]. Every wetland has its own regional and global importance in terms of ecological and socioeconomic values as they play unique roles in the ecosystem and society [3]. Shankar beel has both biological and environmental importance harbouring a large number of floral and faunal diversity, providing a breeding ground for a variety of migratory birds, and home to amphibians, reptiles, micro and macrophytes, insects, fishes, micro and macrophytes and several other important taxa of ecological and economic importance [9]. Fishes are important source of nutrition that supports the economy and livelihood of poor people next to agriculture. The management of fisheries,

conservation and protection of species and aquatic environment depends on the study of fish diversity, distribution patterns, and habitat preferences [7-8]. The diversity and abundance of fish species also change in response to alternation in intrinsic and extrinsic factors [9]. Considering all the factors, an attempt was made to investigate the present fish diversity of Shankar Beel located in the Golaghat district of Upper Assam and their conservation status. To our knowledge, this is the first report of fish diversity of Shankar beel.

2. MATERIALS AND METHODS

2.1 Study Area

The Shankar beel is one of the main wetlands of Golaghat district of Upper Assam, a perennial water body, located around 15 km from Golaghat town. The beel is situated 26031' 57.0936N to 26033' 8.586 N and 93053' 0.0006 E to 93050' 45.48516 E covering an area of 27 ha. The length of the beel is 3 km and breadth is 400 m. The beel originated from the Dhansiri River, the principal river of the Golaghat district, originated from the Laisang peak of Nagaland.

2.2 Study Period

Sampling was carried out for a period of 15 months, from February 2022 to May 2023. The samples were collected in a regular mode, through a visit to the sampling site after an interval of every 15 days, in the morning, between 6 AM to 9.30 AM. Thus by conducting two samplings per month total of 30 samples were collected during the study period. The collected fish were identified, counted, measured, and weighed.

2.3 Data Collection

A random sampling method was applied for the collection of samples. During the study, fish were collected live in different locations, and major fish landing sites of the beel were surveyed. Additionally, different fish species were collected from nearby fish markets and investigated to collect information about the fish. Samples were collected twice in every month, after 15 days, in the early morning between 6-9:30 AM. Fishes were collected from the water body with the help of local fishermen by using cast nets of various sizes fishing devices like moving nets, dhekjal, khewali jal and drag nets of various mesh sizes, and different traps like Jakoi, Polo, sepa, and Bamboo bana. After collection, the number was counted and recorded. Local names were also noted for initial identification. The collected fishes were photographed using a mobile and a Canon DSLR camera and preserved in 10% formaldehyde solution for further study and identity confirmation. The collected specimens were identified based on the morphometric and meristic characteristics following Talwar and Jhingram (1991), Jayaram (1999) and Vishwanath (2002) [10-12]. Identified fish species were classified based on the classification system of Nelson (2006) [13]. Conservation status and population trend of fish species were determined using an updated list of IUCN (2015). The beel was surveyed by visiting three different sites (Site 1, Site 2 and Site 3), and questionaries and suggestions from the local fishermen were also taken.

2.4 Data Analysis

Simple descriptive analysis and graphical presentation of data were carried out using Microsoft Excel (version 2016). The number of specimens (N), diversity, evenness and dominance of species were compared between the sampling sites. The Shannon diversity index (H') was used to estimate the diversity of fish species.

3. RESULTS

The present study recorded the presence of 60 species belonging to 8 orders, 20 families and 40 genera, classified with standard taxonomic protocol and IUCN status (Table 1). Order-wise percentage composition of fish diversity of Shankar beel showed the dominance of the order Cypriniformes representing 24 different species (40%) followed by Perchiformes (23%), Siluriformes (20%) and synbranchiformes (7%) (Fig. 2). Family-wise distribution of fish species recorded in the study area showed that most species belong to the Cyprinidae family which includes some very common species like *Amblypharyngodon mola, Esomus danrica, Puntius* spp. and the major Indian carps (Fig. 3). The total number of individuals collected (N) varies for each fish species. A total of 1625 samples were collected from the study area, recording the highest number of species (48 species) and 678 individuals from site 3, followed by site 1 (40 species, 494 individuals) and site 2 (40 species and 453 individuals). The percentage of fish species obtained from S1, S2 and S3 of the Shankar beel was 30.4%, 27.87% and 41.72% respectively.

(a)

(b)

Fig. 1. (a) Location map and (b) Geographical location of the study area (Shankar Beel)

Table 1. Taxonomic classification of identified fish species (Talwar, 1991; Jayaram, 1999, 2002) with IUCN status

Sl. No	Order	Family	Scientific Name	Local name	Frequency	IUCN status	S1	S2	S3
1.	Osteoglossiformes	Notopteridae	*Notopterus notopterus* (Pallas, 1769)	Kanduli	Very common	LC	+	+	+
2.			*Chitala chitala* (Hamilton, 1822	Chital	Common	LC	-	+	+
3.	Beloniformes	Belonidae	*Xenentodon cancila* (Hamilton, 1822)	Kokila	Common	LC	-	+	-
4.	Cypriniformes	Cyprinidae	*Amblypharyngodon mola*	Mowa	Common	LC	+	+	+
5.			*A. morar*	Boriala	Common	LC	+	+	+
6.			*Barilius barila* (Hamilton, 1822)	Korang	Common	LC	-	-	+
7.			*Cabdio morar* (Hamilton, 1822)	Boriola	Very common	LC	+	+	+
8.			*Catla catla*	Bahu	Common	LC	+	+	+
9.			*Cirrhinus mrigala* (Hamilton, 1822)	Mirika	Very common	LC	+	+	+
10.			*Cirrhinus reba* (Hamilton, 1822)	Bhangun	Very common	LC	+	-	-
11.			*Chela cachius* (Hamilton, 1822)	Chela	Common	LC	-	-	+
12.			*Ctenopharyngodon idella* (Valenciennes, 1844)	Grass Carp	Common	NE	+	+	-
13.			*Cyprinus carpio* (Linnaeus, 1758)	Common carp	Less common	VUL	+	+	+
14.			*Devario devario* (McClelland, 1839)	Lauputhi	Common	LC	+	-	+
15.			*Esomus danrica* (Hamilton, 1822)	Dorikona	Very Common	LC	+	+	+
16.			*Hypophthalmichthys molitrix* (Valenciennes, 1844)	Silver carp	Common	LC	-	+	+
17.			*Hypophthalmichthys nobilis* (Richardson, 1845)	Bighead	Common	DD	+	+	-
18.			*Labeo calbasu* (Hamilton, 1822)	Bahu	Common	LC	+	+	+
19.			*Labeo bata* (Hamilton, 1822)	Bhangone	Common	LC	+	+	+
20.			*Labeo gonius* (Hamilton, 1822)	Kurhi	Common	LC	+	-	-
21.			*Labeo rohita* (Hamilton, 1822)	Rohu	Common	LC	+	+	+
22.			Puntius chola (Hamilton, 1822)	Puthi	Very common	LC	+	+	+
23.			*Puntius sophore* (Hamilton, 1822)	Puthi	Very common	LC	+	+	+
24.			*Puntius terio* (Hamilton, 1822)	Puthi	Very common	LC	+	+	+
25.			*Pethia ticto* (Hamilton, 1822)	Puthi	Very common	LC	+	+	-
26.			*Putius puntio* (Hamilton, 1822)	Puthi	Very common	LC	-	+	+
27.		Cobitidae	*Botia dario* (Hamilton, 1822)	Gethu	Common	LC	+	+	+
28.	Clupeiformes	Clupeidae	*Gudusia chapra* (Hamilton, 1822)	Karati	Common	LC	-	-	+
29.			*Hilsa ilisha*	Ilish	Common	LC	+	-	-
30.	Perchiformes	Ambassidae	*Chanda nama* (Hamilton, 1822)	Chanda	Common	LC	+	+	+
31.			*Parambassis ranga* (Hamilton,	Chanda	Very common	LC	+	-	+

Sl. No	Order	Family	Scientific Name	Local name	Frequency	IUCN status	S1	S2	S3
			1822)						
32.		Anabantidae	*Anabas testudineus* (Bloch, 1792)	Kawoi	Very common	DD	+	+	+
33.		Badidae	*Badis badis* (Hamilton, 1822)	Dum vessel	Very common	LC	+	+	+
34.		Channidae	*Channa gachua* (Hamilton 1822)	Sengali	Common	LC	+	+	+
35.			*Channa punctatus* (Bloch, 1793)	Goroi	Common	LC	+	+	+
36.			*Channa marulius* (Bloch, 1793)	Saal	Common	LC	-	-	+
37.			*C. stewarti*	Sol	Common	LC	-	+	-
38.			*C. straitus*	Sal	Common	LC	-	-	+
39.		Gobiidae	*Glossogobius giuris* (Hamilton, 1822)	Patimutura	Common	LC	+	+	+
40.		Nandidae	*Nandus nandus* (Hamilton, 1822)	Gadgadi	Common	LC	+	-	+
41.		Osphronemidae	*Trichogaster fasciata* (Bloch and Schneider, 1801)	Kholihona	Common	LC	+	+	+
42.			*Trichogaster lalius* (Hamilton, 1822)	Kholihona	Common	LC	+	+	+
43.			*Trichogaster sota* (Hamilton, 1822)	Kholihona	Common	LC	+	+	+
44.	Siluriformes	Bagridae	*Batasio batasio* (Hamilton, 1822)	Batashi Mas	Common	LC	+	-	+
45.			*Mystus bleekeri* (Day, 1877)	Singara	Common	LC	+	+	-
46.			*Mystus cavasius* (Hamilton, 1822)	Lalua singara	Common	LC	+	-	-
47.			*Mystus tengara* (Ham.-Buch.)	Singara	Common	LC	+	+	+
48.			*Mystus vittatus* (Bloch, 1794)	Singara	Common	LC	-	+	+
49.			*Rita rita* (Hamilton, 1822)	Ritha	Common	LC	-	-	+
50.		Claridae	*Clarias batrachus* (Linnaeus, 1758)	Magur	Rare	EN	+	+	+
51.		Chacidae	*Chaca chaca* (Hamilton, 1822)	Kurkuri	Rare	LC	-	-	+
52.		Heteropneustidae	*Heteropneustes fossilis* (Bloch, 1794)	Singi	Common	LC	+	-	+
53.		Siluridae	*Ompok pabo* (Hamilton, 1822)	Pavo	Rare	LC	-	-	+
54.			*Ompok bimaculatus*	Bami	Rare	LC	-	+	-
55.			*Wallago attu* (Bloch and Schneider, 1801)	Borali	Common	LC	+	+	+
56.	Synbranchiformes	Mastacembelidae	*Macrognathus aral* (Bloch and Schneider, 1801)	Tura	Common	LC	+	-	+
57.			*Macrognathus pancalus* (Hamilton, 1822)	Tura	Common	LC	+	+	+
58.			*Mastacembelus armatus* (Lacepede, 1800)	Bami	Common	LC	+	-	+
59.		Synbranchidae	*Monopterus cuchia* (Hamilton, 1822)	Kuchia	Common	LC	-	-	+
60.	Tetraodontiformes	Tetraodontidae	*Leiodon cutcutia* (Hamilton, 1822)	Gangatope	Rare	NE	-	+	-

(NE-Not-evaluated; DD-Data-deficient; LC-Least-concern; VU-Vulnerable; EN-Endangered)

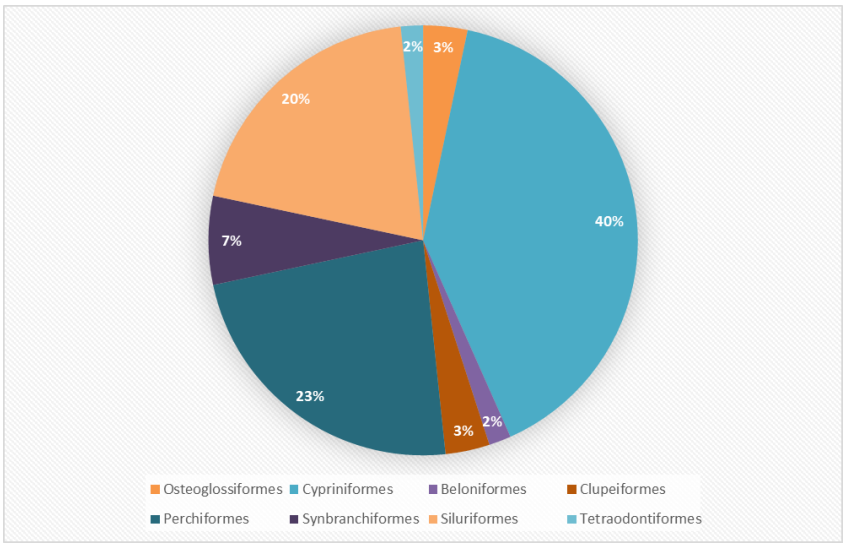

Fig. 2. Order-wise fish diversity of Shankar beel in percentage

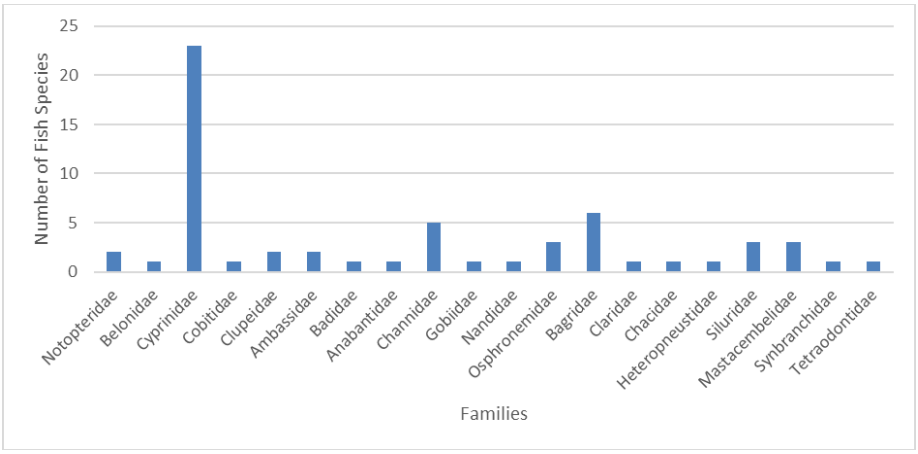

Fig. 3. Family-wise distribution of fish species recorded in the study area

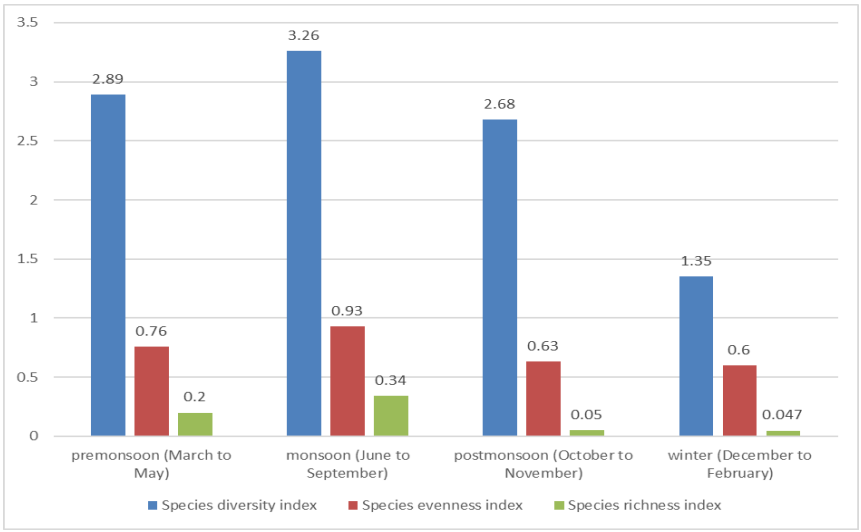

Fig. 4. Graphical representation of season-wise species diversity index (H'), Evenness index and species richness index of collected fish fauna

The highest Shannon-Weiner fish diversity index was found in the Monsoon season, (3.26) and the lowest in the winter season, i.e. from December to February (1.35). The evenness index varied from 0.60 to 0.93, and the species richness index ranged from 0.047 to 0.34 (Fig. 4).

4. DISCUSSION

The present study reveals rich fish diversity of Shankar beel with 60 numbers of fish species with some ornamental species. During the study, some alien species like Common carp (*Cyprinus carpio*) were recorded which may be due to the yearly fry release and implementation of Beel Nursery. The availability of some common native species like *Puntius sarana, Botia Dario, Chitala chitala* etc. has declined as a result of a lack of sufficient water in the winter season and overfishing. Out of the total 60 species, family wise diversity of species recorded include Cyprinidae (23), Bagridae (6), Channidae (5), Siluridae (3), Mastacembelidae (3), Notopteridae (2), Ambassidae (2), Clupeidae (2), Anabantidae (1), Badidae (1), Belonidae (1), Cobitidae (1), Claridae (1), Chacidae (1), Gobiidae (1), Heteropneustidae (1), Nandidae (1), Osphronemidae (3), Synbranchidae (1), and Tetraodontidae (1). *Amblypharyngodon mola, Puntius sophore, Anabas testudineus, Channa punctatus, Pethia ticto, Cirrhinus mrigala, Labeo rohita, Mystus tengara, Wallago attu, Macrognathus aral,* and *Macrognathus pancalus* are the most abundant and common species in Shankar beel. Findings also suggested that out of 60 fish species, 54 species belong under the LC category, whereas 2 species are NE, 2 species are DD, 1 species is EN and only 1 species belongs to the VU category. On the other hand, although *C. stewarti, C. straitus,* and *Chaca chaca* are declared as the Least concern species at present, they are under threat in reality. The commercially important fish species found in the wetland are *Labeo rohita, Cirrhinus mrigala, Labeo gonius, Notopterus notopterus, Chitala chitala, Wallago attu, Channa striatus, Anabas testudineus, Mystus tengra Cirrhinus reba,* and *Heteropneustes fossilis* etc. Cyprinidae is the most dominant family recorded from the present study as also reported by Bordoloi and Hazarika, [14]; Rahman et al., [15]; and Kalita et al., [16].

The diversity of fish are varied at different times and locations. The calculated fish diversity index at the Shankar beel showed moderate to high variability. Diversity is considered to be high when the diversity index value (H') is >3, medium 1<H'<3 and low if H'<3 [17]. The lowest species diversity was found in the winter season. The species evenness of fish of Shankar beel was found within the uniform range, (0.6≤E≤1), indicating an even distribution of fish species. The high value of the Shannon diversity index of fish diversity of Shankar beel throughout the study period highlighted the significance of habitat it offers to diverse fish species and its potential to serve as a site for the conservation of endemic fish species. This study will also help in the implementation of future policies by the government to protect endemic fish species and the wetland.

5. CONCLUSION

Shankar beel is one of the highly productive wetlands of upper Assam. The ecosystem of the beel supports a good habitat for a variety of fish species with a high density of surface and mid-column feeders. Beels are sources of water for agriculture and food and support many vertebrates, invertebrates and aquatic flora. They are also associated with the economy and culture of the native people. Additionally, it harbours a wide variety of indigenous ornamental fishes. Pre-monsoon and monsoon seasons show higher abundance in the fish diversity of the beel. Increasing habitat loss, changes in the ecological condition of the beel, erratic monsoons, flash floods, anthropogenic pressure, and climate change are some of the reasons for declining fish diversity in the Shankar beel which once used to be famous for fish diversity as well as abundance. Considering the present status, implementation of conservation and sustainable policies are required for the positive restoration of habitat as well as aquatic diversity of the beel.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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