SPECIES COMPOSITION AND CONSERVATION STATUS OF ORNAMENTAL FISHES IN KHAMBRENGA WETLAND, KAMRUP DISTRICT, ASSAM, INDIA

ABSTRACT

Ornamental fish culture, also known as aquariculture, is a significant industry globally, contributing to foreign exchange earnings and employment generation. India, particularly the northeastern region, is endowed with diverse indigenous ornamental fish species. However, the ornamental fish trade in India remains relatively underdeveloped. This study aimed to document the ornamental fish diversity in Khambrenga Beel, a freshwater wetland located near Guwahati City, Assam, India.

From December 2022 to April 2023, fish samples were collected and photographed in the study area. Local knowledge and identification literature were utilized to identify the fish species, while the IUCN Red List was referenced to determine their conservation status. A total of 48 species belonging to 30 genera, 20 families, and 10 orders of ornamental fishes were recorded in Khambrenga Beel. The Cypriniformes and Perciformes orders were the most diverse, comprising 16 species each.

The majority of the recorded species were categorized as least concern (LRlc), indicating a relatively stable conservation status. However, three species were categorized as near threatened (NT), one species as vulnerable (VU), and one species as endangered (EN). The abundance of ornamental fishes varied across different sampling sites and seasons, reflecting the influence of habitat heterogeneity and seasonal dynamics.

The findings highlight the importance of conserving Khambrenga Beel's unique ecosystem and its diverse ornamental fish species. Conservation measures such as habitat protection and sustainable fishing practices are crucial for ensuring the long-term survival of these species. This study provides

valuable information for the development of conservation strategies to protect the ornamental fish populations in Khambrenga Beel, thereby contributing to the overall conservation of indigenous ornamental fishes in India.

Keywords: *Ornamental fish, Wetland, Fish Diversity, Conservation, Assam*

1. INTRODUCTION

Ornamental fish culture also known as aquariculture, is the culture of attractive, colorful fishes of peaceful nature in confined aquatic systems. Ornamental fishes are also called as "living jewels". The ornamental fisheries are a source of foreign exchange, in addition to being a source of employment. It has an important role in economies of developed and developing countries. The entire ornamental fish industry, including accessories are estimated to be worth more than $5.88 billion in 2022 [1]. The domestic market for ornamental fishes in India is estimated at Rs 20 crores and the domestic trade is at growing annual rate of 20%. Availability of considerable number of indigenous ornamental fish of high value in the country has contributed greatly for the development of ornamental fish industry in India [2].

Ornamental fishes are the world’s most popular pets and fish keeping happens to be a popular hobby next only to photography. The fantastic shapes and brilliant colours of ornamental fishes made them a popular choice as pets, they can be aptly called as “Living Jewels”.

India is still in a marginal position just contributing 1% of total ornamental fish trade. North Eastern states, West Bengal, Kerala and Tamil Nādu are blessed with highly potential indigenous ornamental fishes. Around 85% of native fishes are from North eastern states. 90% of native ornamental species are collected and reared to meet export demand. In India, the Western Ghats and

the north-eastern region are considered as the hotspot for indigenous ornamental fishes[1]. In the north-eastern area, there 422 fish species have been recorded [3]. Mahapatra documented 250 species of ornamental fishes from the northeastern states[4] 311 fish species have been recorded in Assam, of which 180 has ornamental value [5].

Number of researchers are engaged in studying ichthyofaunal diversity of Assam in various regions of the state. A total of 81 fish species were studied having ornamental value across the Brahmaputra basin [6]. Numbers of tributaries from the northern and southern side of Assam join the Brahmaputra River and develop numbers of flood plain wetlands and rain fed Beels which create feeding and breeding ground for indigenous fish fauna. The present study has been conducted to record the ornamental fish diversity in the Khambrenga Beel which is a wetland in the outskirts of the Guwahati City.

2. MATERIALS AND METHODS:

2.1.Study Area:

The study area, Khambrenga beel also known as Khambrenga Wetland or Khambrenga Lake, is a freshwater wetland located in Chandrapur area of Kamrup,Assam, India, around 15 kms from Guwahati City. It is a prominent water body that is known for its ecological significance and supports a diverse range of flora and fauna, including several indigenous species of fish. Khambrenga Beel is a large, shallow wetland that spans across an area of approximately 160 hectares (1.6 sq kms) during the monsoon season and decreases in size during the dry season. The lake is surrounded by marshy grasslands, agricultural fields, and wetland vegetation, creating a unique habitat for various aquatic and avian species.

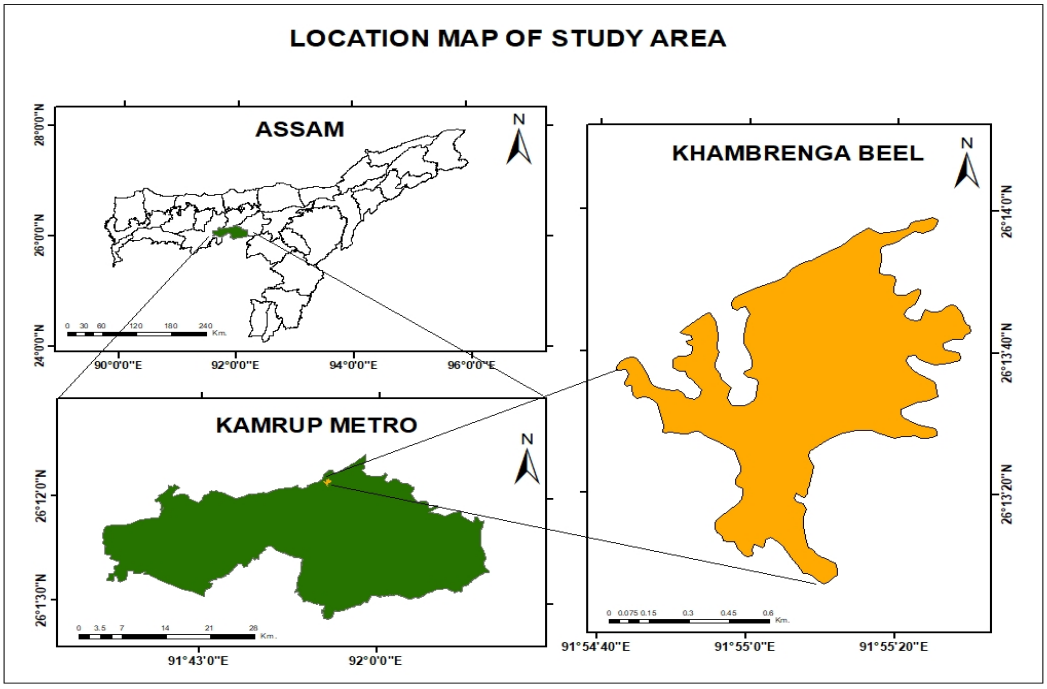

***Figure.1**: Map of Study Area with Location*

2.2.Geography:

The beel is a polygonal riverine wetland situated 26^0 13'15" North and 91^0 54'03" East. To the North it has the river Brahmaputra at a distance of 1200 mts. from the beel and to the South it is lined by the hills of Amchang Wildlife Sancuatry. The beel has an average altitude of 70 meters above sea level.

2.3.Climate:

Khambrenga Beel have a tropical or subtropical climate, depending on its location. It experiences high temperatures and high humidity throughout the year, with significant rainfall and occasional flooding.

Annual temperature range in the Chandrapur area varies from 10^0C to 33^0C. Average humidity is 75%. During the hot season, temperatures in wetland areas may rise significantly, with average highs ranging from 30 to 40 degrees Celsius. The humidity levels may also be high, resulting in a hot and muggy climate [7].

In the rainy season, Khambrenga Beel would likely receive ample rainfall, resulting in waterlogging and inundation of the wetland area. The region may experience heavy monsoonal rainfall, leading to flooded marshes and increased water levels in the beel. The moonson season starts lasts from May till September. Average annual rainfall received in the district ranges from 1500 mm to 2600 mm [8]. This creates a unique ecosystem with diverse flora and fauna, including various water birds, fish, and aquatic plants.

2.4.Sampling

The study was conducted from December 2022 to April 2023. Fish samples were collected and photographed throughout these months from the wetland. The fish were collected using various fishing gears like Langi net, Fasi net, Cast net (Khewali), Puthilangi, Goroilangi, Kawoilangi, Bamboo traps (sepa), Jakoi and other hooks with the help of local fishermen. Fishing operations were done in the early morning hours almost every day.

2.5.Data Collection and Identification

Photograph search engines (FishVerify), the Fishbase database [9], and local knowledge were used to identify the obtained fish samples. Fishermen were interrogated about fishes available previously and now in the wetland by displaying pictures of fishes found in Assam from books like Zoological Survey of India [10] and Vertebrates of Assam [11]. These books are mainly based on available sources of secondary data like books, journals, Ph. D. Theses, etc. Identification literatures such as The Fishes of Assam [12] were also used. In the meantime, its conservation status was ascertained using the IUCN Red list [13] and the IUCN conservation status. Pictures were shot at the research laboratory. In addition, interviews were conducted to acquire local fish expertise.

3. RESULTS AND DISCUSSION

3.1.Species Composition

It is found that the Khambrenga beel (wetland) harbours a great diversity of ornamental fishes. Ornamental fishes were sorted based on their aesthetic beauty, attractive colour pattern, swimming behavior and more resistant to captivity stress [14]. A total of 48 species belonging to 30 genera, 20 families and 10 orders of ornamental fishes were recorded. Out of which 16 species belongs to Cypriniformes order, 16 species belong to Perciformes order, 7 species belongs to Siluriformes order, 2 species belong to Ostioglossiformes order, 2 species belongs to Synbranchiformes order and 1 species each belonging to orders Beloniformes, Gobiiformes, Tetradontiformes, Cyprinodontiformes, Clupiformes respectively. The 47 species belongs to the following families

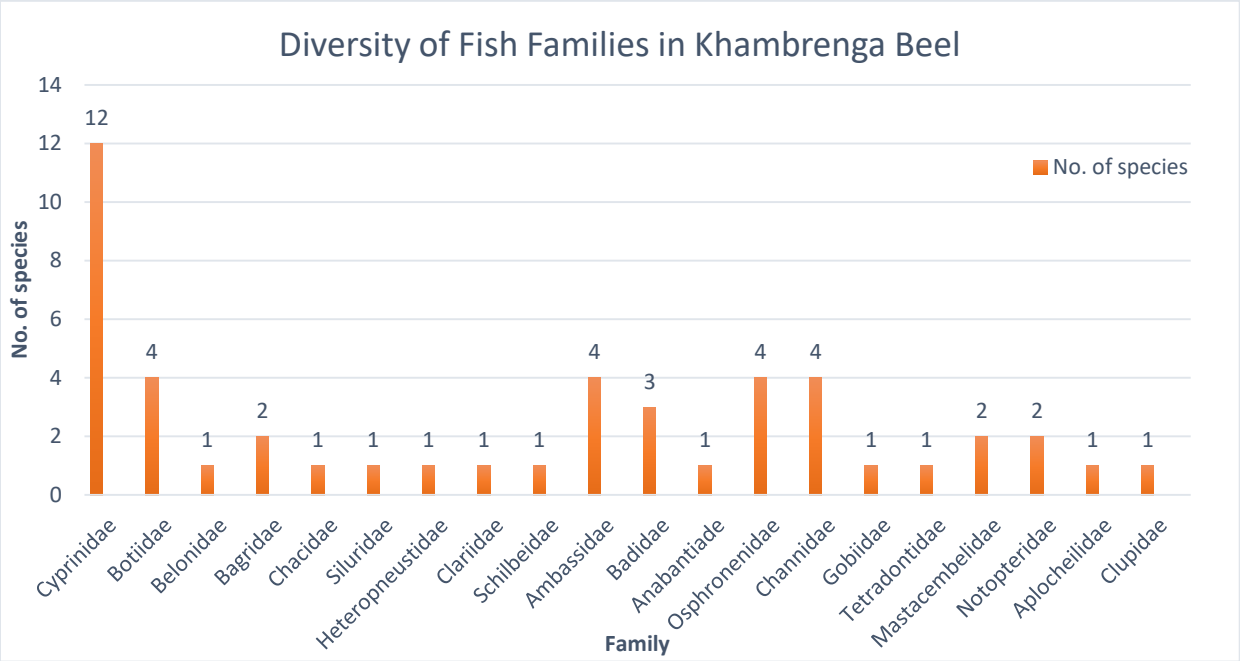

Figure.2: *Diversity of Fish Families in Khambrenga Beel*

All the recorded species from Khambrenga Beel are documented in Table 1 along with their IUCN status, Availability in the beel and their Ornamental potential.

Table 1: *List of recorded ornamental fish species with their status, occurrence & local name*

	Order	**Family**	**Species Names**	**IUCN Status**	**Occurence**	**Local name**	**Ornamental Potential**
1	Cypriniformes	Cyprinidae	1. *Amblypharyngodon mola* (Hamilton, 1822)	LRlc	+++	Moa	Excellent
			2. *Esomus danricus* (Hamilton,1822)	LRlc	+++	Dorikona	Excellent

			3. *Pethia conchonius* (Hamilton,1822)	LRlc	+++	Puthi	Excellent
			4. *Pethia gelius* (Hamilton,1822)	LRlc	++	Puthi	Excellent
			5. *Puntius chola* (Hamilton,1822)	LRlc	++	Puthi	Excellent
			6. *Puntius sophore* (Hamilton,1822)	LRlc	+++	Puthi	Excellent
			7. *Puntius terio* (Hamilton,1822)	LRlc	+	Puthi	Excellent
			8. *Pethia ticto* (Hamilton,1822)	LRlc	+	Kanee Puthi/ Kenipothia	Excellent
			9. *Pethia phutunio* (Hamilton,1822)	LRlc	+++	Puthi	Excellent
			10. *Rasbora daniconius* (Hamilton,1822)	LRlc	++	Dorikona	Excellent
			11. *Rasbora*	LRlc	+++	Eleng/Doriko	Excellent

			rasbora (Hamilton,1822)			na	
			12. *Salmostoma bacaila* (Hamilton,1822)	LRlc	+	Selkona	Excellent
		Botiidae	13. *Botia dario* (Hamilton,1822)	LRlc	+	Rani-botia	Excellent
			14. *Botia lohachata* (Hamilton,1822)	LRlc	+	Botia	Excellent
			15. *Lepidocephalichthys guntea* (Hamilton,1822)	LRlc	++	Guntel botia	Excellent
			16. *Acanthocobitis pavonacea* (McCelland,1839)	VU	+	Botia	High potential
2	Beloniformes	Belonidae	17. *Xenentodon cancila* (Hamilton,1822)	LRlc	+++	Kokila	Excellent
3	Siluriformes	Bagridae	18. *Mystus tengara* (Hamilton,1822)	LRlc	++	Singarah	Excellent
			19. *Mystus bleekeri* (Day,1877)	LRlc	++	Singarah	Excellent
		Chacidae	20. *Chaca chaca* (Hamilton,1822)	LRlc	+	Kurkuri	High potential

		Siluridae	*21. Ompok bimaculatus* (Bloch,1794)	NT	+	Pabhoh	Moderate
		Heteropnuestidae	*22. Heteropnuestus fossilis* (Bloch,1794)	LRlc	+++	Singi	High potential
		Clariidae	*23. Clarias magur* (Hamilton,1822)	EN	+++	Magur	High potential
		Schilbeidae	*24. Pachypterus atherinoides* (Bloch,1794)	LRlc	++	Bohduah/ Bordia	Moderate
4	Perciformes	Ambassidae	*25. Parambassis baculis* (Hamilton,1822)	LRlc	+	Chanda	Excellent
			26. Parambasis lala (Hamilton,1822)	NT	++	Chanda	Excellent
			27. Parambasis ranga (Hamilton,1822)	LRlc	++	Chanda	Excellent
			28. Chanda nama (Hamilton,1822)	LRlc	+++	Chanda	Excellent
		Badidae	*29. Nandus nandus* (Hamilton,1822)	LRlc	++	Gedgedi/ Bhetki/ Veheri	Excellent
			30. Badis	DD	+	Vacheli	High

			assamensis (Ahl,1937)				potential
			31. *Badis badis* (Hamilton,1822	LRlc	++	Randhanee maas	Excellent
		Anabantidae	32. *Anabas testudineus* (Bloch,1794)	LRlc	+++	Kawoi	Excellent
		Osphronenidae	33. *Trichogaster fasciata* (Bloch & Schneider,1801)	LRlc	+++	Kholihona	Excellent
			34. *Trichogaster lalius* (Hamilton,1822)	LRlc	+	Lal-kholihona	Excellent
			35. *Trichogaster labiosa* (Day,1877)	LRlc	+++	Kholihona	Excellent
			36. *Trichogaster chuna* (Hamilton,1822)	LRlc	++	Bahsaylee	
		Channidae	37. *Channa striatus* (Bloch,1793)	LRlc	++	Khol	High potential
			38. *Channa puctatus* (Bloch,1793)	LRlc	+++	Goroi	Moderate
			39. *Channa*	LRlc	+	Chengeli	High

			stewarti (Playfair, 1876)				potential
			40. *Channa gachua* (Hamilton,1822)	LRlc	+++	Cheng	
5	Gobiiformes	Gobiidae	41. *Glossogobius giuris* (Hamilton,1822)	LRlc	++	Panimutura	High potential
6	Tetradontiformes	Tetraodontidae	42. *Leiodon cutcutia* (Hamilton,1822)	LRlc	+	Gangatope	Excellent
7	Synbranchiformes	Mastacembelidae	43. *Macrognathus aral* (Bloch & Schneider,1801)	LRlc	++	Tora/ Turi	Excellent
			44. *Macrognathus pancalus* (Hamilton,1822)	LRlc	++	Tora/ Turi	Excellent
8	Ostioglossiformes	Notopteridae	45. *Notopterus notopterus* (Pallas,1769)	LRlc	+	Kandhuli	Excellent
			46. *Chitala chitala* (Hamilton,1822)	NT	+	Chital	Excellent
9	Cyprinodontiformes	Aplocheilidae	47. *Aplocheilus panchax* (Hamilton,1822)	LRlc	+	Kanpona S	Moderate
10	Clupiformes	Clupidae	48. *Gudusia chapra*	LRlc	++	Koroti	Excellent

			(Hamilton,1822)				

LRlc-Lower Risk Least Concern; **EN**-Endangered; **VU**-Vulnerable; **NT**-Near Threatened; **DD**-Data Deficient
+++: High Occurence; ++: Moderate Occurence; +: Rare Occurence
Ornamental Potential: Excellent > High Potential > Moderate

All these species are food fish except for *Chaca chaca* and *Leiodon cutcutia.* The listed fish species have great fin features, aesthetic looks, body colouration and are agile swimmers. The indigenous catfishes, *Mystus tengara, Mystus bleekeri, Chaca chaca, Ompok bimaculatus, Heteropnuestus fossilis, Clarias magur* and snakeheads, *Channa striatus, Channa puctatus, Channa stewartia, Channa gachua* have high potential and are highly demanded as ornamental fish when they are small in size.

3.2.Conservation Status

Out of the 48 species recorded, 42 species enlisted as least concern species (LRlc), 3 species as near threatened (NT), 1 species as vulnerable (VU), 1 species as endangered (EN) and 1 species as data deficient (DD). The overall abundance of ornamental fishes varied across different sampling sites and seasons, indicating the influence of habitat heterogeneity and seasonal dynamics.

Among all the reported species, 15 species showed high occurrence, 17 species showed moderate occurrence and 16 species showed rare occurrence.

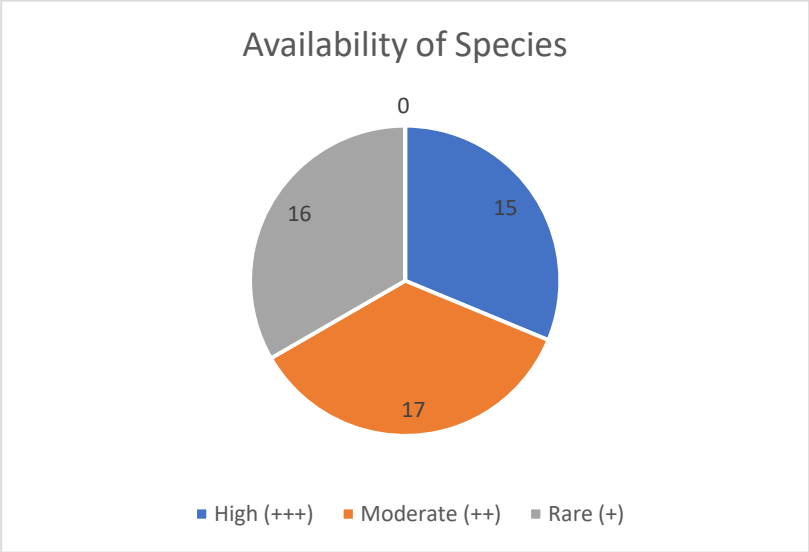

Figure.3 : *Occurrence of Fish species in Khambrenga Beel*

3.3.Degradation of the Wetland

The total open water area has decreased 22.50 ha. from 1992-2019. Massive changes have been found in the period of 2000-2010 i.e. -17.28 ha. where in the period 2010-2019 changes of -4,94 ha. has been observed [15]. It is observed from our study that both natural and anthropogenic activities are responsible for shrinking of the wetland. The dynamic growth of the aquatic vegetation in Khambrenga wetland is very high. It has been discovered that growth of aquatic and semi aquatic vegetation in the wetland has taken place along with many weeds like water hyacinth. Hyacinth has seriously harmed inland waterway ecosystems globally, both economically and ecologically [15][16].

The findings of this study provide valuable information for the conservation and management of Khambrenga Beel's ornamental fish diversity. The presence of diverse species, including popular ornamental fish species, underscores the need to protect this ecosystem from anthropogenic activities such as overfishing, habitat degradation, and pollution. Implementing appropriate conservation measures, including the establishment of protected areas and sustainable fishing practices, is crucial to maintain the long-term viability of ornamental fish populations in Khambrenga Beel.

4. CONCLUSION

The present study demonstrates the diverse assemblage of ornamental fishes in Khambrenga Beel, Assam despite having a small area of the lake. It is the first ever documentation of potential ornamental species from Khambrenga Beel (wetland) in Kamrup District, Assam. The results contribute to the understanding of the fish diversity in this unique wetland ecosystem. At present the wetland is considered as the most threaten habitats plagued by many problems. The wetlands face both natural and anthropogenic problems [17]. Effective conservation strategies, including habitat protection and sustainable management practices, are essential to safeguard the ornamental fish species in Khambrenga Beel and ensure their long-term survival.

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Supplementary

Figure.4: Some listed ornamental fishes of the wetland

4.1 *Pachypterus atherinoides*

4.2 *Mystus tengera*

4.3 *Mystus blekeri*

4.4 *Trichogaster lalius*

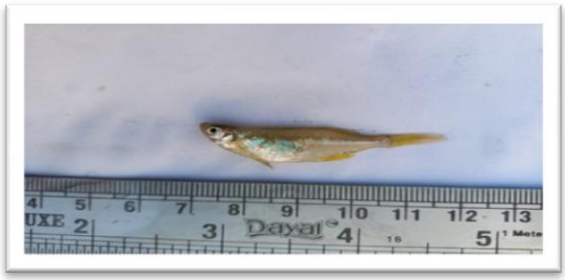
4.11 *Puntius chola*

4.12 *Acanthocoibitis botia*

4.13 *Parambasis baculis*

4.14 *Chanda nama*

4.15 *Trichogaster fasciata*



4.16 *Esomus danricus*

4.17 *Ompok bimaculatus*

4.18 *Nandus nandus*

4.19 *Chanda nama*

4.20 *Pethia gelius*

4.21 *Gudusia chapra*

4.22 *Aplochelius panchax*

4.23 *Xenontodon cancila*

4.24 *Trichogaster labiosus*

4.25 *Badis assamensis*

4.26 *Leiodon cutcutia*

Glosogobius giuris

Notopterus notopterus

4.27 *Puntius sophore*

4.28 *Anabus testudineus*

4.29 *Trichogaster chuna*

4.30 *Puntius terio*