



Species Composition and Conservation Status of Ornamental Fishes in Khambrennga Wetland, Kamrup District, Assam, India

Aminur Rahman ^{a*}, Abinash Kalita ^b, Sajidul Islam ^b
and Parag Deka ^b

^a Department of Zoology, Cotton University, Guwahati, Assam, India.

^b Department of Zoology, Pandu College, Guwahati, Assam, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author AR designed and wrote the protocol of the study. Authors AK, SI and AR performed the study and analysed the results. Author AR wrote the first draft of the paper. Authors PD guided the study and provided inputs for the overall study. All authors read and approved the final manuscript.

Article Information

DOI: 10.56557/UPJOZ/2024/v45i53926

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://prh.mbimph.com/review-history/3266>

Original Research Article

Received: 16/12/2023

Accepted: 21/02/2024

Published: 27/02/2024

ABSTRACT

Ornamental fish culture, also known as aquaculture, 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 Khambrennga 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

*Corresponding author: Email: amirahmans@gmail.com;

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 Khambrengea 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 (LRIc), 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 Khambrengea 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 Khambrengea 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 aquaculture, 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 Khambrengea Beel which is a wetland in the outskirts of the Guwahati City.

2. MATERIALS AND METHODS

2.1 Study Area

The study area, Khambrengea beel also known as Khambrengea Wetland or Khambrengea 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. Khambrengea 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.

2.2 Geography

The beel is a polygonal riverine wetland situated 26° 13'15" North and 91° 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 Sanctuary. The beel has an average altitude of 70 meters above sea level.

2.3 Climate

Khambrennga 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°C to 33°C. 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, Khambrennga 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 monsoon 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.

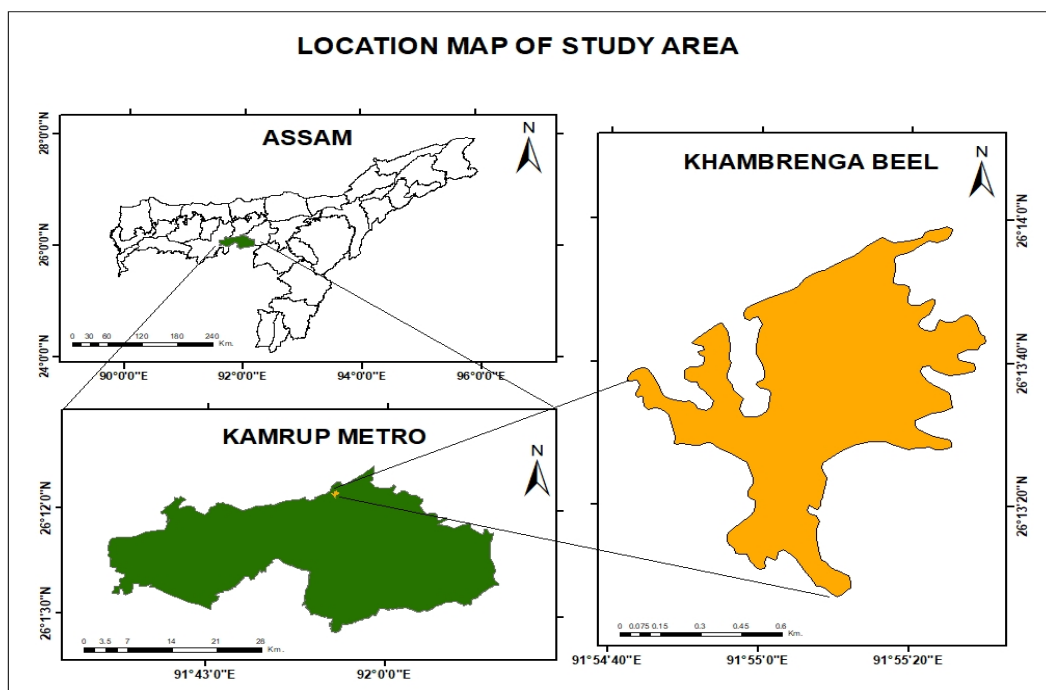


Fig. 1. Map of study area with location

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 Khambrennga 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 belong to Siluriformes order, 2 species belong to Ostioglossiformes order, 2 species belong to Synbranchiformes order and 1 species each belonging to orders Beloniformes, Gobiiformes, Tetradontiformes, Cyprinodontiformes, Clupiformes respectively. The family Cyprinidae of Cypriniformes order is the most abundant family in Khambrennga wetland as well as other freshwater wetlands of Assam [15,16]. The 47 species belongs to the following families (Fig.2.).

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

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*, *Heteropneustes 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.

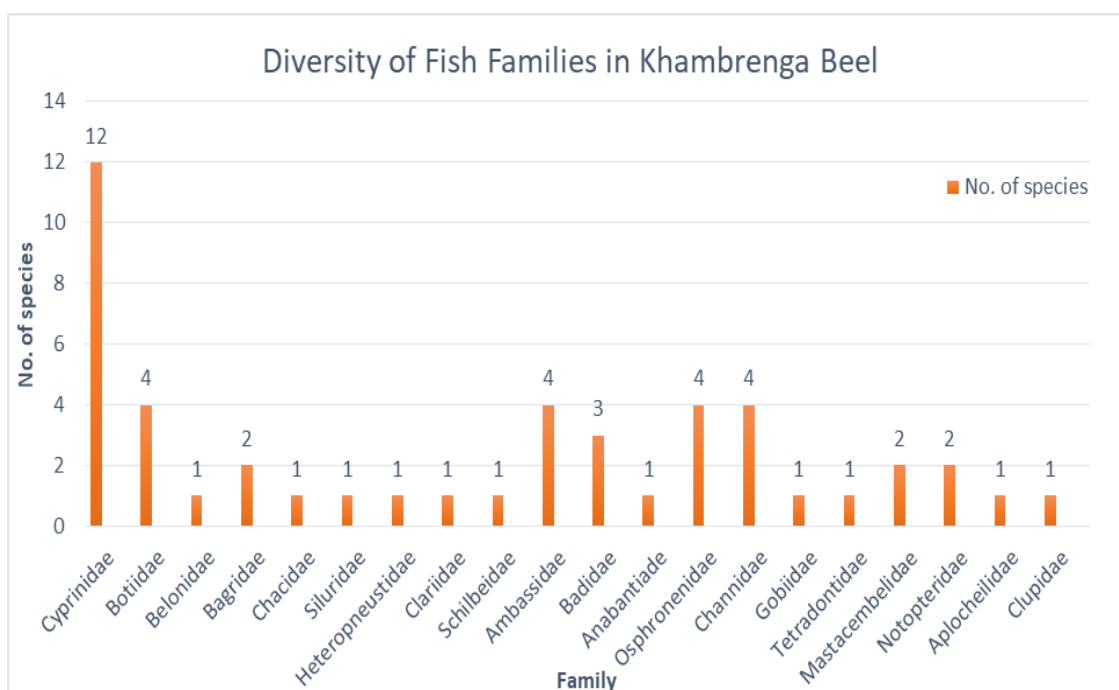


Fig. 2. Diversity of Fish Families in Khambrennga Beel

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

Order	Family	Species Names	IUCN Status	Occurrence	Local name	Ornamental Potential	
1	Cypriniformes	Cyprinidae	1. <i>Amblypharyngodon mola</i> (Hamilton, 1822)	LRlc	+++	Moa	Excellent
			2. <i>Esomus danricus</i> (Hamilton, 1822)	LRlc	+++	Dorikona	Excellent
			3. <i>Pethia conchonius</i> (Hamilton, 1822)	LRlc	+++	Puthi	Excellent
			4. <i>Pethia gelius</i> (Hamilton, 1822)	LRlc	++	Puthi	Excellent
			5. <i>Puntius chola</i> (Hamilton, 1822)	LRlc	++	Puthi	Excellent
			6. <i>Puntius sophore</i> (Hamilton, 1822)	LRlc	+++	Puthi	Excellent
			7. <i>Puntius terio</i> (Hamilton, 1822)	LRlc	+	Puthi	Excellent
			8. <i>Pethia ticto</i> (Hamilton, 1822)	LRlc	+	Kanee Puthi/ Kenipothia	Excellent
			9. <i>Pethia phutunio</i> (Hamilton, 1822)	LRlc	+++	Puthi	Excellent
			10. <i>Rasbora daniconius</i> (Hamilton, 1822)	LRlc	++	Dorikona	Excellent
			11. <i>Rasbora rasbora</i> (Hamilton, 1822)	LRlc	+++	Eleng/Dorikona	Excellent
			12. <i>Salmostoma bacaila</i> (Hamilton, 1822)	LRlc	+	Selkona	Excellent
			13. <i>Botia dario</i> (Hamilton, 1822)	LRlc	+	Rani-botia	Excellent
			14. <i>Botia lohachata</i> (Hamilton, 1822)	LRlc	+	Botia	Excellent
			15. <i>Lepidocephalichthys guntea</i> (Hamilton, 1822)	LRlc	++	Guntel botia	Excellent
			16. <i>Acanthocobitis pavonacea</i> (McCelland, 1839)	VU	+	Botia	High potential
2	Beloniformes	Belonidae	17. <i>Xenentodon cancila</i> (Hamilton, 1822)	LRlc	+++	Kokila	Excellent
3	Siluriformes	Bagridae	18. <i>Mystus tengara</i> (Hamilton, 1822)	LRlc	++	Singarah	Excellent
			19. <i>Mystus bleekeri</i> (Day, 1877)	LRlc	++	Singarah	Excellent
		Chacidae	20. <i>Chaca chaca</i> (Hamilton, 1822)	LRlc	+	Kurkuri	High potential
		Siluridae	21. <i>Ompok bimaculatus</i> (Bloch, 1794)	NT	+	Pabhoh	Moderate
		Heteropnuestidae	22. <i>Heteropnuestus fossilis</i> (Bloch, 1794)	LRlc	+++	Singi	High potential
		Clariidae	23. <i>Clarias magur</i> (Hamilton, 1822)	EN	+++	Magur	High potential
Schilbeidae	24. <i>Pachypterus atherinoides</i> (Bloch, 1794)	LRlc	++	Bohduah/ Bordia	Moderate		
4	Perciformes	Ambassidae	25. <i>Parambassis baculis</i> (Hamilton, 1822)	LRlc	+	Chanda	Excellent
			26. <i>Parambassis lala</i> (Hamilton, 1822)	NT	++	Chanda	Excellent
			27. <i>Parambassis ranga</i> (Hamilton, 1822)	LRlc	++	Chanda	Excellent
		Badidae	28. <i>Chanda nama</i> (Hamilton, 1822)	LRlc	+++	Chanda	Excellent
			29. <i>Nandus nandus</i> (Hamilton, 1822)	LRlc	++	Gedgedi/ Bhetki/ Veheri	Excellent
			30. <i>Badis assamensis</i> (Ahl, 1937)	DD	+	Vacheli	High potential
			31. <i>Badis badis</i> (Hamilton, 1822)	LRlc	++	Randhane maas	Excellent
		Anabantidae	32. <i>Anabas testudineus</i> (Bloch, 1794)	LRlc	+++	Kawoi	Excellent
		Osphronenidae	33. <i>Trichogaster fasciata</i> (Bloch & Schneider, 1801)	LRlc	+++	Kholihona	Excellent
			34. <i>Trichogaster lalius</i> (Hamilton, 1822)	LRlc	+	Lal-kholihona	Excellent
			35. <i>Trichogaster labiosa</i> (Day, 1877)	LRlc	+++	Kholihona	Excellent
			36. <i>Trichogaster chuna</i> (Hamilton, 1822)	LRlc	++	Bahsaylee	Excellent
			Channidae	37. <i>Channa striatus</i> (Bloch, 1793)	LRlc	++	Khol

Order	Family	Species Names	IUCN Status	Occurrence	Local name	Ornamental Potential
		38. <i>Channa puctatus</i> (Bloch,1793)	LRlc	+++	Goroi	Moderate
		39. <i>Channa stewarti</i> (Playfair, 1876)	LRlc	+	Chengeli	High potential
		40. <i>Channa gachua</i> (Hamilton,1822)	LRlc	+++	Cheng	Moderate
5	Gobiiformes	Gobiidae				
		41. <i>Glossogobius giuris</i> (Hamilton,1822)	LRlc	++	Panimutura	High potential
6	Tetraodontiformes	Tetraodontidae				
		42. <i>Leiodon cutcutia</i> (Hamilton,1822)	LRlc	+	Gangatope	Excellent
7	Synbranchiformes	Mastacembelidae				
		43. <i>Macrornathus aral</i> (Bloch & Schneider,1801)	LRlc	++	Tora/ Turi	Excellent
		44. <i>Macrornathus pancalus</i> (Hamilton,1822)	LRlc	++	Tora/ Turi	Excellent
8	OstioGLOSSIFORMES	Notopteridae				
		45. <i>Notopterus notopterus</i> (Pallas,1769)	LRlc	+	Kandhuli	Excellent
		46. <i>Chitala chitala</i> (Hamilton,1822)	NT	+	Chital	Excellent
9	Cyprinodontiformes	Aplocheilidae				
		47. <i>Aplocheilus panchax</i> (Hamilton,1822)	LRlc	+	Kanpona	Moderate
10	Clupiformes	Clupidae				
		48. <i>Gudusia chapra</i> (Hamilton,1822)	LRlc	++	Koroti	Excellent

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

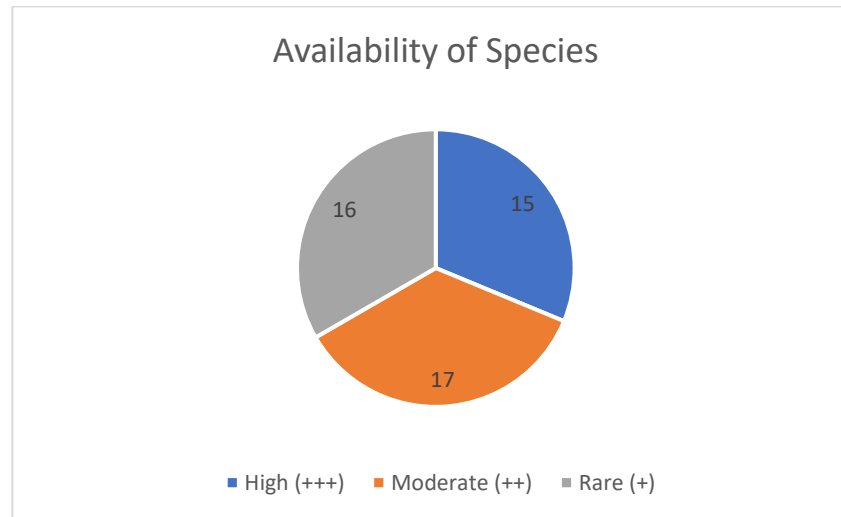


Fig. 3. Occurrence of Fish species in Khambrenka Beel

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.

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 [17]. 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 Khambrengea 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 [17,18].

The findings of this study provide valuable information for the conservation and management of Khambrengea 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 Khambrengea Beel.

4. CONCLUSION

The present study demonstrates the diverse assemblage of ornamental fishes in Khambrengea Beel, Assam despite having a small area of the lake. It is the first ever documentation of potential ornamental species from Khambrengea 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 [19]. Effective conservation strategies, including habitat protection and sustainable management practices, are essential to safeguard the ornamental fish species in Khambrengea Beel and ensure their long-term survival.

ACKNOWLEDGEMENT

The authors sincerely acknowledge the people of the nearby village of Khambrengea Beel (wetland) for their continuous assistance in pursuing the present work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. "Ornamental Fish Market Size, Share & Growth Analysis." Industry Forecast 2022-2030. Accessed: Feb. 19, 2023. [Online]. Available: <https://www.skyquestt.com/report/ornamental-fish-market>.
2. "Guidelines for the Import of Ornamental Fishes into India," Department of Animal Husbandry, Dairying and Fisheries (DAHDF), Accessed: March. 19, 2023. [Online]. Available: <https://www.dahd.nic.in>
3. Debnath R, et al. The Present Fisheries Status of Assam: A Review," Int J Curr Microbiol Appl Sci. 2020;9(11):629–636. DOI: 10.20546/ijcmas.2020.911.077.
4. Goswami UC, Basistha SK, Bora D, Shyamkumar K, Saikia B, Changsan K. Fish diversity of North East India, inclusive of the Himalayan and Indo Burma biodiversity hotspots zones: A checklist on their taxonomic status, economic importance, geographical distribution, present status and prevailing threats. International Journal of Biodiversity and Conservation. 2012 Dec;4(15):592-613. DOI: 10.5897/IJBC11.228.
5. Biswas SP, Santosh Kumar, and Das JN. Conservation and Management of Ornamental Fish Resources of North East India. J Aquac Res Dev. 2015;06(03). DOI: 10.4172/2155-9546.1000310.
6. Goswami C, Zade VS. Ornamental fish Diversity across Brahmaputra Valley of Assam; 2015. [Online].

- Available: www.ijiset.com
7. Records & Averages; 2023. [Online]. Available: www.msn.com/en-us/weather.
8. Central Ground Water Board, "Ground water information booklet Kamrup district at a glance; 2013.
9. Fishbase; 2023. [Online]. Available: www.fishbase.se.
10. Banerjee D, Laishram K. Fauna of Assam, 1st ed., vol. 2. Zoological Survey of India; 2023.
11. Barooah C, Sarma L. Vertebrates of Assam, 1st ed. Assam Science Technology and Environmental Council; 2016.
12. Sarma N. The Fishes of Assam, EBH Publishers (India); 2017.
13. "IUCN Redlist of Threatened species; 2023. [Online]. Available: www.iucnredlist.org.
14. Harsha Haridas, Saravanan K, Praveenraj J, Ravindra Sontakke, Gladston Y, Ajina SM, Deepitha R, Sreepriya Prakasasn, Kiruba Sankar R, Dam Roy S. Training Manual on Freshwater Ornamental Fish Breeding and Aquascaping Techniques. ICAR-CIARI, Port Blair, India. 2019;39.
15. Rahman W, Deka R, Kalita B, Deka P. Comparative study on Ichthyofaunal resources of Charan and Manaha Beel of Morigan District of Assam, India. International Journal of Fish and Aquatic Studies. 2016;4(4):43-51.
16. Kalita P, Pathak S, Deka P. A preliminary study on ichthyofaunal resource of Motapung-Maguri Beel of Tinsukia district of Assam, India. Int. J. Fauna Biol. Stud. 2016;3(4):97-102.
17. Goswami, Jayanta, Kalita, Pradip, Alajangi, Simhachalam. Mapping and Change Analysis of Wetland using Geospatial Technology: A Case Study of Khamranga Wetland, Chandrapur Kamrup M, Assam; 2021.
18. Baruah DP, Medhi K. An Investigation on Assessment of Ecological and Socio-Economic Condition of Khamrenga Wetland, Assam, India. Int. J. of Aquatic Science. 2018;9(2):122-129.
19. Das I. Degradation of wetland environment: A case study of Dora Beel of Kamrup District, Assam. Meander. 2015; 861(15460.60):15-28.

SUPPLEMENTARY



4.1 *Pachypterus atherinoides*



4.2 *Mystus tengera*



4.3 *Mystus blekeri*



4.4 *Trichogaster lalius*



4.5 *Macroglyphus panculus*



4.6 *Badis badis*



4.7 *Amblypharyngodon mola*



4.8 *Macroglyphus aral*



4.9 *Notopterus notopterus*



4.10 *Salmostoma bacalia*



4.19 *Chanda nama*



4.20 *Pethia gelius*



4.21 *Gudusia chapra*



4.22 *Aplochelys panchax*



4.23 *Xenontodon cancila*



4.24 *Trichogaster labiosus*



4.25 *Badis assamensis*



4.26 *Leiodon cutcutia*



4.11 *Puntius chola*



4.12 *Acanthocoibitis botia*



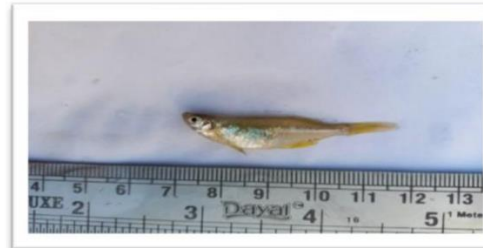
4.13 *Parambasis baculis*



4.14 *Chanda nama*



4.15 *Trichogaster fasciata*



4.16 *Esomus danricus*



4.17 *Ompok bimaculatus*



4.18 *Nandus nandus*



Fig. 4. Some listed ornamental fishes of the wetland

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://prh.mbimph.com/review-history/3266>