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A study on Ichthyofaunal diversity and conservation status in Bhuila Lake of Basti, Uttar Pradesh, India

Jaya Chaudhary, Kavita Chaudhary and *Susmita Srivastav

Department of Zoology,
Shiv Harsh Kisan P.G. College,
BASTI-272001 (UP), INDIA.
*Corresponding Author
E-mail : susmita.sus74@gmail.com;

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ABSTRACT

As the human population continues to expand, India must explore every possible avenue to enhance its food production capacity. Fishes play a crucial role in the economies of numerous nations, serving as a staple food source for many populations. Many of the water bodies that serve as crucial life support systems for numerous organisms are experiencing ecological degradation due to irrational interference and unsustainable development practices. Fish represent nearly fifty percent of the total vertebrate population, making it crucial to preserve their diversity. This study aims to document the fish diversity in Bhuila Lake, located in the Basti district of Uttar Pradesh, India. During the present study, a total of 14 species of fish belonging to 3 orders, 6 families, and 7 genera were recorded from the selected sites of the lake. According to the Conservation Assessment and Management Plan(CAMP) report, conservation status among the identified fourteen species, 1 species is endangered, 3 are vulnerable, and 7 are near threatened, the remaining 3 species are not evaluated. The present study provides an insight into the fish diversity in Bhuila Lake, its proper management, and the importance of conserving the fish diversity

Figures : 04 References : 28 Tables : 03
KEY WORDS : Bhuila Lake, Conservation status, Fish Diversity

Introduction

Fish are considered a valuable biological indicator of environmental quality and anthropogenic stress in aquatic ecosystems[28]. Fish is rich in nutrients and a good source of protein (12% to 25%), hence constituting a stable, important, and delicious food item in the diet of many people. Earth's biodiversity includes an immense variety of life forms and processes[17]. The biodiversity of aquatic environments and its management are acknowledged as critical for the sustainable use of natural resources.India has a diverse array of water bodies, including coldwater and hill streams, brackish waters, estuaries, wetlands, and marine environments. These aquatic environments host a diverse range of fish species. Wetlands hold a significant role among various types of water bodies, serving as essential habitats for waterfowl, fish, and diverse aquatic life. These can be characterised as distinct land areas with varying water levels that hold essential ecological importance and sustain a diverse range of plant and animal species. The conservation of biodiversity is associated with global environmental changes, including climate change and alterations in land use and land cover.The aquatic ecosystems rely on fish, which contribute a wide range of biogenic complexes and ecological traits[14]**.** Fishes are vital for maintaining the biodiversity of an aquatic environment.The diversity of fish in freshwater ecosystems is crucial for the livelihoods and economic viability of nearby communities**.**The growth of a fish species is influenced by its environment[12].Species variety is expected to decline further due to elevated temperatures, diminished precipitation, and increased water withdrawal for agricultural and other purposes[1,26]**.** Considering that fish represent about fifty percent of all vertebrates, it is necessary to conserve their diversity; hence, this study was conducted to investigate fish diversity in the Bhuila Lake of Basti district, Uttar Pradesh, India.

TABLE-1 : Fish diversity in the study area

S. No.	Scientific name	Common/Local Name	Family	Abundance
Order-Clupeiformes				
1	*Notopterus chitala*	Moya	Notopteridae	++
2	*Notopterus notopterus*	Patra	Notopteridae	+++
Order- Cypriniformes				
3	*Cirrhinus mrigala*	Nain	Cyprinidae	++
4	*Cirrhinus reba*	Raia	Cyprinidae	+
5	*Labeo calbasu*	Karaunchar	Cyprinidae	++
6	*Labeo dero*	Gola raia	Cyprinidae	+
7	*Labeo gonius*	Kursi	Cyprinidae	+++
8	*Labeo pangusia*	Rewa	Cyprinidae	+
9	*Mystus cavasius*	Sutahawatengara	Bagridae	++
10	*Mystus osteobagrus*	Dariai tengar	Bagridae	+
11	*Mystus seenghala*	Dariai tengar	Bagridae	+++
12	*Heteropneustes fossilis*	Singhi	Saccobranchidae	+++
13	*Wallago attu*	Padhani	Siluridae	+
Order-Ophiocephaliformes				
14	*Channa stewartii*	Saur	Ophiocephalidae	+

(+++ = Abundant, ++ = Moderate, + = Rare)

Material and Methods

Study Area

A lake is a large water body with a diverse range of plants and animals. The present study was carried out monthly from January to December at Bhuila Lake. This Lake is located near Jaitapur village, tehsil Harraiya, District Basti, Uttar Pradesh. Lake is situated at 82°32’17.5" E longitude and 26°54’06.8" N latitude. The area of this lake is 839439.07 m^2 with a peripheral total distance of 4.3 km. In the current study, six sites were selected based on characteristics such as feasibility, accessibility, fish availability offshore and inshore locations, and various ecological niches.

Collection and preservation of fish

Fish samples were collected monthly with the help of various net sizes from six selected sites in the lake by

TABLE-2 : Family-wise representation of the number and percentage of fish at Bhuila Lake

S. No.	Order	Family	No. of species	Fish species percentage
1	Order:Clupeiformes	Notopteridae	2	14.29
2	Order: Cypriniformes	Cyprinidae	6	42.86
		Bagridae	3	21.43
		Saccobranchidae	1	7.14
		Siluridae	1	7.14
3	Order: Ophiocephaliformes	Ophiocephalidae	1	7.14

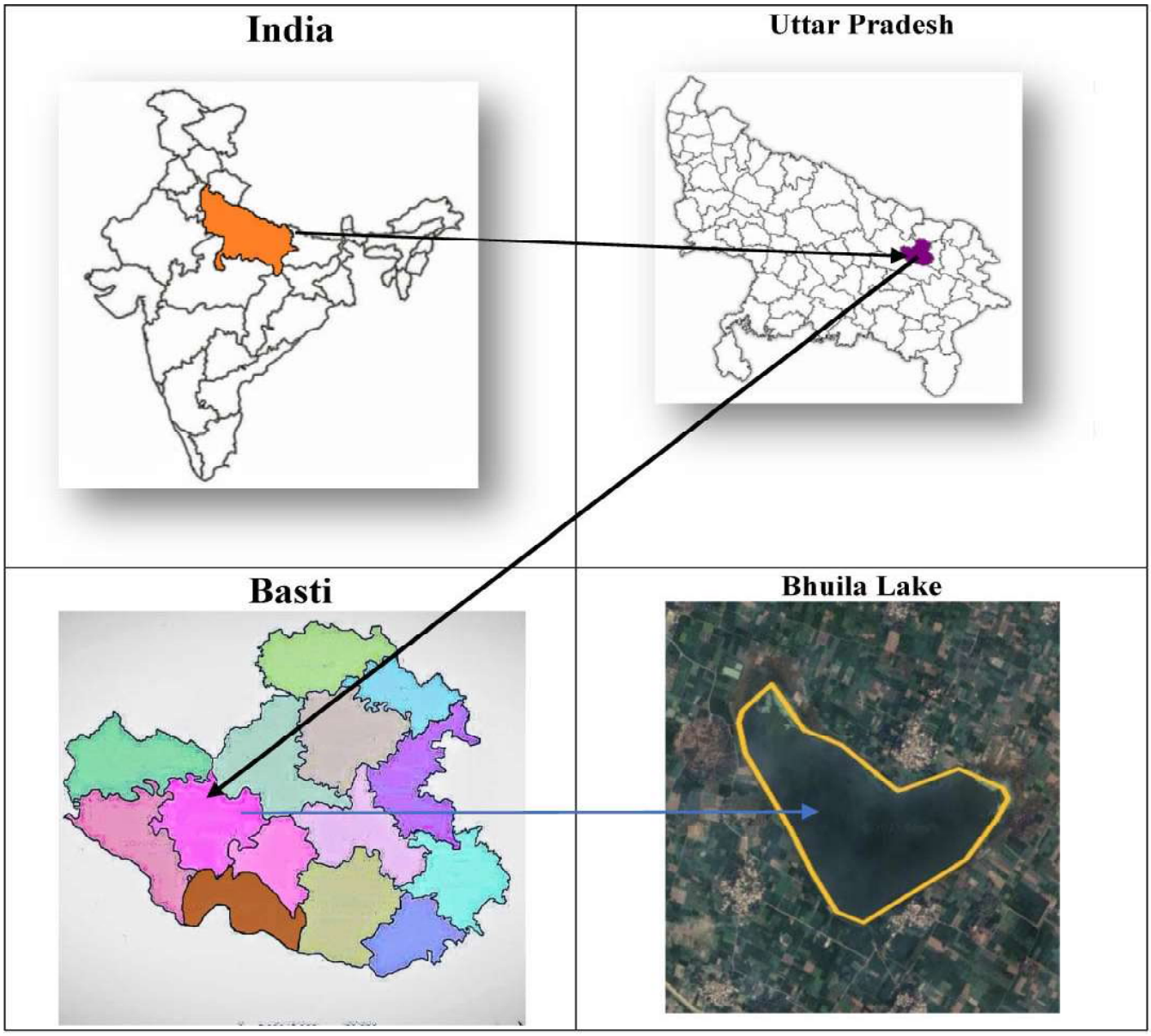

Fig. 1 : Location of Study Area (Source: Government of India, Google map)

TABLE-3 : Conservation status of Bhuila Lake

S. No.	Taxonomical rank	Scientific name	IUCN status	CAMP status
1	**Order:Clupeiformes**			
	Family: Notopteridae	*Notopterus chitala*	NT	EN
		Notopterus notopterus	LC	LR-nt
2	**Order: Cypriniformes**			
	Family: Cyprinidae	*Cirrhinus mrigala*	LC	LR-nt
		Cirrhinus reba	LC	VU
		Labeo cal basu	LC	LR-nt
		Labeo dero	LC	VU
		Labeo gonius	LC	LR-nt
		Labeo pangusia	NT	LR-nt
	Family: Bagridae	*Mystus cavasius*	LC	LR-nt
		Mystus osteobagrus	NE	NE
		Mystus seenghala	LC	NE
	Family: Saccobranchidae	*Heteropneustes fossilis*	LC	VU
	Family: Siluridae	*Wallago attu*	VU	LR-nt
3	**Order: Ophiocephaliformes**			
	Family: Ophiocephalidae	*Channa stewartii*	LC	NE

(EN = Endangered; VU = Vulnerable; LR-nt = Lower risk near threatened; LC = Least concern; NT = Near Threatened)

local fishermen operating cast nets for catching fish in the morning hours.A field kit, comprising measuring measuring tape, buckets, preservative, enamel trays, digital camera, etc., was assembled for routine usage. A boat was used, and sampling stations were visited in a meticulously adhered sequence throughout the investigation period.Since preservation discolours the fish, photographs were taken onsite. The collected fish were brought to the laboratory and were fixed in the solution according to the size of the species in separate jars. The larger fish were given an abdominal incision before being fixed; the smaller fish were immersed in the formalin solution. The fish were tagged with their serial number, precise size, date of collection, and local name. The standard keys were used to systematically identify fish[4,10,11,21,23].The status of each fish was determined based on the report of the Conservation Assessment and Management Plan (CAMP-1998)[3] for freshwater fishes of India, as well as the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN-2025)[7]. The classification of fish relative abundance is divided into three categories: Abundance (+++) represents 71 to 100% of the total catch, Moderate (++) represents 36 to 70% of the total catch, and Rare (+) represents 1 to 35% of the total catch, under the assumption that fishing effort remains

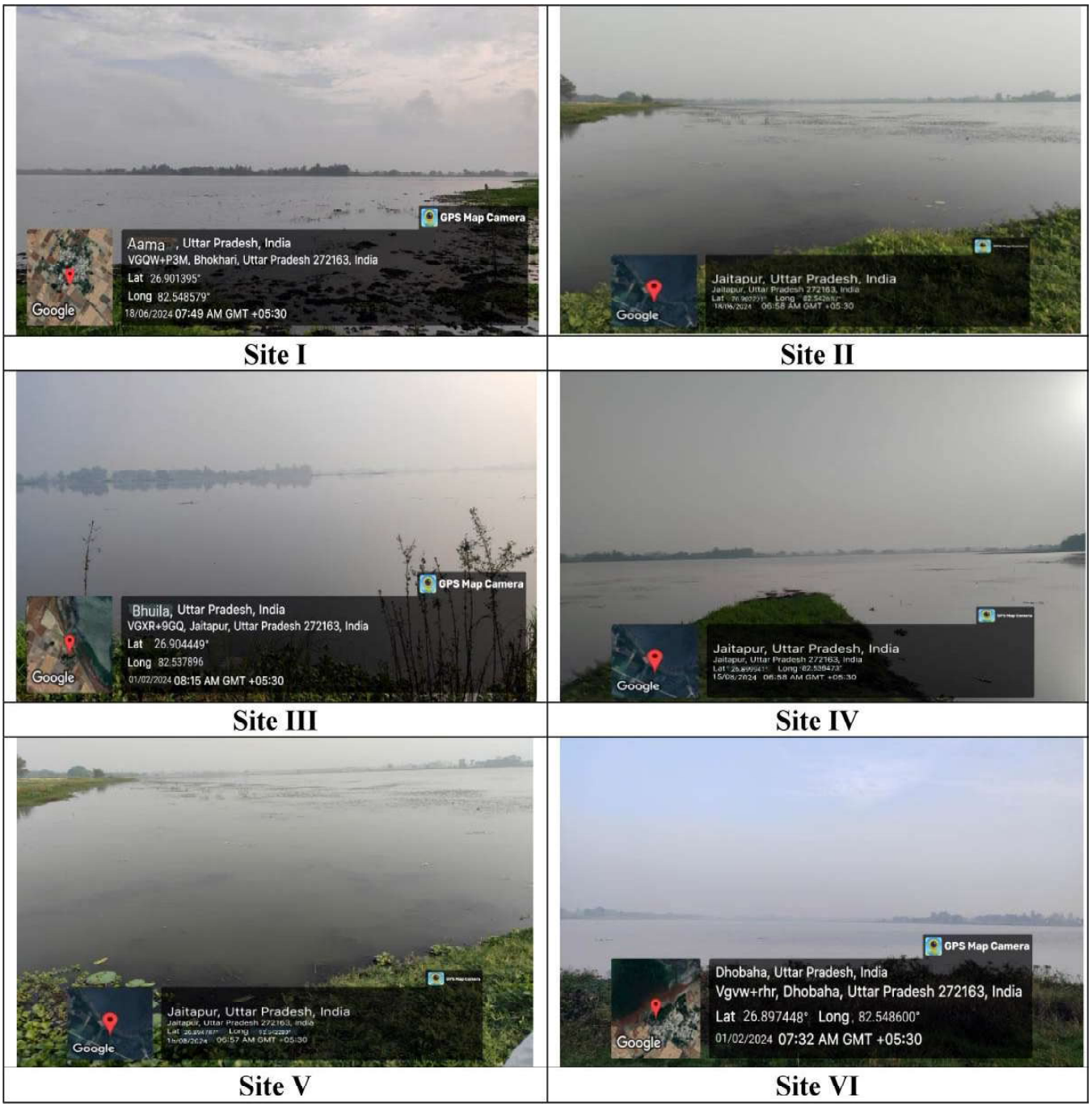

Fig. 2 : Location of Sampling Sites

Site	Near	Latitude longitude
Site I	Aama Bhuilapar	26.901395 ° 82.548579°
Site II	Jaitapur west	26.902231° 82.542657°
Site III	Bhuila Deeh	26.904449° 82.537896°
Site IV	Baba bhuileshwar Mandir	26.899941° 82.538473°
Site V	Jaitapur East	26.894787° 82.542289°
Site VI	Dhobha	26.897448° 82.548600°

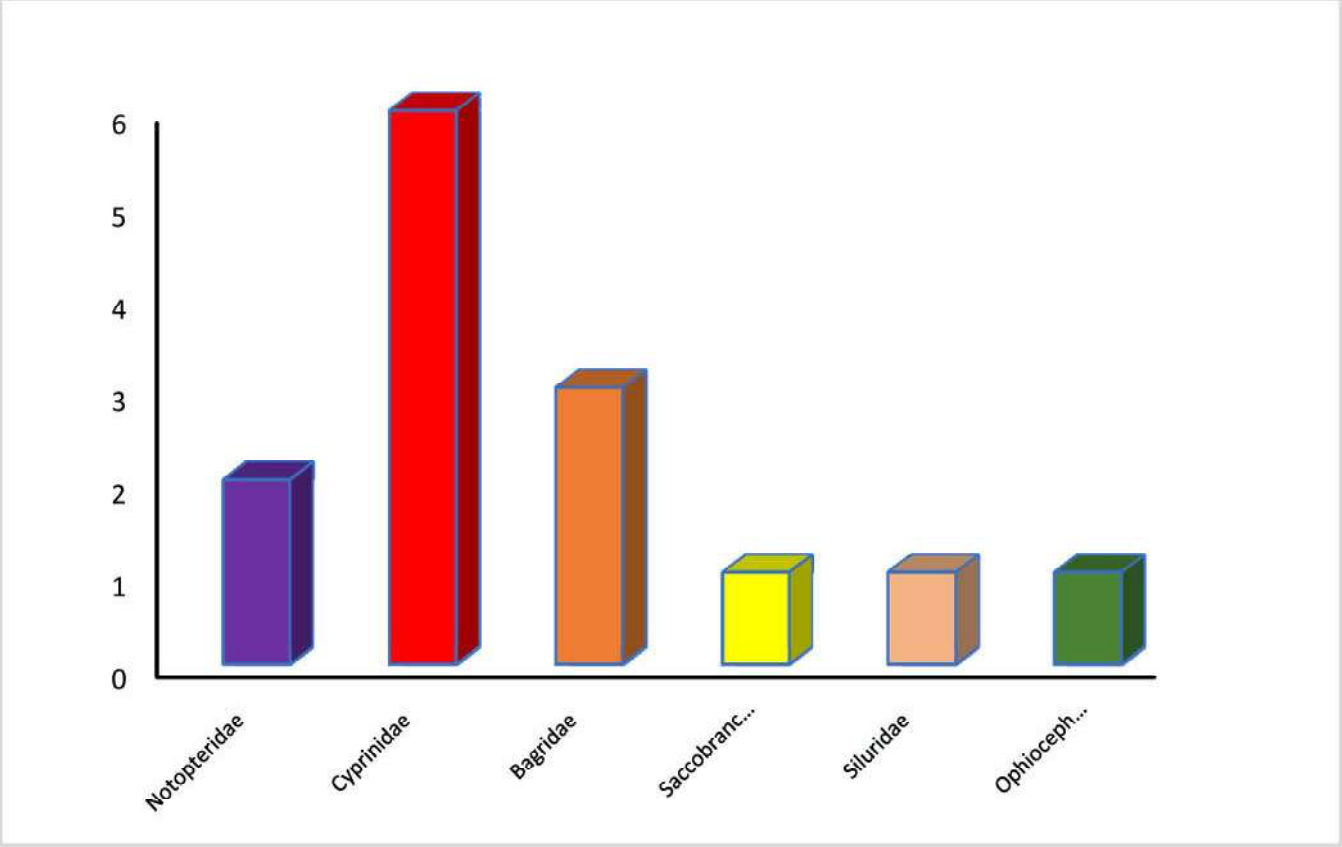

Fig. 3 : Order and number of species wise arrangement of fishes at Bhuila Lake

constant for each catch.

Result and Discussion

The current investigation reported 14 species of fish belonging to 3 different orders, 6 different families, and 7 genera from different selected sampling sites within the lake. The taxonomic distribution and relative abundance of the species present in the lake are shown (Table-1 and Fig. 3), respectively. The percentage of the contribution of other families is shown in Table-2. The most prevalent order was found in Cypriniformes, which includes the family Cyprinidae, has six species, about 42.86% of total diversity *Cirrhinus mrigala, Cirrhinus reba, Labeo calbasu, Labeo dero, Labeo gonius, Labeo pangusia,* Family Bagridae contains 3 species (21.43%): *Mystus cavasius, Mystus osteobagrus, Mystus seenghala.* The Saccobranchidae and Siluridae families each comprise one species, *Heteropneustes fossilis, Wallago attu,* respectively. Another observed order Clupeiformes, family Notopteridae (14.29 %) - *Notopterus chitala, Notopterus notopterus.* From the Order Ophiocephaliformes, there exists only one family, Ophiocephalidae,(7.14%) *Channa stewartii*.

Labeo gonius, Mystus seenghala, Heteropneustes fossilis, and *Notopterus notopterus* are prevalent fish species in the research sites, followed *by Notopterus chitala, Cirrhinus mrigala, Labeo calbasu, and Mystus cavasius. Cirrhinus reba, Labeo dero, Labeo pangusia, Mystus osteobagrus, Wallago attu,* and *Channa stewartii* are the least abundant fish species in Bhuila Lake.

Conclusion

This ichthyofaunal study is crucial for comprehending the various fish fauna in the aquatic environment. Alterations in the fish community directly or indirectly influence the physicochemical and biological attributes of the lake. The study indicates that numerous causes contribute to the declining biodiversity of fish in the lake. These include habitat degradation, siltation, and water contamination resulting from nearby domestic waste, pesticides, and agrochemicals, as well as the elimination of breeding grounds.

Nursery grounds resulted from willow cultivation and the transformation of lake regions into agricultural land.In order to preserve ecological integrity and reverse the decline in aquatic diversity, the study also suggests that the protected area's management and strategy need to be revised.The IUCN reports that of 14 species, 1 is classified as vulnerable, 2 as near threatened, 10 as least concern, and 1 remain unassessed. The CAMP report lists one endangered species, three vulnerable

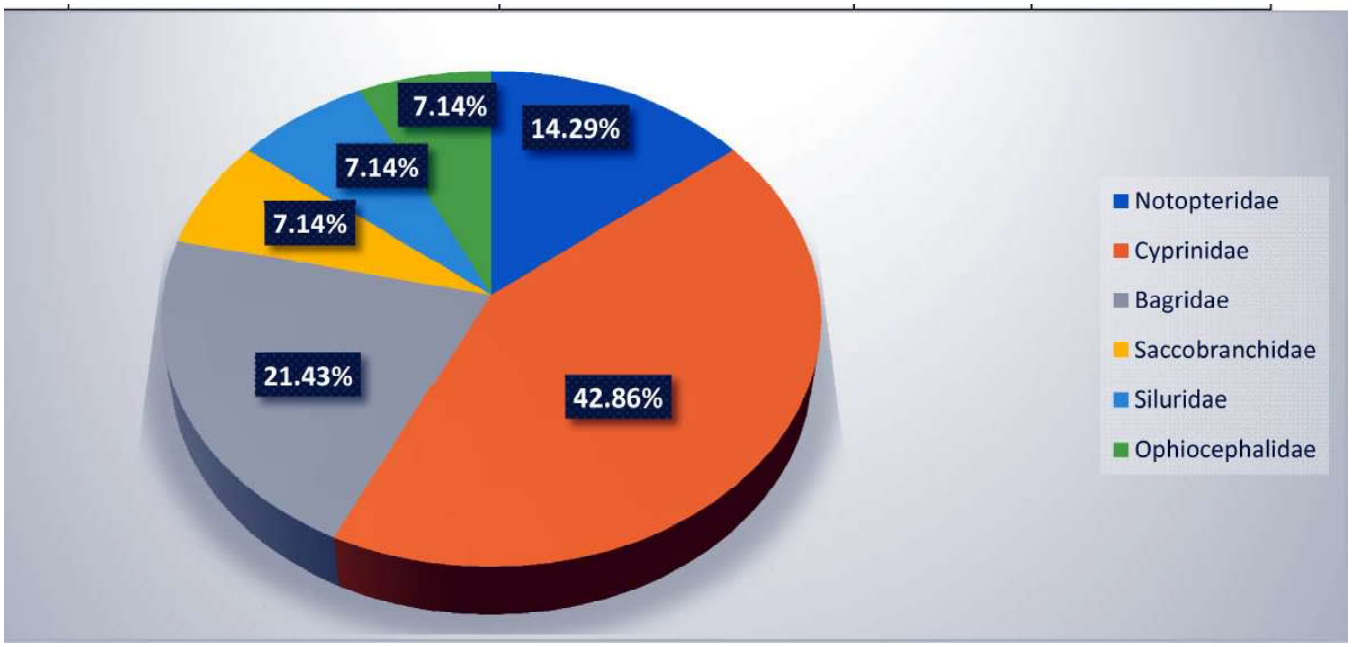

Fig. 4: Family wise percentage representation of fishes at Bhuila Lake

species, and seven near-threatened species. Three species have not been evaluated. Previous studies have also been conducted on the conservation status of fish[27]. Research on fish from the freshwater or inland water sources of the Indian subcontinent has been conducted for the past century[11]. Over the past few decades, researchers have examined the diversity of ichthyofauna in diverse freshwater bodies across India[2,5,8,9,15,16,18-21,24-26]. Pollution and unsustainable overfishing are the primary factors contributing to the reduction of fish populations. Long, fine-mesh nylon nets are used to randomly kill brooders throughout the breeding season[6].The study emphasises the necessity of revising the management approach of the study area to maintain ecological integrity and restore aquatic diversity loss.

Recommendations

To preserve fish diversity, it is advisable to implement specific conservation measures:

- Avoiding the introduction of non-native species is crucial.
- Fingerling/fry must remain undisturbed during this phase.
- Harvesting should be strictly prohibited during breeding seasons.
- Implementation of a catch limit to prevent overfishing
- Continuous monitoring of the fish population and habitat to identify the areas that need protection
- Educate the public about the significance of biodiversity in sustaining ecological equilibrium
- Measures should be taken to mitigate anthropogenic activities such as pollution and contamination.
- Engage the local community and involve them in the fishery management and conservation effort

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