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Ichthyofaunal diversity of Ramgarh Lake, Gorakhpur, Uttar Pradesh

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Abstract
Survey of Fishes in the proposed area of Ramgarh Lake was done in the month of January, 2025. Investigation revealed the occurrence of 21 native and 4 exotic species of fin fishes (total 25) belonging to 6 orders and 10 families. The details of the species recorded in the lake were- Osteoglossiformes (Notopteridae- *Notopterus notopterus*, *Chitala chitala*), Cypriniformes species (Cyprinidae- *Catla catla, Labeo rohita, Labeo bata, Labeo gonius, Cirrhinus mrigala, Cirrhinus reba, Hypophthalmichthys molitrix, Ctenopharyngodon idella, Aristichthys nobilis, Cyprinus carpio, Oxygaster bacaila, Puntius sarana*), Siluriformes (*Mystus tengara*, *Mystus vittatus*, Sisoridae- *Bagarius bagarius*; Pangasidae- *Pangasius pangasius*, Clariidae- *Clarias batrachus*; Heteropneustidae- *Heteropneustes fossilis*), Perciformes (Channidae- *Channa punctatus*, *Channa striatus*, *Channa marulius*, Synbranchiformes (Mastacembelidae- *Mastacembelus armatus*, Beloniformes (Belonidae-*Xenantodon cancila*). Though commercially important fishes are being cultured in Ramgarh Lake, importance of small indigenous freshwater fishes (SIFs) present in this water body for sustained nutritional security of poor people residing in nearby localities may not be overlooked.

Keywords: Biodiversity, indigenous freshwater fishes, sustained nutritional security, Gorakhpur, exotic

Introduction
Lakes are important part of our ecosystem that provide not only direct benefits like, drinking water, irrigation, fishes, aquatic crop production, recreation etc. but also indirect benefits like, regulation of hydrological cycle, local climate control, maintenance of ecological biodiversity etc. But now, lakes are being contaminated through various pollutants due to urbanization in recent decades. As a result of which diversity of flora and fauna also decreased. The present work is carried out to study the diversity of fishes of the lake at present.

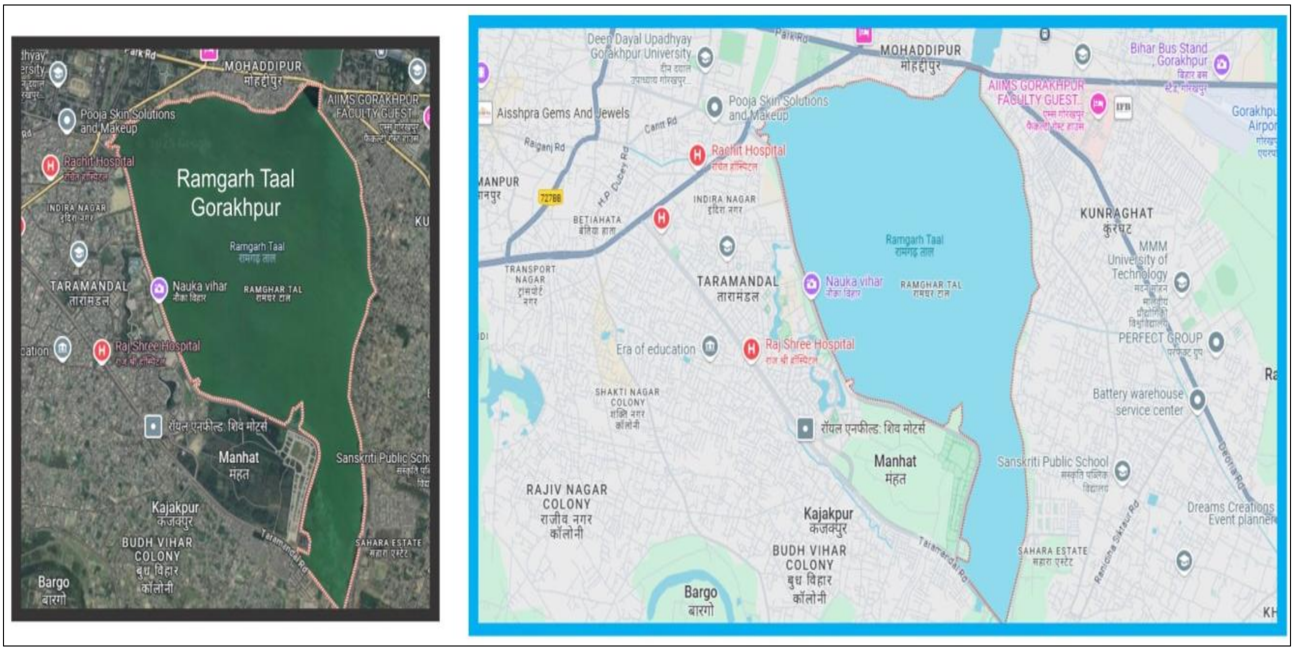
India is a prominent freshwater lake of considerable ecological, cultural, and economic importance. Encompassing an area of approximately 700 hectares, the lake plays a vital role in sustaining regional biodiversity and supporting local livelihoods, particularly through fisheries and agriculture. A notable ecological feature of Ramgarh Lake is its rich and diverse Ichthyofaunal assemblage, which renders it a critical habitat for numerous freshwater fish species. This Ichthyofaunal diversity is attributed to the lake's favorable ecological parameters, including heterogeneous aquatic vegetation, nutrient-rich waters, and dynamic hydrological regimes. These conditions collectively facilitate the coexistence of both indigenous and migratory fish species.

The lake harbors a wide array of economically and ecologically significant fish taxa. Noteworthy among these are species from the family Cyprinidae, such as *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala*, which constitute the major Indian carps.

Ramgarh Lake also functions as a critical breeding and nursery ground for several fish species, thereby contributing significantly to the recruitment and sustainability of regional fish populations. However, in recent years, the lake's Ichthyofaunal diversity has been increasingly threatened by anthropogenic pressures, including pollution, eutrophication, overfishing, and habitat modification. The proliferation of invasive species and unregulated fishing practices further exacerbate the vulnerability of native fish populations.

In response to these challenges, various conservation initiatives have been undertaken by local authorities and environmental organizations. These include community-based awareness programs, ecological restoration projects, and the implementation of sustainable fisheries management strategies. The conservation of Ichthyofaunal diversity in Ramgarh Lake is imperative not only for preserving ecological integrity but also for ensuring the long-term sustainability of fisheries-based livelihoods and the overall health of this vital freshwater ecosystem.

Study area: Ramgarh Lake is a lake located in Gorakhpur, Uttar Pradesh, India. In 1970, at its largest size, the lake covered an area of 723 hectares (1,790 acres) with a circumference of 18 kilometers. Today, it covers about 678 hectares (1,680 acres) area of Gorakhpur City, the headquarters of Gorakhpur District, is the second most vital town in Eastern Uttar Pradesh, after Varanasi. Geographically, it lies between 26°46' to 26°47' N latitude and 83°22' to 83°23' E longitude, covering an approximate area of 700 to 750 hectares. The lake is nearly circular in shape and serves as a prominent water body within the Gorakhpur urban landscape.



Map 1: Showing satellite map of Ramgarh Lake of (Gorakhpur) (Source: satellites pro)

Materials and Methods

Material required
- Camera
- Pen & Notebook
- Dissection Box
- Dissecting Tray
- Bottles for preservation
- Formalin

Plan of required Work
- Survey of fishes in the Ramgarh Lake was done.
- Photographic evidence of the Collected Sample Fishes was done using I-Phone 12 mobile phone.

Basis of selection of Study Area
1. **Ecological Richness and Biodiversity Hotspot:** Ramgarh Lake is one of the ecologically significant freshwater bodies in eastern Uttar Pradesh, known for its rich fish diversity. It supports a variety of indigenous and commercially important fish species, including members of the Cyprinidae, Siluridae, Channidae, and Notopteridae families. The lake's biodiversity offers a unique opportunity to study species distribution, habitat associations, and seasonal variation in fish populations
2. **Geographical and Hydrological Suitability:** The lake spans an area of approximately 723 hectares and is fed by rainwater and local drains, creating a semi-natural lentic environment. Its varying depth and vegetative cover provide diverse ecological niches for aquatic organisms. The physical and hydrological characteristics make it a suitable site for year-round sampling, population monitoring, and water quality assessments
3. **Anthropogenic Influence and Environmental Stress:** Ramgarh Lake is increasingly affected by anthropogenic pressures such as urban runoff, domestic sewage discharge, agricultural effluents, and encroachment. These stressors impact fish diversity, water quality, and ecosystem stability. Thus, the lake serves as an appropriate model to evaluate the effects of pollution, eutrophication, and other disturbances on aquatic fauna
4. **Socio-economic Relevance:** The lake supports a substantial number of local fishers who depend on it for their livelihood. It contributes to the local economy through fish production and tourism. Assessing the fish diversity and ecological health of the lake is essential for sustainable fisheries management and community welfare, aligning with the goals of conservation-oriented research
5. **Availability of Historical Data and Previous Studies:** Ramgarh Lake has been the focus of various limnological and ichthyological studies, providing a valuable baseline for further research. Existing records facilitate comparative studies over time, including assessments of emerging threats such as fish parasitism (e.g., Ichthyophonus spp.) and invasive species. This historical context enhances the scientific viability of the site.

Method of Study: Fish Diversity of Ramgarh Lake

1. **Study Area Description**

- **Location:** Ramgarh Lake, Gorakhpur, Uttar Pradesh, India
- **Coordinates:** 26.7615^0N, 83.3890^0 E

2. **Fish Collection Techniques**

- Use of cast nets, drag nets, gill nets and traps
- Assistance from local fishermen included

3. **Identification of Species**

- Fishes preserved in 10% formalin
- Identification using standard taxonomic keys (e.g., Jayaram, Talwar & Jhingran)
- Classification into families, orders, and common names

Documentation

- Photography of species
- Record of local/traditional names and usage (ethno-biological aspect is included)

Results and Discussion

Present Study revealed the occurrence of 21 native and 4 exotics species of fin fishes (total 25) belonging to 6 orders, 10 families. The details of the species recorded in the lake were- Osteoglossiformes (Notopteridae- *Notopterus notopterus*, *Chitala chitala*), Cypriniformes species (Cyprinidae-*Catla catla, Labeo rohita, Labeo bata, Labeo gonius, Cirrhinus mrigala, Cirrhinus reba, Hypophthalmichthys molitrix, Ctenopharyngodon idella, Aristichthys nobilis, Cyprinus carpio, Oxygaster bacaila, Puntius sarana*), Siluriformes (*Mystus tengara*, *Mystus vittatus*, Sisoridae- *Bagarius bagarius*; Pangasidae- *Pangasius pangasius*, Clariidae- *Claria sbatrachus*; Heteropneustidae- *Heteropneustes fossilis*), Perciformes (Channidae- *Channa punctatus, Channa striatus, Channa marulius*, Synbranchiformes (Mastacembelidae- *Mastacembelus armatus*, Beloniformes (Belonidae- *Xenantodon cancila*).

Exotic Fishes in the lake

Exotic fish are species that are not originally from a particular water body but have been introduced from other regions or countries. In the case of Ramgarh Lake in Gorakhpur, several exotic fish species have been introduced mainly for increasing fish production and economic benefits through aquaculture.

Several exotic species have been reported in Ramgarh Lake, with the most common among them being:

- Common carp (*Cyprinus carpio*)
- Silver carp (*Hypophthalmichthys molitrix*)
- Grass carp (*Ctenopharyngodon idella*)
- Bighead carp (*Hypophthalmichthys nobilis*)

These species were introduced primarily for their rapid growth rates, high feed conversion efficiency, and market demand. While they have contributed to increased fish production and economic returns for local fishers, their ecological impacts are causes for concern.

Ecological Impacts: Exotic fish often compete with native species for food and habitat, leading to a decline in native fish populations. For example, silver and bighead carps, which are filter feeders, consume large quantities of plankton - resources also vital for native planktivorous fish. Grass carp, a voracious herbivore, can significantly reduce aquatic macrophytes, thereby altering spawning and nursery habitats essential for native species.

Disease and Parasitic Transmission: The introduction of exotic fish has also been linked to the spread of novel pathogens and parasites. These may include protozoans, helminths, and fungal infections such as *Ichthyophonus* species which pose a serious threat to the health of native fish populations.

Biodiversity Concerns: Long-term presence and dominance of exotic species can lead to reduced genetic diversity, extinction of vulnerable native species, and disruption of ecological processes. These changes may also affect other trophic levels, including invertebrates and aquatic vegetation, thereby impacting the entire lake ecosystem.

Given these concerns, the management of exotic fish in Ramgarh Lake requires a balanced approach. Strategies such as controlled stocking, biodiversity monitoring, and habitat restoration must be prioritized to safeguard the ecological integrity of the lake while maintaining its fisheries productivity.

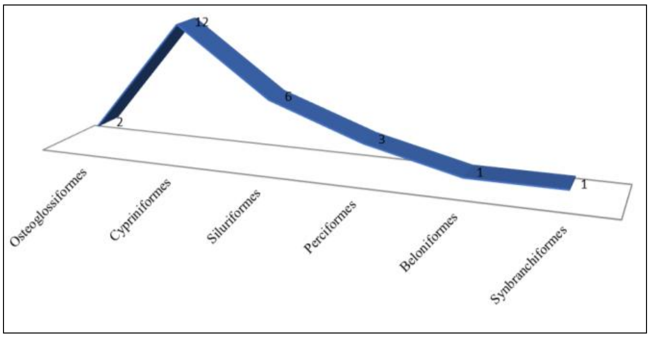
Observation Table

Table 1: Showing the Ichthyofaunal Diversity of Ramgarh Lake, Gorakhpur, Uttar Pradesh

SN.	Order	Family	Zoological Name	Local Name	Conservation Status	
					IUCN Status	Commercial Status (Local)
1.	Osteoglossiformes	Notopteridae	*Notopterus notopterus*	Bronze featherback	LC	High demand
			Chitala chitala	Moy (Chital)	NT	High demand
2.	Cypriniformes	Cyprinidae	*Catla catla*	Bhakur	LC	High demand
			Labeo rohita	Rohu	LC	High demand
			Labeo bata	Bata	LC	High demand
			Labeo gonius	Kursi	LC	Average demand
			Cirrhinus mrigala	Nain	LC	High demand
			Cirrhiuns reba	Raia	LC	-
			Hypophthalmichthys molitrix	Silver Carp (Exotic)	NT	High demand
			Ctenopharyngodon idella	Grass Carp (Exotic)	LC	High demand
			Aristichthys nobilis	Bighead carp (Exotic)	DD	High demand
			Cyprinus carpio	Common carp (Exotic)	LC	Low demand
			Oxygaster bacaila	Chalhawa	LC	Average demand
			Puntius sarana	Daraheei	LC	High demand
3.	Siluriformes	Bagaridae	*Mystus tengara*	Tengana	LC	High demand
			Mystus vittatus	Tengra	LC	Low demand
		Sisoridae	*Bagarius bagarius*	Gonchh	VU	Low demand

		Pangasidae	*Pangasius pangasius*	Payas	LC	High demand
		Clariidae	*Clarias batrachus*	Magur	LC	High demand
		Heteropneustidae	*Heteropneustes fossilis*	Singhi	LC	High demand
4.	Perciformes	Channidae	*Channa punctatus*	Girai	LC	Low demand
			Channa striatus	Saur	LC	High demand
			Channa marulius	Saur	LC	High demand
5.	Beloniformes	Belonidae	*Xanantodon cancila*	Kauva	LC	Low demand
6.	Synbranchiformes	Mastacembelidae	*Mastacembelus armatus*	Patya	LC	Low demand

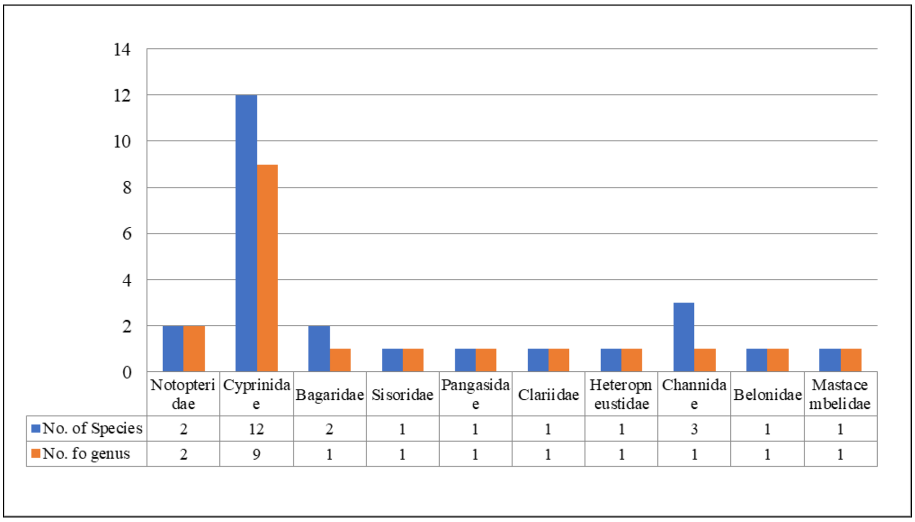
Abbreviations: DD - Data deficient; EN - Endangered; LC - **Least Concern:** NT - Near Threatened; VU - Vulnerable.



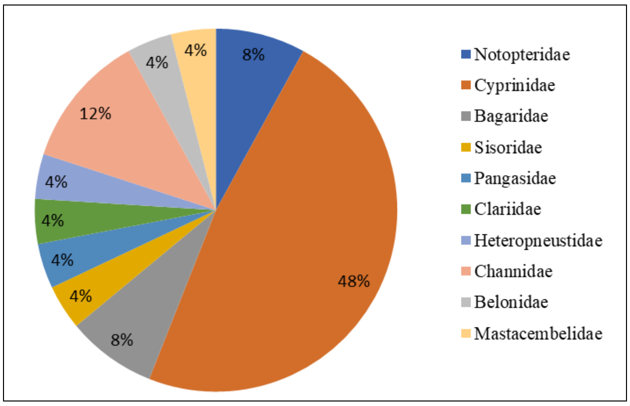
Graph 1: Order wise Occurrence of Fish Species in Ramgarh Lake.

Table 2: Showing Relative Abundance of Fishes in Ramgarh Lake, Gorakhpur, Uttar Pradesh

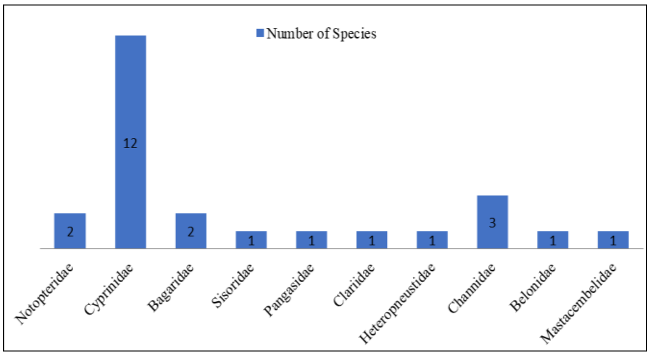
S. No.	Family	No. of Species	No. of Genus
1	Notopteridae	2 (8%)	2 (10.5%)
2	Cyprinidae	12 (48%)	9(47.36%)
3	Bagaridae	2 (8%)	1(5.26%)
4	Sisoridae	1 (4%)	1 (5.26%)
5	Pangasidae	1 (4%)	1 (5.26%)
6	Clariidae	1 (4%)	1 (5.26%)
7	Heteropneustidae	1(4%)	1 (5.26%)
8	Channidae	3 (12%)	1 (5.26%)
9	Belonidae	1 (4%)	1 (5.26%)
10	Mastacembelidae	1(4%)	1 (5.26%)



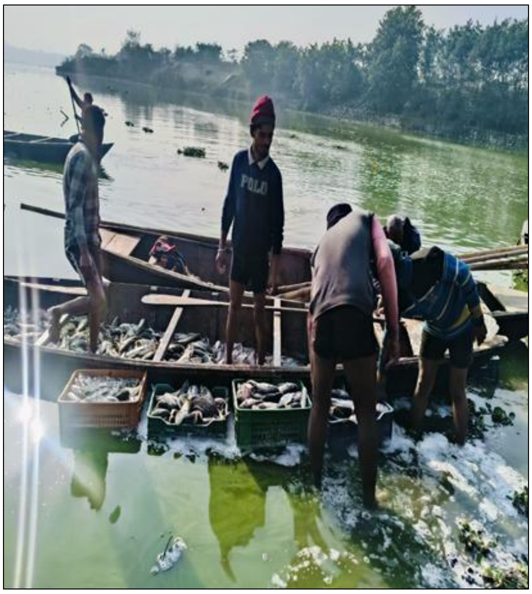
Graph 2: Showing Relative abundance of Fishes in proposed Study Area



Graph 3: Family wise % composition of the Fish Species in the proposed Study Area



Graph 4: Family wise composition of the No. of Fish Species in the proposed Study Area



Fish Collection & Preservation at Ramgarh Lake, Gorakhpur, U.P.

Conclusion

The study of fish diversity in Ramgarh Lake reveals a rich and varied aquatic ecosystem that supports numerous species across different families. This diversity highlights the ecological importance of the lake in maintaining regional biodiversity. However, the presence of environmental pressures such as pollution, overfishing, and habitat degradation poses threats to the sustainability of this ecosystem. Therefore, continuous monitoring, habitat conservation, and the implementation of sustainable fisheries management practices are crucial to preserving the fish diversity of Ramgarh Lake for future generations.

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