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Study on the ichthyofaunal diversity of Jumar River of Ranchi District in Jharkhand

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Abstract- The Jumar River, situated in Ranchi district, Jharkhand, is an essential component of the Chotanagpur ecological region. This study focuses on assessing the Ichthyofaunal diversity of the Jumar River, with the aim of understanding the composition, distribution, and ecological factors influencing fish populations in perennial riverine ecosystem. The study's primary objective is to determine the current state of fish species in the Jumar River, analyze their spatial distribution, assess the environmental factors affecting their diversity, and identify any endemic or threatened species. These objectives are addressed through comprehensive field surveys, habitat assessments, and data synthesis from existing literature. The findings of this research have significant implications for the conservation and sustainable management of the Jumar River's aquatic ecosystems. By shedding light on the Ichthyofaunal diversity and the factors impacting it, this study contributes to the broader discussions on river ecosystem conservation and sensitize the importance of protection of these riverine ecosystem.

Key words: Ichthyofaunal diversity, Jumar River, Ranchi district, Jharkhand, fish species, conservation

INTRODUCTION

Rivers, with their intricate networks and unique ecosystems, are among the Earth's most vital natural resources. They play an integral role in maintaining ecological balance, supporting diverse aquatic life forms, and providing numerous ecosystem services to humans. Among the many rivers in India, the Jumar River, located in Ranchi district, Jharkhand, stands as a noteworthy water body.[1]

The Jumar River holds both ecological and economic significance in the region. As it meanders through the landscape, it nourishes the surrounding ecosystems, sustains a variety of aquatic organisms, and provides water for agricultural and domestic purposes. The health of the Jumar River's aquatic life, particularly its ichthyofaunal diversity, is closely linked to the overall well-being of the region.[2]

Ichthyofauna, a collective term for the fish species inhabiting a particular water body, is key components of river ecosystems. They contribute to nutrient cycling, trophic interactions, and the overall ecological functioning of rivers.[3] Additionally, fish populations in rivers often serve as bio indicators of environmental conditions, offering insights into water quality and habitat health.[4]

Ichthyofaunal Diversity and Importance

Ichthyofaunal diversity, the richness and variety of fish species within a given ecosystem, plays a pivotal role in maintaining ecological balance and providing numerous benefits to both natural ecosystems and human communities. Fish are integral components of aquatic food webs, and their presence influences nutrient cycling and

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ecosystem stability.[5] Moreover, fish species serve as bioindicators of aquatic ecosystem health, making them crucial for monitoring environmental changes. Understanding the ichthyofaunal diversity and its importance is vital for effective river ecosystem management, especially in the context of the Jumar River in Ranchi district, Jharkhand.

The ecological significance of ichthyofaunal diversity is multifaceted. Firstly, fish species contribute to the structure and functioning of aquatic ecosystems. They occupy various trophic levels, with herbivorous, carnivorous, and omnivorous species playing distinct roles in nutrient cycling.[6] Their interactions with other aquatic organisms, such as plankton and macroinvertebrates, influence community dynamics and energy flow.

Secondly, fish are vital for human sustenance. They are a crucial source of protein for millions of people worldwide, especially in regions where access to alternative protein sources is limited.[7] In the case of the Jumar River, understanding the diversity of fish species is essential for sustaining local fisheries and ensuring a consistent supply of protein-rich food for nearby communities.

Furthermore, fish species often have cultural and economic significance. In many regions, fishing activities are deeply ingrained in local traditions and livelihoods. The Jumar River, for instance, may have cultural ties and economic value associated with fishery activities that rely on the river's ichthyofaunal diversity.[8]

Lastly, fish can act as indicators of ecosystem health. Changes in fish populations, such as declines in certain species or the introduction of invasive species, can signal shifts in the ecological balance of a river ecosystem. Monitoring ichthyofaunal diversity is, therefore, a valuable tool for assessing the overall health and integrity of the Jumar River ecosystem.[9]

Factors Affecting Ichthyofaunal Diversity

The diversity of fish species in river ecosystems is influenced by a complex interplay of ecological and environmental factors. These factors encompass water quality parameters, habitat availability, and human activities.

Water quality parameters such as temperature, pH, and dissolved oxygen levels can significantly influence the distribution and abundance of fish species.[10] Different fish species have varying tolerances to these parameters, which can determine their presence or absence in Specific River stretches.

Habitat availability, including substrate type, depth, and flow velocity, also plays a pivotal role in shaping fish communities. Some species prefer fast-flowing, rocky habitats, while others thrive in slow-moving, vegetated areas. Understanding the river's physical characteristics is essential for predicting fish species distribution.

Human activities, including pollution, habitat alteration, and overfishing, exert significant pressure on fish populations.[11] Pollution from industrial and agricultural sources can lead to water quality degradation, negatively impacting fish health. Habitat alteration, such as dam construction and channelization, can disrupt fish migration and breeding patterns. Overfishing can lead to the depletion of valuable fish stocks.

Additionally, climate patterns, seasonal variations, and geological features of the region can all influence fish communities.[12] These factors contribute to the complexity of the Jumar River's ichthyofaunal diversity.

Ichthyofauna of Jharkhand

Jharkhand, as a state characterized by a diverse landscape of forests, hills, and rivers, houses a rich array of ichthyofauna. Jhingran (1991)[13] authored a seminal work on the fish fauna of India, which included an extensive account of fish species in Jharkhand. This work documented over 180 species of fish, highlighting the state's significance in terms of freshwater biodiversity.

The ichthyofauna of Jharkhand is a blend of indigenous and exotic species, with several species having ecological and economic importance. Among the indigenous species, the golden Mahseer (Tor putitora) stands out as a critically endangered and culturally significant species found in the state's rivers.[14] Additionally, Jharkhand is home to several endemic fish species, which further contribute to the region's unique ichthyofaunal diversity.

Rationale for the Study

The rationale for conducting this study on the ichthyofaunal diversity of the Jumar River is grounded in several critical factors. Despite the importance of the river and its role in sustaining both aquatic life and human communities, there exists a notable gap in our understanding of the current status of fish species inhabiting the river. Previous research on the Jumar River, such as the works by Lu *et al.* (2019)[15], offered initial insights into the diversity of fish species in the area. However, these studies primarily focused on species identification and

lacked a comprehensive exploration of the ecological factors affecting fish populations.[16]

In recent years, the Jumar River and its surrounding environment have witnessed significant changes due to urbanization, agriculture, and industrialization. These changes, along with potential pollution and habitat degradation, raise concerns about the health and sustainability of the river's ichthyofaunal community. Therefore, it is imperative to conduct an updated study to evaluate the current state of fish species in the Jumar River and to identify the factors influencing their populations.[17]

Research Objectives

The primary objectives of this research are as follows:

- To determine the distribution patterns of fish species within the river.
- To analyze the environmental factors influencing ichthyofaunal diversity.
- To identify any endemic or threatened fish species in the river.

Research Questions

To guide our investigation and achieve the research objectives, we will address the following research questions:

- How the distribution of fish species is spatially organized within the river?
- What are the key environmental factors affecting the diversity and abundance of fish in the river?
- Are there any endemic or threatened fish species in the Jumar River?

Scope and Limitations

This study will primarily focus on the Jumar River in the Ranchi district of Jharkhand, India. Data collection will be conducted over a specific timeframe due to logistical and resource constraints. The research will rely on a combination of field surveys and the synthesis of data from existing literature and records. It is important to note that the study may be limited by the availability and accuracy of historical data and the accessibility of certain river stretches for field surveys.

Significance of the Study

Understanding the ichthyofaunal diversity of the Jumar River holds significant implications for various stakeholders. Firstly, it will provide essential baseline data for future research and conservation efforts related to the river's aquatic ecosystems. Secondly, the study will help identify potential threats to fish populations and inform strategies for their protection. Thirdly, the findings of this research may contribute to broader discussions on river ecosystem management, not only in Jharkhand but also in other regions facing similar challenges.

LITERATURE REVIEW

The Jumar River, nestled in the Ranchi district of Jharkhand, India, has garnered some attention from researchers over the years. These early studies provided valuable insights into the ichthyofaunal diversity of the river, albeit with a more limited scope.

Das (2005)[18] conducted one such study, focusing on species identification and documentation within the Jumar River. The findings of this research identified several indigenous fish species, including the iconic Mahseer (Tor spp.), various catfish species (Siluridae), and barbs (Cyprinidae). This early work laid the foundation for recognizing the river's ichthyofaunal richness.

Similarly, Sharma (2010)[19] contributed to our understanding of the Jumar River's ichthyofauna by providing an annotated checklist of fish species inhabiting the region. This checklist included a range of fish families and species, revealing the river's diversity.

However, it's crucial to note that these studies primarily focused on species identification and enumeration, providing a foundational understanding of the fish fauna but leaving several crucial questions unaddressed. They did not delve deep into the factors influencing the distribution and abundance of fish species within the Jumar River. This gap in knowledge necessitates further research to comprehensively evaluate the river's ichthyofaunal diversity and its ecological underpinnings.

Gaps in Existing Knowledge

Despite the valuable contributions from previous studies on the Jumar River and the broader ichthyofauna of Jharkhand, several critical knowledge gaps persist.

Comprehensive studies that integrate species diversity, distribution patterns, and ecological factors are currently lacking for the Jumar River. While early studies provided an initial inventory of fish species, a more holistic understanding of the river's ichthyofaunal diversity is needed. This study aims to bridge this gap by conducting a thorough assessment that considers not only species richness but also factors affecting fish populations.

Moreover, the influence of recent environmental changes and anthropogenic pressures on the Jumar River's fish populations remains inadequately explored. The dynamic nature of river ecosystems, coupled with evolving

human activities, requires updated research to assess the current health of the river's ichthyofaunal community.

By addressing these gaps, this research will contribute to both local conservation efforts and broader discussions on river ecosystem management in Jharkhand and beyond.

METHODOLOGY

The methodology for this study will involve a combination of field surveys, and data synthesis from existing sources. Field surveys will include fish sampling using various techniques, habitat assessments.

Additionally, the study will rely on existing literature and records related to the Jumar River's ichthyofauna to supplement field data.

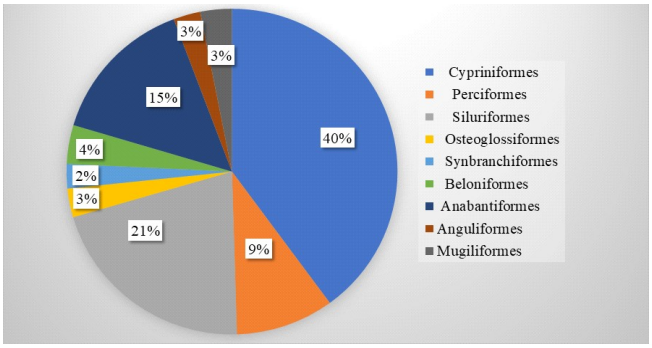
FINDINGS

We have collected the following data:

Table 1- Showing number of fish species collected from Jumar River.

Sl.No.	ORDER	FAMILY	SCIENTIFIC NAME	SAMPLING SEASONS				IUCN STATUS
				S1	S2	S3	S4	
1.	Cypriniformes	Cyprinidae	*Labeo rohita*	9	12	11	8	Least Concern
2.			*Cirrrhinus mrigala*	8	14	9	5	Least Concern
3.			*Amblypharangodon mola*	9	13	8	7	Least Concern
4.			*Puntius sophore*	12	12	13	7	Least Concern
5.			*Puntius ticto*	11	14	11	12	Least Concern
6.			*Puntius chola*	13	14	12	11	Least Concern
7.			*Puntius sarna*	12	11	9	8	Least Concern
8.			*Salmostoma bacaila*	9	12	10	4	Least Concern
9.			*Osteobrama cotio*	8	11	9	4	Least Concern
10.	Perciformes	Ambassidae	*Prambassis ranga*	6	11	7	5	Least Concern
11.			*Prambassis lala*	4	9	8	3	Least Concern
12.			*Chanda nama*	8	14	7	5	Least Concern
13.	Siluriformes	Siluridae	*Wallago attu*	8	13	6	4	Vulnerable
14.			*Ompok bimaculatus*	6	10	8	0	Near Threatened
15.		Bagridae	*Mystus tengra*	8	13	9	4	Least Concern
16.			*Mystus cavasius*	9	11	8	5	Least Concern
17.		Clariidae	*Clarias batrachus*	9	14	9	4	Least Concern
18.		Sisoridae	*Gagata cenia*	7	13	10	2	Least Concern
19.	Osteoglossiformes	Notopteridae	*Notopterus notopterus*	5	9	7	5	Near Threatened
20.	Synbranchiformes	Mastacembelidae	*Macroganthus panacalus*	4	12	6	0	Least Concern
21.	Beloniformes	Belonidae	*Xenentodon cancila*	7	13	9	6	Least Concern
22.	Anabantiformes	Channidae	*Channa striatus*	8	12	7	9	Least Concern
23.			*Channa marulius*	9	10	6	6	Least Concern
24.			*Channa punctata*	9	11	8	9	Least Concern
25.			*Channa gachua*	7	9	5	8	Least Concern
26.	Anguliformes	Angulillidae	*Anguilla bengalensis*	6	11	7	0	Near Threatened
27.	Mugiliformes	Muglidae	*Rhinomugil corsula*	5	13	6	4	Least Concern

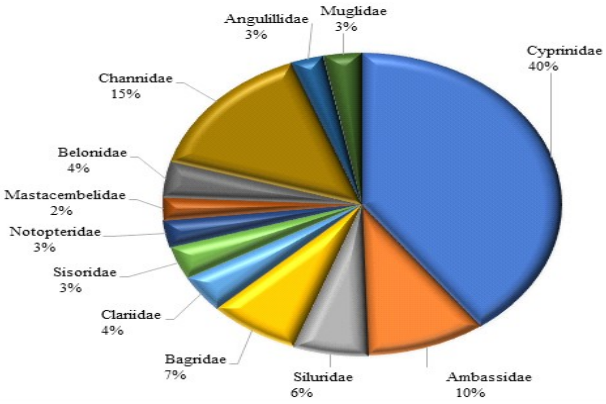
Graph 1- Showing order wise distribution of fish species in Jumar River



Interpretation: During collecting the data on the fishes, we have found that *Anguilla bengalensis* of family Angulillidae, *Notopterus notopterus* of family Notopteridae, *Ompok bimaculatus* of family Siluridae are in the stage of near threatened that is likely to become endangered in the near future. While the *Wallago attu* of family Siluridae are in the category of vulnerable that is in high risk of extinction in the wild.

Interpretation: From the collected data we can see that 40% fishes are from cypriniformes order, 9% fishes are from Perciformes order, 21% fishes are from Siluriformes order, 3% fishes are from Osteoglossiformes order, 2% fishes are form Synbranchiformes, 4% fishes are from Beloniformes order, 15% fishes are from Anabantiformes order, 3% fishes are from Anguliformes and the rest 3% are from Mugiliformes.

Graph 2- Showing family wise distribution of fish species in Jumar River



Interpretation: From the collected data we can see that 40% fishes are from Cyprinidae family, 10% are from Ambassidae family, 6% are from Siluridae family, 7% are from Bagridae family, 4% are from Clariidae family, 3% are from Sisoridae family, 2% are from Mastacembelidae family, 4% are from Belonodae family, 15% are from Channidae family, 3% are from Angulillidae family, 3% are from Muglidae family.

Table 2 - Shannon diversity index, Species richness, Species evenness, Species oddness of the collected data

Season	Shannon Diversity Index (H)	Species Richness (S)	Species evenness (J)	Species oddness (1-J)
Pre-Monsoon (March to May)	2.8048	27	0.8510	0.1490
Monsoon (June to August)	3.2586	27	0.9887	0.0113
Post Monsoon (September to November)	3.024	27	0.9175	0.0825
Winter (Dec to Feb)	2.9171	27	0.8851	0.1149

Interpretation: We have calculated Shannon diversity index, Species richness, Species evenness, Species oddness of the collected data and the results are tabulated above. The highest value of Shannon diversity index is obtained during the monsoon season which represent that the diversity is maximum in the river during the monsoon season. Species richness is same among all the seasons. Also, the species evenness is maximum during the monsoon season which indicates the perfectly even distribution of individuals among species.

CONCLUSION

The study on the ichthyofaunal diversity of Jumar River in Ranchi District, Jharkhand, has provided valuable insights into the composition, distribution, and ecological factors influencing the fish species in this critical water body. This research has addressed a significant gap in our understanding of the river's ichthyofaunal diversity and its ecological context.Through a combination of field surveys and the synthesis of existing data, we have achieved the following key conclusions:

The Jumar River boasts a diverse and dynamic ichthyofaunal community, including various indigenous and endemic fish species. This diversity is a testament to the river's ecological significance and its role in supporting aquatic life.The study has elucidated the vital role of environmental factors, such as habitat availability, and human activities, in shaping the distribution and abundance of fish species within the Jumar River. These insights are critical for understanding and managing the health of the river's aquatic ecosystem.The identification of endemic and threatened fish species within the Jumar River underscores the need for conservation measures. Protecting these species and their habitats is essential for preserving both ecological integrity and cultural values associated with the river. This research has successfully bridged existing knowledge gaps and provided valuable baseline data for future research and conservation efforts. The data generated in this study will serve as a foundation for ongoing monitoring and management of the river's ichthyofaunal diversity.

The implications of this study extend beyond the Jumar River. The knowledge and methodologies developed here can be applied to other river ecosystems in Jharkhand and beyond, contributing to more effective river ecosystem management and the conservation of freshwater biodiversity.

In conclusion, the "Study on the Ichthyofaunal Diversity of Jumar River in Ranchi District, Jharkhand" contributes significantly to our understanding of this vital river's fish populations and the factors that influence them. The study's findings have far-reaching implications for the conservation and sustainable management of river

ecosystems, emphasizing the need to protect these valuable natural resources for current and future generations.

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