Survey of Freshwater Fish Diversity in Saharanpur District, Uttar Pradesh, India

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Abstract
The present study investigated freshwater fish diversity in Saharanpur district, Uttar Pradesh, India, during January-April 2026. Fish samples were collected from rivers, canals, ponds, wetlands, and reservoirs using standard sampling methods. A total of 24 fish species belonging to 9 families and 5 orders were recorded, with family Cyprinidae being dominant (41.6%). River habitats showed higher fish diversity compared to stagnant water bodies. Economically important fishes such as *Labeo rohita*, *Catla catla*, and *Cirrhinus mrigala* were commonly observed. Biodiversity indices indicated moderate to high ichthyofaunal diversity and relatively stable ecological conditions. However, pollution, agricultural runoff, and overfishing negatively affected fish diversity. The study emphasizes the importance of conservation and sustainable fisheries management for freshwater ecosystems in Saharanpur district.

Keywords: Freshwater fishes; Ichthyofaunal diversity; Cyprinidae; Biodiversity conservation; Saharanpur district.

1. Introduction
Freshwater ecosystems are among the most productive and biologically important ecosystems on Earth, supporting diverse aquatic organisms including fishes, amphibians, aquatic plants, plankton, and invertebrates (Dudgeon et al., 2006; Nelson, 2006). Among these, fishes constitute a major component of freshwater biodiversity and play important roles in ecological stability, nutrient cycling, food web interactions, and ecosystem functioning (Karr, 1981; Moyle and Cech, 2004).

Freshwater fishes are also economically import-i-ant because they provide food, employment, recreation, and livelihood opportunities to millions of people worldwide (FAO, 2022). In India, inland fisheries contribute significantly to nutritional security, rural development, and socio-economic growth (Talwar and Jhingran, 1991; Sarkar et al., 2008). India possesses extensive freshwater resources such as rivers, lakes, ponds, reservoirs, wetlands, canals, and floodplain ecosystems that support rich ichthyofaunal diversity (Jayaram, 2010).

Studies on freshwater fish diversity are essential for understanding species composition, ecological adaptations, conservation status, and aquatic ecosystem health. Fish parasitological and physiological studies have also contributed to ichthyological research in India. Fish specimens are commonly examined for helminth parasites using standard taxonomic methods

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(Kumar et al., 2026), while biochemical studies have demonstrated physiological alterations in infected fish tissues due to parasitic infections (Kumar et al., 2025). Snakehead fishes (*Channa* spp.) are widely consumed in South East Asia, China, and India because of their nutritional and commercial importance (Kumar et al., 2023).

India is recognized as a megadiverse country because of its varied climatic conditions and aquatic habitats (Bhat, 2004). Freshwater fish diversity is influenced by ecological factors such as water quality, habitat structure, dissolved oxygen, and hydrological conditions (Lakra et al., 2010; Sarkar et al., 2012). The Ganga river system and its tributaries provide suitable environmental conditions for numerous freshwater fish species.

Saharanpur district of Uttar Pradesh, located near the foothills of the Shivalik range, possesses diverse freshwater habitats including rivers, irrigation canals, ponds, wetlands, reservoirs, and seasonal streams. These water bodies support both commercially important and indigenous fish species. Freshwater ecosystems are increasingly threatened by industrialization, included the Hindon River, Eastern Yamuna Canal, village ponds, and agricultural water reservoirs.

urbanization, agricultural runoff, pollution, habitat degradation, overfishing, and climate change (Dudgeon et al., 2006; Revenga et al., 2005). These factors have adversely affected freshwater biodiversity in different parts of India (Sarkar et al., 2008; Mishra et al., 2013).

2. Materials and Methods

2.1 Study Area

The present investigation was carried out in Saharanpur district of Uttar Pradesh, India, situated between 29°34′ to 30°21′ North latitude and 77°09′ to 78°13′ East longitude near the foothills of the Shivalik range. The district experiences a subtropical climate characterized by hot summers, moderate winters, and seasonal monsoon rainfall. The region forms part of the upper Gangetic plain and possesses diverse freshwater habitats supporting rich ichthyofaunal diversity (Lakra et al., 2010; Jayaram, 2010).

The study area included rivers, irrigation canals, village ponds, wetlands, marshy areas, and agricultural reservoirs. Major aquatic bodies surveyed during the investigation

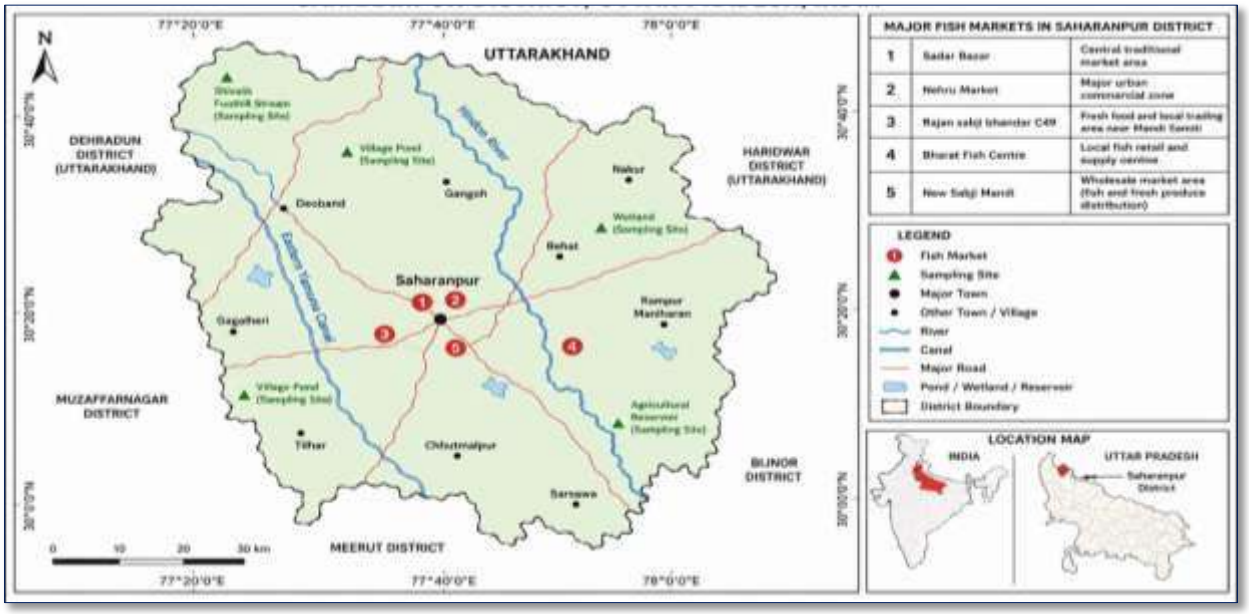

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Figure: 1. Map showing major freshwater fish sampling sites and fish market locations in Saharanpur district, Uttar Pradesh, India.

2.2 Duration of Study

Field surveys and fish sampling were conducted from January 2026 to April 2026 at regular intervals to observe seasonal variation in fish diversity and distribution.

2.3 Collection of Fish Specimens

Fish specimens were collected with the assistance of local fishermen using cast nets, drag nets, hand nets, gill nets, and hooks and lines following standard fish sampling procedures (Talwar and Jhingran, 1991). Sampling was mainly carried out during early morning and evening hours when fish activity was relatively higher. Collected specimens were cleaned with freshwater and photographed for documentation

Figure: 2. Fish sample collection from the study site

2.4 Preservation and Identification

Collected fish specimens were preserved in 10% formalin solution for laboratory examination and taxonomic identification. Large-sized specimens were injected with preservative solution prior to storage to prevent tissue decomposition. Proper labeling was maintained for each specimen, including date of collection, habitat type, and sampling site.

Identification of fish species was carried out using external morphological characters, morphometric measurements, meristic counts, fin structure, scale patterns, body coloration, and diagnostic taxonomic features following standard ichthyological keys and reference literature (Day, 1878; Talwar and Jhingran, 1991; Jayaram, 2010; Nelson, 2006).

2.5 Morphometric and Meristic Analysis

Morphometric measurements including total length, standard length, head length, body depth, and fin length were recorded using measuring scales and digital calipers. Meristic characters such as fin rays and lateral line scales were also examined for accurate species identification (Jayaram, 2010).

Figure: 3. Measurement of Fish for Morphometric Analysis

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2.6 Data Analysis

Collected data were systematically arranged and analyzed to determine species diversity, abundance, and habitat-wise distribution. Biodiversity indices such as Species Richness, Shannon-Wiener Diversity Index, Simpson Diversity Index, and Relative Abundance Percentage were used for ecological assessment (Magurran, 2004).

3. Results

3.1 Fish Diversity Recorded from Saharanpur District

The present investigation recorded a total of 24 freshwater fish species belonging to 9 families and 5 orders from different aquatic habitats of Saharanpur district during January 2026 to April 2026. Family Cyprinidae was found to be dominant in terms of species richness and abundance, followed by Channidae, Bagridae, Clariidae, Siluridae, and Heteropneustidae. The recorded fishes included commercially important carps, catfishes, snakeheads, and air-breathing fishes commonly found in the freshwater ecosystems of northern India.

Economically important food fishes such as *Labeo rohita*, *Catla catla*, and *Cirrhinus mrigala* were widely distributed in rivers, ponds, and reservoirs, whereas air-breathing fishes including *Clarias batrachus* and *Heteropneustes fossilis* were commonly observed in stagnant and low-oxygen water bodies. Similar dominance of cyprinid fishes has also been reported from freshwater ecosystems of the Ganga basin (Lakra et al., 2010; Sarkar et al., 2012).

Table: 1. Freshwater Fish Species Recorded from Saharanpur District

Sr.No.	Scientific Name	Common Name	Family	Order	Habitat
1	Labeo rohita	Rohu	Cyprinidae	Cypriniformes	River/Pond
2	Catla catla	Catla	Cyprinidae	Cypriniformes	River
3	Cirrhinus mrigala	Mrigal	Cyprinidae	Cypriniformes	Pond
4	Cyprinus carpio	Common Carp	Cyprinidae	Cypriniformes	Reservoir
5	Puntius sophore	Pool Barb	Cyprinidae	Cypriniformes	Pond
6	Channa punctata	Spotted Snakehead	Channidae	Anabantiformes	Pond
7	Channa striata	Striped Snakehead	Channidae	Anabantiformes	Wetland
8	Clarias batrachus	Magur	Clariidae	Siluriformes	Wetland
9	Heteropneustes fossilis	Singhi	Heteropneustidae	Siluriformes	Pond
10	Mystus vittatus	Striped Catfish	Bagridae	Siluriformes	Canal
11	Wallago attu	Freshwater Shark Catfish	Siluridae	Siluriformes	River
12	Oreochromis niloticus	Tilapia	Cichlidae	Cichliformes	Reservoir

Table: 2. Freshwater Fish Species Recorded in number from Saharanpur District

Family	Number of Species	Percentage (%)
Cyprinidae	10	41.6
Channidae	4	16.7
Bagridae	2	8.3
Clariidae	2	8.3
Siluridae	2	8.3
Heteropneustidae	1	4.2
Cichlidae	1	4.2
Others	2	8.4

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The high dominance of Cyprinidae suggests that riverine and pond ecosystems of Saharanpur district are highly suitable for carp diversity and fisheries production. The occurrence of multiple fish families reflects ecological heterogeneity and habitat diversity within the study area.

3.2 Habitat-wise Distribution of Fishes

Riverine ecosystems exhibited comparatively higher fish diversity than ponds and wetlands because of continuous water flow, better oxygen availability, and habitat heterogeneity. Cyprinid fishes dominated rivers and canals, whereas air-breathing fishes such as *Clarias batrachus* and *Heteropneustes fossilis* were abundant in stagnant habitats with low dissolved oxygen levels.

Reservoirs and village ponds supported both indigenous and cultured fish species including carps and tilapia. Seasonal fluctuations in water level and habitat conditions influenced the occurrence and abundance of several fish species during the study period.

Table: 3. Habitat-wise Distribution of Fish Species

Habitat Type	Number of Species Recorded	Dominant Fish Groups	Major Species Observed
River	12	Cyprinids, Catfishes	Labeo rohita, Catla catla, Wallago attu
Canal	8	Cyprinids, Snakeheads	Mystus vittatus, Channa punctata
Pond	10	Air-breathing fishes, Carps	Cirrhinus mrigala, Heteropneustes fossilis
Wetland	6	Snakeheads, Catfishes	Clarias batrachus, Channa striata
Reservoir	7	Carps, Tilapia	Cyprinus carpio, Oreochromis niloticus

The results indicate that rivers serve as major biodiversity hotspots for freshwater fishes in Saharanpur district. Wetlands and stagnant water bodies mainly supported air-breathing fishes due to low dissolved oxygen conditions. Reservoirs supported both indigenous and cultured species including tilapia and common carp.

3.3 Morphometric and Meristic Observations

Morphometric and meristic analyses were carried out for selected fish species to assist in accurate taxonomic identification. Variations were observed in body shape, scale type, fin structure, and morphometric measurements among different species.

Table: 4. Morphometric Characteristics of Selected Fish Species

Species	Total Length (cm)	Standard Length (cm)	Body Shape	Scale Type
Labeo rohita	28.5	23.4	Streamlined	Cycloid
Catla catla	31.2	25.6	Deep-bodied	Cycloid
Clarias batrachus	24.8	20.3	Elongated	Scaleless
Channa punctata	21.5	17.8	Cylindrical	Cycloid
Mystus vittatus	18.6	15.2	Elongated	Scaleless

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Morphometric variations among fishes indicate ecological specialization and habitat adaptation. Streamlined carps were better adapted to flowing waters, whereas elongated catfishes and snakeheads were adapted to stagnant or muddy habitats.

3.4 Biodiversity Indices and Ecological Analysis

The freshwater ecosystems of Saharanpur district exhibited moderate to high ichthyofaunal diversity. The Shannon-Wiener Diversity Index value (2.81) indicated relatively stable ecological conditions and good species diversity.

Table: 5. Biodiversity Indices Recorded During the Study

Biodiversity Parameter	Observed Value	Interpretation
Species Richness	24	Moderate to high diversity
Shannon–Wiener Index (H′)	2.81	Ecologically stable habitat
Simpson Diversity Index	0.89	High species diversity
Relative Abundance of Cyprinidae	41.6%	Dominance of carp fishes

The biodiversity indices suggest that Saharanpur district possesses ecologically productive freshwater habitats capable of supporting diverse fish fauna. However, dominance of a single family (Cyprinidae) also indicates moderate ecological imbalance due to environmental disturbances.

3.5 Ecological and Conservation Status

The study revealed that several fish species recorded from Saharanpur district possess considerable ecological and commercial importance.

Table: 6. Ecological Characteristics and Conservation Status of Selected Fish Species

Species	Feeding Habit	IUCN Status	Commercial Importance
Labeo rohita	Omnivorous	Least Concern	High
Catla catla	Omnivorous	Least Concern	High
Cirrhinus mrigala	Detritivorous	Least Concern	High
Cyprinus carpio	Omnivorous	Vulnerable	High
Channa punctata	Carnivorous	Least Concern	Moderate
Channa striata	Carnivorous	Least Concern	High
Clarias batrachus	Omnivorous	Endangered	High
Wallago attu	Carnivorous	Near Threatened	High

The occurrence of economically important fishes indicates the fisheries potential of the region, whereas the presence of sensitive and threatened species highlights the necessity for biodiversity conservation and sustainable fisheries management practices in Saharanpur district.

Table: 7. Threat Analysis Affecting Fish Diversity

Threat Factor	Observed Impact
Water Pollution	Decline in sensitive fish species
Agricultural Runoff	Eutrophication and habitat degradation
Overfishing	Reduction in commercially important fishes
Urbanization	Loss of natural aquatic habitats
Sewage Disposal	Reduced water quality and oxygen level

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Anthropogenic disturbances were found to significantly influence fish diversity and habitat quality in Saharanpur district. Sensitive fish species were comparatively less abundant in polluted habitats, whereas tolerant and air-breathing species showed greater survival capacity.

4. Discussion

The present investigation revealed considerable ichthyofaunal diversity in the freshwater ecosystems of Saharanpur district, Uttar Pradesh. A total of 24 freshwater fish species belonging to 9 families and 5 orders were recorded from different aquatic habitats during the study period (Tables 1 and 2). Similar observations regarding freshwater fish diversity have been reported from various regions of the Ganga river basin and northern India (Lakra et al., 2010; Sarkar et al., 2012).

Family Cyprinidae was found to be dominant in terms of species richness and abundance, contributing approximately 41.6% of the total fish fauna recorded during the investigation (Table 2). The dominance of cyprinid fishes may be attributed to their wide ecological adaptability, omnivorous feeding behavior, rapid growth, and suitability to riverine as well as pond ecosystems. Similar dominance of Cyprinidae has also been reported by Talwar and Jhingran (1991), Jayaram (2010), and Lakra et al. (2010) from freshwater ecosystems of India.

The occurrence of economically important fishes such as *Labeo rohita*, *Catla catla*, and *Cirrhinus mrigala*(Table 1) indicates the fisheries potential of freshwater habitats in Saharanpur district. These species are widely cultured and consumed due to their high nutritional and commercial value (Talwar and Jhingran, 1991).

Snakehead fishes including *Channa punctata* and *Channa striata* were also frequently observed in ponds and wetlands. Similar observations on the importance of snakehead fishes as food fishes in India and South East Asia have been reported by Kumar et al. (2023).

Habitat-wise analysis demonstrated that riverine ecosystems supported comparatively higher fish diversity than ponds, wetlands, and reservoirs (Table 3). Rivers provide continuous water flow, higher dissolved oxygen concentration, nutrient availability, and greater habitat heterogeneity, thereby supporting diverse fish assemblages. Similar ecological patterns have been documented in the Ganga basin by Lakra et al. (2010) and Sarkar et al. (2012).

Wetlands and stagnant water bodies mainly supported air-breathing fishes such as *Clarias batrachus* and *Heteropneustes fossilis* (Tables 1 and 3). These fishes possess accessory respiratory organs that enable survival in habitats with low dissolved oxygen concentration. Such adaptive characteristics of air-breathing fishes have also been described by Moyle and Cech (2004).

Morphometric and meristic observations revealed considerable variation in body shape, scale type, and body proportions among different fish species (Table 4). Streamlined body forms observed in carps such as *Labeo rohita* and *Catla catla* indicate adaptation to active swimming in flowing waters, whereas elongated and cylindrical body forms of catfishes and snakeheads reflect adaptation to stagnant, muddy, and vegetated habitats (Jayaram, 2010).

The biodiversity indices recorded during the investigation indicated moderate to high ichthyofaunal diversity within the freshwater ecosystems of Saharanpur district (Table 5). The Shannon-Wiener Diversity Index value (2.81) suggested relatively stable ecological conditions and good species heterogeneity, while the Simpson Diversity Index value (0.89) reflected high fish diversity. Similar biodiversity patterns have been reported from freshwater ecosystems of northern India by Mishra et al. (2013).

Ecological and conservation assessment showed that several recorded species possess considerable commercial and ecological importance (Table 6). However, anthropogenic disturbances including water pollution, agricultural runoff, sewage disposal, urbanization, habitat degradation, and overfishing were observed to negatively affect fish diversity and habitat quality (Table 7). Polluted habitats showed reduced abundance of sensitive fish species, whereas tolerant and air-breathing fishes exhibited comparatively higher survival capacity under stressed environmental conditions.

The occurrence of threatened and commercially important species such as *Clarias batrachus* and

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Wallago attu (Table 6) highlights the urgent need for effective conservation and sustainable fisheries management strategies in Saharanpur district. Habitat restoration, pollution control, regulated fishing practices, and regular biodiversity monitoring are essential for the long-term conservation of freshwater fish diversity in the region.

5. Conclusions

The present study revealed moderate to high freshwater fish diversity in Saharanpur district, Uttar Pradesh, with a total of 24 fish species belonging to 9 families and 5 orders recorded from different aquatic habitats. Family Cyprinidae was found to be dominant, indicating the suitability of riverine and pond ecosystems for carp diversity and fisheries production. Rivers showed comparatively higher species diversity than wetlands and stagnant water bodies. The study also highlighted the ecological and commercial importance of several fish species recorded during the investigation. However, increasing anthropogenic activities such as water pollution, agricultural runoff, habitat degradation, and overfishing were observed to adversely affect freshwater biodiversity. Therefore, effective conservation measures, sustainable fisheries management, habitat restoration, and regular biodiversity monitoring are essential for the long-term protection and sustainable utilization of freshwater fish resources in Saharanpur district.

6. Ethical Approval Not applicable.

7. Consent for Publication Not applicable.

8. Competing Interests The authors declare that there are no competing interests regarding the publication of this paper.

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10. Authors' Contributions

PK and SK conceptualized, designed, and supervised the study and contributed to data interpretation and statistical analysis. V carried out field surveys, fish sample collection, data compilation, laboratory work, and manuscript preparation. MC assisted in methodology development, data analysis, and manuscript editing. All authors reviewed and approved the final manuscript.

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