Spatiotemporal Variation in Fish Diversity in Gularbhoj Dam, Baur River

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Abstract

The present study investigates the ichthyofaunal diversity of the Baur Reservoir, located in Udham Singh Nagar district of Uttarakhand, India. A total of 18 fish species belonging to 7 families and 16 genera were recorded during the study period. The family Cyprinidae emerged as the most dominant group, followed by Bagridae and Charridae. The species Catla catla, Labeo rohita, and Cirrhinus mrigala were the most frequently encountered, indicating their ecological significance and adaptability to the reservoir habitat. Occasional observations of species such as Tor suggest a moderate presence of sensitive taxa. Comparison with earlier studies in other regional water bodies, including the Bhagirathi River, Tumaria Reservoir, and Nanak Sagar Dam, revealed a similar dominance of Cyprinidae, though overall species abundance in Baur has declined, likely due to unsustainable fishing practices, habitat alterations, and seasonal environmental stressors. The findings highlight the ecological richness of the Baur Reservoir and emphasize the urgent need for conservation-oriented management strategies to sustain fish biodiversity and ecosystem health.

Keywords

Cyprinidae, Ichthyofaunal diversity, IUCN

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Introduction

Freshwater ecosystems play a pivotal role in maintaining ecological balance and supporting socio-economic livelihoods, particularly in developing countries like India. Among these, reservoirs serve as critical habitats for diverse aquatic species, especially fish, which are not only central to ecosystem functioning but also serve as vital sources of nutrition and income for local communities. The Gular-Bhoj Dam reservoir also known as Haripura or Baur Dam situated on the Baur River in the Udham Singh Nagar district of Uttarakhand, India, represents one such vital aquatic system. It sustains a rich diversity of ichthyofauna and contributes significantly to regional fisheries and ecological services.

In recent decades, however, escalating anthropogenic pressures, including agricultural expansion, urbanization, tourism, and unregulated fishing have posed serious threats to the ecological integrity of the reservoir. Globally and nationally, riverine and reservoir ecosystems have been subjected to habitat fragmentation and environmental degradation, primarily due to dam construction and excessive freshwater extraction. These disruptions often lead to the decline of native fish populations and alter natural hydrological regimes essential for fish migration, reproduction, and survival (Jhingran, 1977; Tockner, *et. al*., 2000).

Fishes, being highly sensitive to environmental fluctuations, are widely recognized as bioindicators of aquatic ecosystem health (Harris, 1995). Their morphological and behavioural adaptations allow them to reflect ecological changes over varying spatial and temporal scales (Karr, 1991). The significance of monitoring fish communities becomes even more pronounced in regions where water bodies are subjected to developmental interventions.

While earlier studies have investigated the ichthyofaunal diversity of the Garhwal and adjoining Himalayan regions Badola, 1975; Lakra, *et.al*.,1987; Singh, *et. al*.,1987; Dobriyal and Singh, 1988; Dobriyal, 1991; Agarwal, *et. al*., 2011) the specific impacts of environmental stressors on the fish diversity and habitat conditions of the Gularbhoj reservoir remain underexplored. Moreover, existing infrastructure such as dams and barrages continues to disrupt fishery resources by altering flow regimes and obstructing migratory pathways, thereby affecting spawning behaviour, feeding patterns, and population structure.

In this context, the present study aims to investigate the species diversity of fish in the Gularbhoj reservoir. This study is expected to inform about the health of the aquatic ecosystem of the Baur River in Gularbhoj and the extent of human interference which will further help in evidence-based policy decisions and contribute to conserving the ecosystem of freshwater resources in the region.

Methodology

The present study was carried out during the period of six months from January,2025 to June 2025. Ichthyofaunal samples were collected from the Baur River near Gularbhoj Dam with the assistance of local fishermen employing traditional fishing gears, including cast nets and hand nets (Fig.1), chhati jaal (mono filamentous net) (Fig.2). These gears vary in mesh size and design, enabling the capture of a diverse range of fish species across different microhabitats. Field data was documented through direct observation, photographic evidence, and specimen

collection. Collected specimens were preserved in formalin and later identified in the laboratory using standard taxonomic keys and references (Badola, 1975; Day, 1878; Jayaram, 2017.)

Fig.1. Hand Net

Fig.2. Chhatti Jaal (Mono Filamentous Net)

3a.

3b.

Fig.3a & 3b. Fishermonger

Fig. 4. Students holding different fishes

5a.

5b.

Fig.5a & 5b Identification of Fish Based on Morphological Characters

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Result and Discussion

The present study documented a total of 18 fish species from the Baur Reservoir, representing 7 families and 16 genera **(Table 1)**. These findings reflect a significant level of ichthyofaunal diversity within the reservoir ecosystem.

Fig. 6. Channa

Fig.7. Katla

Fig.8. Bhedal

Fig.9. Snakehead

Fig.10. Seenghala

Fig.11. Big head Fish

Fig.12. The Asian swamp eel

Fig.13. Needle Fish

Fig. 14. Ketar (The local catfish)

Table.1 - Ichthyofaunal Diversity of Baur River at Gularbhoj dam: Fish Species, Order, Family and Special Features.

S. No.	Order &Family	Scientific Name	Special Feature
1.	Order: Perciformes Family: Chanidae	*Channa striata* (Melua, Snakehead fish)	Air-breathing fish; survive in low-oxygen water.
2.	Order: Cypriniformes Family: Cyprinidae	*Cyprinus carpio* (Common Carp)	Hardy and Adaptable, widely farmed and introduced worldwide.
3.	Order: Beloniformes Family: Exocoetidae	*Parexoetidae branchypterus* (Flying fish)	It can glide above water for up to 200 meters to escape predators.
4.	Order: Beloniformes Family: Belonidae	*Xenetodon cancila* (Nunwa)	Needle-like body, specialized for ambush predation in freshwater.
5.	Order: Cypriniformes Family: Bagridae	*Sperata seenghala* (Seenghala)	Large catfish with good commercial value, strong taste and high protein content
6.	Order: Cypriniformes Family: Bagridae	*Mystus tengara* (Tengra)	Small native catfish known for its flavour and suitability in small water bodies.
7.	Order: Cypriniformes Family. Dorosomatidae	*Tenuolosa Ilisha* (Pala fish,Hilsa)	Migratory fish with a unique flavour profile and a rich nutritional value.
8.	Order: Cypriniformes Family*: Cyprinidae*	*Tor putitora* (Mahseer)	A popular game fish, once believed to be the largest species of mahseer, and can reach up to 2.75 m (9.0 ft) in length and 54 kg (119 lb) in weight, though most caught today are far smaller. Its caudal, pelvic, and anal fins show a reddish-golden tint.
09.	Order: Cypriniformes Family*: Channidae*	*Channa microplates* (Channa fish)	A large species, capable of growing up to 4.3 feet long and weighing 44 lbs. Its unique ability to breathe air and move on land, along with its aggressive predatory behaviour and camouflage, make it a fascinating fish.
10.	Order: Cypriniformes Family: *Cyprinidae*	*Cirrhinus mrigala* (Nain)	Popular in aquaculture, the Bottom feeder contributes to pond cleaning.
11.	Order: Cypriniformes Family *: Cyprinidae*	*Catla catla* (Katla)	Large-sized Indian carp; fast growth and commercial importance.
12.	Order: Cypriniformes Family*: Cyprinidae*	*Chagunius chagunio* (Puthia)	Native riverine fish; known for resilience in flowing waters.
13.	Order: Cypriniformes Family: *Cyprinidae*	*Puntius sarana* (Puthia)	Attractive scales; used in aquaculture, omnivorous feeding habits.
14.	Order: Cypriniformes Family: *Cyprinidae*	*Puntius sophore* (Puthia)	Small freshwater fish, important in subsistence fishing.
15.	Order: Perciformes. Family: Osphronemidae	*Trichogaster fasciata* (Bhedal)	Labyrinth fish, can breathe air; found in stagnant or slow-moving water
16.	Order:Siluriformes Family: Clariidae	*Clarius mogur* (Kater, Local Mogur)	Can breathe air, travel short distances over land.
17.	Order: Cypriniformes Family: *Cyprinidae*	*Labeo rohita* (Rohu)	Most popular Indian carp; fast-growing and nutritious.
18.	Order: Cypriniformes Family: *Cyprinidae*	*Hypophthalmichthys* (Bighead carp)	Large, scaleless head, upturned mouth, dark, mottled colouring on the upper body

During the current survey, 18 fish species were identified from Baur Reservoir, categorized under 4 orders and 7 families (Table .1). Joshi *et. al.*, 2024 reported 16 species from 5 orders and 8 families specifically from the Gularbhoj region. In the present study, the dominant catch included commercially important carps such as *Catla catla*, *Labeo rohita*, and *Cirrhinus mrigala*. Overall, the fish diversity was composed of nine species from the family Cyprinidae, two species (Bagridae and Chanidae) and single representatives from families Dorosomatidae, Clariidae, Osphronemidae, Exocoetid and Belonidae. Based on catch composition, Cyprinidae was identified as the most dominant family, followed by Bagridae and Chanidae as sub-dominant groups.

The dominance of Cyprinidae aligns with observations from other regional studies (Sharma *et.al*; 2018), emphasizing its ecological adaptability and reproductive success in both lentic and lotic environments. Notably, *Channa* and *Puntius* spp. were the most frequently encountered and seasonally persistent fish species across sampling periods. Occasional occurrences of *Tor* was also noted, though in considerably lower numbers, confirming their relatively limited presence in the reservoir (Agarwal, *et.al*., 2011). Sharma, *et.al*; 2018 reported in their study that in the Bhagirathi stream habitats *Cyprinus carpio* (common carp), a well-established species in lentic waters, was found in abundance. Other genera such as *Noemacheilus* and *Barilius* were sporadically observed, while *Garra*, *Botia*, and *Glyptothorax* were encountered infrequently.

Among the fish species observed, *Channa* and *Puntius* spp. were the most commonly recorded and showed persistence throughout different sampling seasons. *Tor* species were observed only occasionally and in much smaller numbers, indicating their relatively limited distribution within the reservoir. *Cyprinus carpio* (common carp), a species highly suited to still-water (lentic) conditions, was found in large numbers in the Bhagirathi stream habitats. In contrast, genera like Noemacheilus and Barilius were observed only sporadically, while *Garra, Botia,* and *Glyptothorax* were recorded infrequently. The predominance of Cyprinidae is consistent with findings from other regional studies, highlighting the family's ecological versatility and reproductive efficiency in both still (lentic) and flowing (lotic) water systems. (Agarwal, *et. al.*, 2011., Sharma, *et. al*., 2018).

The *Clarias magur,* popularly known as magur, is the most propitious species among the catfishes for freshwater aquaculture in India and neighbouring countries due to its high growth rate, efficient food conversion and fetching a very high market price (Das, 2007; Sahoo, *et .al.*, 2016; Sahoo, *et .al*., 2020). Magur is naturally a hardy species and an obligatory air breather usually inhabits low-lying water bodies like swamps, marshes, derelict waters and rivers, and has the ability to thrive in adverse ecological conditions like very low dissolved oxygen, high turbidity and ammonia (Verma, *et.al.*, 2011; Kumar,

et.al., 2012; Sarma, *et.al*., 2013; Ferozeshah, *et. al.*, 2021). While, *Tor putitora* inhabiting the mountain rivers is a game and food fish with long life span. The Himalayan mahseer exhibited slow growth comparatively to its first cousin Tor tor i.e. inhabiting in tropical waters. The commercially exploited fish species seem to exhibit a decline in the asymptotic length and may hence be related to excessive exploitation (Nautiyal, *et.al.*,2008). *Clarias magur* along with *Tor putitora* are classified as critically endangered species by International Union for Conservation of Nature (IUCN).

Puntius sarana is considered as a vulnerable species. Once *Puntius sarana* was available almost all around the year in ponds, lakes, ditches, floodplains, streams, coastal waters, estuaries, and rivers such as the Padma, Jamuna, Halda, Meghna, and also reported in the Gangetic River system of India and Bangladesh (Hossain, et. al.,2009; Siddik, *et.al*.,2016.). But this species is drastically declined in these water bodies over the years and currently it is on the verge of extinction (IUCN, 2010; Siddik, *et.al.,* 2013; Hanife. *al.,*2015). The increasing water pollution and destruction of breeding grounds for various reasons also restricted the natural breeding of Puntius sarana (Hossain, *et.al.*, 2009, Chaklader, *et.al.*, 2014, Nahar, *et.al*.,2015). *Puntius sophore* is facing threats and is confronting danger in regular conditions because of heavy fishing and anthropogenic exercises and its supplies are declining quickly from the Indian waters (Dua and Parkash,2009; Sarkar, *et.al.*,2010; Gupta, 2015; Kallimani, *et. al.*, 2021).

Cyprinidae continues to dominate both historically and presently, the overall fish abundance has experienced a noticeable decline. (Rawat, 1991; Joshi, 2006; Pathani and Joshi ,2007; Bandhu, *et.al.*, 2018; Kumar, *et.al*., 2019; Rajesh, 2021;)

The decline in sensitive fish species can largely be linked to unsustainable fishing methods and alterations to their natural habitats such as the construction of dams and roads which may interfere with specific habitat needs or result from human disturbances. Seasonal environmental pressures, especially during the monsoon season, also contribute to the problem by disrupting breeding cycles and displacing eggs and juveniles (Sharma *et. al.*, 2018). In recent years, there has been a noticeable decline in fishery yields, primarily due to habitat degradation, overfishing, and inadequate management strategies (Khan, *et .al.*, 2013; Mir, 2013).

Conclusion

These findings underscore the ecological richness of Baur Reservoir while simultaneously highlighting the pressing need for sustainable fisheries management to preserve aquatic biodiversity in the face of growing anthropogenic pressures.

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