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Study of Fish Diversity of Narmada River West Nimar, Barwani Region, (M.P.) India

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Abstract

Freshwater ecosystems support a wide range of biological diversity but are increasingly experiencing ecological stress due to anthropogenic disturbances. Fish communities, in particular, are highly sensitive to environmental changes and serve as effective indicators of aquatic ecosystem health. The present investigation documents the diversity and distribution of freshwater fishes in the Narmada River flowing through the West Nimar (Barwani) region of Madhya Pradesh. Fish diversity was examined in relation to environmental conditions that influence species occurrence and abundance.

A total of 49 fish species were recorded from the selected sampling sites during the study period. These species belonged to four orders, with Cypriniformes being the most dominant (26 species), followed by Siluriformes (10 species), Perciformes (9 species), and Beloniformes (4 species). The findings provide updated baseline information on the ichthyofaunal composition of this stretch of the Narmada River, which may support future conservation planning, ecological assessment, and sustainable management of inland water resources.

Keywords: Fish diversity, West Nimar region, Narmada River

Introduction

India possesses immense potential for the expansion and sustainable development of inland fisheries, which contribute significantly to the national economy and food security. Fish populations are a vital component of aquatic ecosystems and play an essential role in supporting human livelihoods. Scientific documentation of freshwater fishes in the Indian subcontinent dates back to the pioneering works of Hamilton-Buchanan (1822), followed by comprehensive contributions from Day (1878), Jayaram (1981), and Talwar and Jhingran (1991).

Geographically, India extends from 08°04′ to 37°06′ N latitude and 68°07′ to 97°25′ E longitude and is recognized as one of the world's twelve mega-biodiversity nations. The country encompasses two globally significant biodiversity hotspots, namely the Western Ghats and the Eastern Himalayas, which harbor rich and unique aquatic fauna.

The nation is endowed with a wide array of inland water resources, including rivers, streams, reservoirs, lakes, irrigation canals, subterranean waters, wetlands, and village ponds. These diverse aquatic ecosystems collectively represent a valuable ecological heritage characterized by high species richness and habitat diversity.

Inland aquatic systems support a large number of economically important organisms, particularly fishes, which constitute a major source of animal protein for human populations. Earlier studies have highlighted the ecological importance of fish diversity, emphasizing the dominance of the order Cypriniformes and

the crucial role of biodiversity in maintaining ecosystem stability and resilience (Shukla & Sharma, 2015; Azad & Shukla, 2015).

Materials and Methods

The Narmada River is the fifth largest river in India and longest west-flowing river of Indian peninsula Originated from Maikal ranges at Amarkantak in M.P. at an elevation of 900 meters. River Narmada is considered as the "Life Line" for the millions of people of central Indi. It flows over a length of 1312 km before draining into the Gulf of Cambay, 50 km west of Bharuch. The Narmada river extends over an area of 98,796^2 km and lies between eastern (Longitudes 72°32' to 81°45') and northern (latitudes 21°20' to 23°45')

The present study was two sampling stations (Rajghat and Chikhalda), selected at the back water river Narmada from city Barwani respectively. The period of study was one year September 2023 to August 2024. Sampling of fish has been done for every month for night and days throughout the study period. Collection of fish was made by using the cast nets and gill nets under the supervision of Fisherman. The fish were counted on the spot and 2-3 individuals of each type were selected preserved in 5% formalin solution. The identification of the fishes was done with the help of standard keys and books (Jayaram, 1996; Shrivastava, 1968; Day, 1958).

Diversity was measured by using the following indices

Shannon-Weiner diversity index (1949),

$H' = -\Sigma\ p_i 1np_i$

Simpson's index $(D)=1/\Sigma p_i^2$

Results and Discussion

Fish production in inland water bodies such as lakes, ponds, and reservoirs is either directly or indirectly influenced by the availability of planktonic organisms and benthic fauna (Das & Chand, 2003). The phys-ico-chemical characteristics of water play a crucial role in regulating both the quality and abundance of these aquatic organisms (Shrivastava, 1968).

Fish diversity in the Narmada River was assessed using data obtained from two sampling stations. The study documented a total of 49 fish species representing 23 genera, classified under 10 families and 4 orders from the Narmada River stretch of West Nimar (Barwani) (Table 1).

Among the recorded groups, Cypriniformes emerged as the most dominant order with 26 species, followed by Siluriformes comprising 10 species. The remaining orders included Perciformes with 9 species and Beloniformes with 4 species.

Comparable results were reported by Sunita Bakawale et al. (2013), who recorded 51 fish species belonging to 15 families and 7 orders. Their findings also revealed seasonal variation in diversity, with higher species richness during winter and lower diversity in the summer season. Dominance of Cypriniformes in the Narmada River was also recorded by Vipin Vyas et al. (2013), where Cypriniformes accounted for 39.15%, most dominated order followed by Bargridae and Mastacembelidae (8.72% each). These groups are dominant in lentic waters of India and Bangladesh and are more tolerant to pollution (Pathak & Mudgal, 2005).

The change in the composition of a fish assemblage often indicate a variation in water quality parameters such as pH, temperature, dissolved oxygen, and nutrients (Jhingran, 1982). Due to higher fecundity of

major carps and suitable environmental conditions, relatively higher numbers were observed (Talwar & Jhingran, 1991; Das & Chand, 2003; Pathak & Mudgal, 2005).

The month-wise values of Shannon-Weiner diversity (H) and Simpson Diversity (D) indices are shown in (Figure 1).

The Shannon–Wiener index (H′) indicates moderate to high diversity across the study period, with the maximum diversity recorded in November 2023 (H′ = 2.925). This suggests high species richness and relatively even distribution during the post-monsoon period. The lowest Shannon value in May 2024 (H′ = 2.102) reflects reduced diversity and uneven species distribution, likely due to environmental stress during peak summer conditions.

The Simpson's reciprocal index (D) emphasizes species dominance. The highest Simpson value in August 2024 (D = 17.04) indicates very high diversity with minimal dominance, suggesting a stable community structure, possibly influenced by favourable monsoon conditions. Conversely, the lowest Simpson value in May 2024 (D = 4.96) indicates strong dominance of a few species and low overall diversity.

Table 1 List of fish fauna in Narmada River West Nimar Barwani Region (M.P.)

S.N.	Order	Family	Genus	Species (with author and year)	Common Name
1	Cypriniformes	Cyprinidae	Catla	*catla (Hamilton, 1822)*	Catla
2			Labeo	*bata (Hamilton, 1822)*	Bata
3				*calbasu (Hamilton, 1822)*	Orange fin labeo
4				*rohita (Hamilton, 1822)*	Rohu labeo
5				*gonius (Hamilton, 1822)*	Kuria labeo
6				*angra (Hamilton, 1822)*	Mochhna
7				*boga (Hamilton, 1822)*	Boga labeo
8				*boggut (Sykes, 1839)*	Boggut labeo
9				*fimbriatus (Bloch, 1795)*	Fringed-lipped peninsula carp
10				*pungusia(Hamilton , 1822)*	pangusia carp
11			Cirrhinus	*cirrhosus (Bloch, 1795)*	Mrigal carp
12				*mrigala (Hamilton, 1822)*	Mrigal
13				*reba (Hamilton, 1822)*	Reba carp

S.N.	Order	Family	Genus	Species (with author and year)	Common Name
14			Puntius	*sarana (Hamilton, 1822)*	Olive barb
15				*sophore (Hamilton, 1822)*	Pool barb
16				*pinnauratus (Day, 1865)*	—
17				*chola (Hamilton, 1822)*	Swamp barb
18			Barilius	*barila (Hamilton, 1822)*	Barali
19				*radiolatus (Gunther,1868)*	Gunther's Baril
20			Tor	*tor (Hamilton, 1822)*	Tor barb/Kajra
21				*khudree (Sykes, 1839)*	Deccan mahseer
22				*putitora (Hamilton, 1822)*	Putitor mahseer
23			Amblypharyngodon	*mola (Hamilton, 1822)*	Mola carplet
24				*microlepis (Bleeker, 1835)*	Indian carplet
25			Bangana	*dero (Hamilton, 1822)*	Kalabans
26			Cabdio	*morar (Hamilton, 1822)*	morari
27	Siluriformes	Bagridae	Mystus	*bleekeri (Day, 1877)*	Day's mystus
28				*seenghala (Sykes, 1839)*	Giant river catfish
29			Rita	*rita (Hamilton, 1822)*	Rita
30		Claridae	Clarias	*magur (Linnaeus, 1758)*	Philippine catfish
31				*batrachus (Linnaeus, 1758)*	Walking catfish
32		Heteropneustidae	Heteropneustes	*fossilis (Bloch, 1794)*	Singhi
33		Siluridae	Ompok	*bimaculatus (Bloch, 1794)*	Butter catfish

S.N.	Order	Family	Genus	Species (with author and year)	Common Name
34				*pabo (Hamilton, 1822)*	Pabo catfish
35			Wallago	*attu (Bloch & Schneider, 1801)*	Wallago/Balla i
36			Bagarius	*bagarius (Hamilton, 1822)*	Goonch
37	Perciformes	Anabantidae	Anabas	*testudineus (Bloch, 1792)*	Climbing perch
38			Colisa	*fasciatus (Bloch & Schneider,1801)*	Striped gourami
39		Channidae	Channa	*gachua (Hamilton, 1822)*	Dwarf snakehead
40				*marulius (Hamilton, 1822)*	Great snakehead
41				*orientalis (Bloch & Schneider,1801)*	Walking Snakehead
42				*punctata (Bloch, 1793)*	Spotted snakehead
43				*striata (Bloch, 1793)*	Striped snakehead
44		osphronemidae	Trichogaster	*chuna (Hamilton, 1822)*	Honey gourami
45				*fasciata (Bloch & Schneider,1801)*	Banded gourami
46	Beloniformes	Belonidae	Xenentodon	*cancila (Hamilton, 1822)*	Freshwater garfish
47			Strongylura	*strongylura (van Hasselt, 1823)*	Spottail needlefish
48		Hemiramphidae	Hyporhamphus	*limbatus (Valenciennes, 1847)*	Congaturi halfbeak
49				*quoyi (Valenciennes, 1847)*	Quoy's garfish

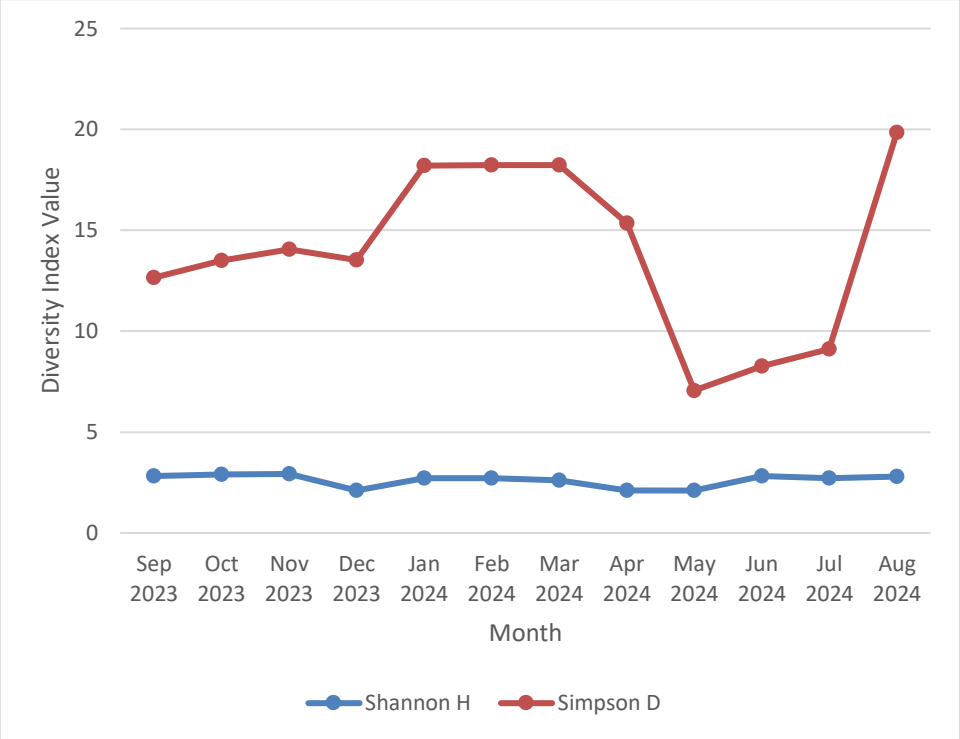

Figure 1 Monthly Variation in Fish Diversity based on Shannon and Simpson Indices

Conclusion

The results indicated a noticeable decline in the overall abundance of fish fauna in the River Narmada when compared with earlier records, suggesting progressive deterioration of the aquatic ecosystem. This decline is a clear indication of habitat degradation caused by anthropogenic activities such as indiscriminate plant and herb extraction, agricultural runoff, and poisoning from nearby fields. Seasonal diversity analysis using the Shannon–Wiener and Simpson indices revealed marked temporal variation in fish diversity. Higher diversity during post-monsoon and monsoon season (November-March and August) reflects improved habitat conditions and greater resource availability, whereas lower diversity during the summer season (April-May) indicates increased environmental stress, reduced species richness, and dominance of a few tolerant species. The concurrence of low Shannon and Simpson values in May 2024 strongly points to a period of maximum ecological stress within the fish community. Furthermore, rapid population growth has accelerated the conversion of agricultural and natural landscapes into urban areas, including road construction and infrastructure development, exerting additional pressure on aquatic habitats. Considering that fish are a nutrient-rich and vital source of food security, there is an urgent need for the effective, planned, and sustainable utilization of aquatic resources, particularly fish resources, to ensure their long-term conservation and ecological sustainability.

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