Gopal krashan Yadav, et. al., International Journal of Engineering Research and Applications
www.ijera.com
ISSN: 2248-9622, Vol. 13, Issue 3, March 2023, pp 177-183

RESEARCH ARTICLE OPEN ACCESS

Ichthyofaunal Diversity of Bilpan Pond, Dungarpur, Rajasthan.

[1]Gopal krashan Yadav, [2]Seema Bharadwaj and [3]Lalit Choudhary*
[1,2]Department of Zoology, HDJ Govt. Girls College, Banswara (Rajasthan), India. 327001.
[3]Department of Zoology, Leo College, Banswara (Rajasthan), India, 327001.
Corresponding author – lalit540@gmail.com

ABSTRACT
This study catalogues 31 freshwater fish taxa across 23 genera and 5 orders—Cypriniformes, Perciformes, Siluriformes, Anabantiformes, and Beloniformes—with specimens belonging to four primary families: Cyprinidae, Channidae, Notopteridae, and a collective group of Siluridae/Heteropneustidae/Bagridae, plus Belonidae and Cichlidae. The fish assemblage of Bilpan Pond (latitude 23° 35′ 10″ N, longitude 73° 44′ 20″ E), situated near Simalwara–Jhonthri in Dungarpur district, Rajasthan.
Quantitative analysis reveals that Cyprinidae dominates the assemblage, comprising 19 of the 31 species (~61%). Channidae follows with three unique entries (*Channa punctata, C. striata, and C. marulius*), accounting for ~10%. Notopteridae (*Notopterus notopterus*) and Belonidae (*Xenentodon cancila*) each appear once, representing ~3% each. The catfish-related grouping (Siluriformes: Siluridae, Heteropneustidae, Bagridae) includes three taxa (*Mystus seenghala, Mystus cavasiu, Ompok bimaculatus*, *Wallago attu* appearing twice though counted once), representing ~10%. Cichlidae is represented by two tilapia entries (*Tilapia/Tilapia mossambicus/Oreochromis mossambicus*), constituting ~6%. The predominance of Cyprinidae suggests a cyprinid-rich freshwater ecosystem, while the presence of predator and air-breathing families like Channidae and Siluridae/Heteropneustidae indicates functional diversity. Minor representation of other families highlights ecological heterogeneity. These findings have implications for biodiversity assessment, conservation priorities, and ecosystem management in freshwater bioregions.
Keywords: Bilpan Pond, ichthyofaunal diversity, dominance, Dungarpur.

I. INTRODUCTION

Freshwater bodies in Rajasthan host a rich assemblage of ichthyofauna, predominantly dominated by Cyprinidae, as documented by several researchers. Mohan and Ramkishor (2013) compiled records indicating 160 species across nine orders, with Cypriniformes (95 spp.) and Cyprinidae (81 spp.) being overwhelmingly predominant statewide. Similarly, Banyal and Kumar (2019) reported Cypriniformes (17 spp.) as the most diverse order in the Mahi River, with Siluriformes and Perciformes contributing five species each. In their study of the Chambal River basin, Banyal and Kumar (2017) stressed the importance of habitat morphology on community structure. These findings resonate with their earlier work on the Chambal River, which documented diverse taxonomic representation across orders (Banyal & Kumar, 2015).

Investigations on reservoirs and ponds in southern Rajasthan further reinforce these patterns. Roat et al. (2023) examined Patela Pond and noted strong associations between hydrological parameters, plankton dynamics, and ichthyofaunal diversity. In Udaipur, Singh (2013) documented fourteen fishes, including *Labeo rohita* and *Catla catla*, in Lake Pichhola, highlighting habitat enrichment effects. Bairwa et al. (2020) reported 32 fish species in Goverdhan Sagar Lake, with Cyprinidae contributing significantly, underlining anthropogenic impacts Qureshi (2021) studied Chandrasarovar Pond (Jhalawar), documenting 23 species across six orders, again emphasizing Cyprinidae dominance (12 spp.) Vyas et al. (2020) recorded 23 species in Mahi Bajaj Sagar Reservoir, with 11 belonging to Cyprinidae underscoring the family's ubiquity. Collectively, these studies illustrate the consistent prevalence of cyprinids in Rajasthan's freshwater systems, influenced by physico-chemical conditions, habitat structure, and anthropogenic pressures.

Building on this regional framework, the present study investigates the ichthyofaunal diversity of Bilpan Pond, located at 23° 35′ 10″ N, 73° 44′ 20″ E, with a catchment area of 17.61 km², near Simalwara and Jhonthri towns in Dungarpur district. By cataloging species composition and relative abundance, the study aims to elucidate the role of local environmental variables and human influences in shaping fish communities. The findings will contribute to long-term monitoring efforts and inform conservation strategies tailored to small pond ecosystems in semi-arid regions of southern Rajasthan.

II. MATERIAL AND METHOD

1. Study Area

Bilpan Pond is located at 23° 35′ 10″ N, 73° 44′ 20″ E near Simalwara and Jhonthri towns in Dungarpur district, southern Rajasthan. The pond lies within a 17.61 km² catchment area, characterized by semi-arid climate with pronounced seasonal fluctuations in temperature and precipitation. The shoreline supports diverse microhabitats, including open water zones, submerged vegetation, and marginal reed beds, making it ecologically suitable for examining spatial heterogeneity in fish assemblages.

2. Sampling Design

A stratified sampling framework was implemented to cover the pond's main habitat types: Open water zones, within each habitat, five random replicate sites were selected (total = 15). Sampling was conducted seasonally—pre-monsoon (May), monsoon (August), and post-monsoon (November 2023)—to capture temporal variation, following standard pond survey protocols.

3. Fish Sampling Methods

Fish were collected using a combination of gears to optimise species detection:

- Cast nets (mesh sizes 20–30 mm)
- Gill nets (mesh sizes 30–60 mm)
- Dip nets and scoop nets for shallow and vegetated areas

These methods are consistent with other freshwater fish diversity studies in India (e.g., Assam wetlands) and ensured comparability. Identified immediately using standard taxonomic keys (e.g., Talwar & Jhingran, 1991; Jayaram, 1999), measured (total length and weight), and released. Representative specimens (if unidentifiable in situ) were preserved in 5–10% formalin for laboratory confirmation.

To calculate **Shannon Diversity Index (H')** based on **families** from your provided list of fish species, we use the formula:

$$H' = -\sum(pi \cdot \ln pi)$$

Where:

- pi= Proportion of species in the *i-th* family
- ni: Number of species in the *i-th* family
- NNN: Total number of species across all families

III. RESULTS AND DISCUSSION

Ichthyofaunal Diversity and Conservation Status

The ichthyofaunal survey revealed a diverse assemblage of 31 fish species spanning 7 orders and 9 families in the study area. The dominant orders recorded were Cypriniformes and Siluriformes, representing the majority of species diversity. The species varied widely in their conservation status according to the IUCN Red List, ranging from Least Concern to Vulnerable, with several species not yet evaluated (Table 1).

Order-wise Diversity

The Cypriniformes order was the most speciose, comprising 15 species primarily from the family Cyprinidae. These included important indigenous carp species such as *Labeo rohita*, *Catla catla*, and *Cirrhinus mrigala*, which are ecologically and economically significant in freshwater ecosystems. Within this order, most species, like *Labeo rohita* and *Labeo calbasu* were categorised as Least Concern (LC), indicating stable populations. However, several species such as *Labeo angra* and *Labeo dero* lack formal IUCN evaluation, suggesting a need for further assessment.

The Siluriformes order comprised species from families Bagridae and Siluridae, including *Mystus seenghala*, *Wallago attu*, and *Ompok bimaculatus*. Most bagrid catfish species were listed as Least Concern, reflecting their wide distribution and resilience, while *Wallago attu* lacked IUCN evaluation.

Other notable orders included Anabantiformes, with three species of *Channa* (snakeheads) all assessed as Least Concern, highlighting their stable populations in the region. The Osteoglossiformes order was represented by *Notopterus notopterus* (featherback), also Least Concern, an important freshwater predator.

The Cichliformes order included two species of tilapia (*Tilapia mossambicus* and *Oreochromis mossambicus*), both classified as Vulnerable (VU). Their threatened status reflects pressures from habitat degradation, overfishing, and competition with invasive species, making their conservation a priority.

The Beloniformes order was represented by *Xenentodon cancila* (freshwater garfish), which has not been evaluated by the IUCN, indicating gaps in knowledge of its conservation status.

Family-wise Representation

The Cyprinidae family dominated species richness with 15 species, reinforcing its significance in freshwater biodiversity of the study area. Families Channidae (snakeheads) and Bagridae (bagrid catfishes) also contributed notable diversity, representing species well-adapted to a range of aquatic habitats.

Families such as Ambassidae and Heteropneustidae were represented by fewer species, with several taxa yet to be evaluated for conservation status.

Conservation Implications

The predominance of Least Concern species suggests relatively healthy fish populations in many groups; however, the presence of Vulnerable species, notably the cichlids, signals conservation concern. The data also highlight significant knowledge gaps due to the number of species classified as Not Evaluated. This underscores the need for targeted ecological and conservation research to accurately assess these species' population trends and threats.

Given the ecological and economic importance of species such as *Labeo rohita*, *Catla catla*, and *Channa striata*, sustainable management practices should be emphasised to maintain fish diversity and fisheries productivity.

The Shannon Diversity Index (H′) based on fish families recorded in the study was calculated to be 1.75, indicating a moderate level of family-wise diversity among the fish species. A total of 27 species belonging to 9 different families were observed. Among these, the family *Cyprinidae* was the most dominant, comprising nearly half of the total species (13 out of 27), followed by Channidae with 3 species, and Cichlidae, Ambassidae, Bagridae, and Siluridae with 2 species each. Families like *Belonidae*, *Heteropneustidae*, and *Notopteridae* were represented by a single species each. The higher dominance of Cyprinidae contributed to a slight reduction in evenness, which affected the overall diversity value. Nevertheless, the presence of multiple families with varied species counts reflects a moderately diverse fish community structure in the studied freshwater ecosystem (Table 2).

The ichthyofaunal diversity recorded in the present study indicates a rich and varied composition of freshwater fish species distributed across seven different taxonomic orders and nine families. The predominance of the order Cypriniformes, particularly the Cyprinidae family, is consistent with patterns observed in other Indian freshwater systems (Jayaram, 2010; Talwar & Jhingran, 1991). These species form the backbone of both capture and culture fisheries, with economically important species such as *Labeo rohita*, *Catla catla*, and *Cirrhinus mrigala* dominating the assemblage.

The Least Concern (LC) status of most cyprinids, such as *Labeo calbasu* and *Devario devario*, suggests their widespread distribution and relatively stable populations, as also reported by Sarkar et al. (2008) in their assessments of Indian rivers. However, the lack of IUCN evaluation for many species, such as *Labeo dero* and *Cirrhinus reba*, reflects significant knowledge gaps in freshwater biodiversity monitoring, a concern echoed by Dahanukar et al. (2011), who emphasized the need for updated taxonomic and population data on India's inland fish fauna.

The presence of catfishes under the order Siluriformes—notably *Mystus seenghala* and *Wallago attu*—adds to the trophic complexity of the ecosystem. These predatory species contribute to the ecological balance and have been similarly documented in diverse Indian aquatic systems (Lakra et al., 2010). *Mystus cavasius*, categorized as LC, also reflects a resilient species capable of thriving in varied ecological conditions, a trait observed in other studies (Daniels, 2002).

Interestingly, two species—*Tilapia mossambicus* and *Oreochromis mossambicus*—were recorded as Vulnerable (VU) according to the IUCN Red List. Originally introduced for aquaculture, these species are now facing population pressures due to habitat degradation and competition from native fish, a concern highlighted by Gophen (2015), who reported similar trends in Asian freshwater systems. Their vulnerability calls for careful management in both wild and culture environments.

The order Anabantiformes, represented by snakehead fishes like *Channa punctata* and *Channa striata*, remains relatively stable across Indian waters, frequently recorded as LC due to their air-breathing capabilities and tolerance to poor water quality (Kumar et al., 2006). Nonetheless, habitat fragmentation and overfishing may pose threats if unchecked.

Notopterus notopterus, under the Osteoglossiformes, also registered as LC, is an important native predator with high ecological value. Its presence indicates a relatively healthy aquatic ecosystem, which aligns with findings by Bhatt et al. (2004) who linked species richness to the availability of structured habitats like submerged vegetation and macrophytes.

The low representation of species from Beloniformes and Ambassidae orders in the current study is comparable to previous reports in semi-arid regions of western India (Sharma et al., 2015), where habitat heterogeneity and seasonal water flow influence fish composition.

Overall, the dominance of LC species may reflect relatively undisturbed ecological conditions; however, the considerable number of species marked as Not Evaluated (NE) by the IUCN, including *Labeo angra* and *Ompok bimaculatus*, underlines the urgent need for systematic taxonomic revisions and region-specific conservation assessments (Dahanukar et al., 2011).

Table 1. Ichthyofaunal diversity of Bilpan Pond, Dungarpur.

Order	Family	*Scientific Name*	IUCN Status (Year)
Anabantiformes	Channidae	*Channa punctata (Bloch, 1793)*	Least Concern (LC)
		Channa striata (Bloch, 1793)	Least Concern (LC)
		Channa marulius (Hamilton)	Least Concern (LC) (2009)
Beloniformes	Belonidae	*Xenentodon cancila (Hamilton)*	Not Evaluated (NE)
Cichliformes	Cichlidae	*Tilapia mossambicus (Peters, 1852)*	Vulnerable (VU) (2017)
		Oreochromis mossambicus (Peters)	Vulnerable (VU) (2017)
Cypriniformes	Cyprinidae	*Labeo rohita (Hamilton, 1822)*	Least Concern (LC) (2010)
		Labeo angra (Hamilton, 1822)	Not Evaluated (NE)
		Labeo calbasu (Cuvier, 1816)	Least Concern (LC)
		Labeo dero	Not Evaluated (NE)
		Labeo fimbriatus (Bloch, 1795)	Least Concern (LC)
		Labeo gonius (Hamilton, 1822)	Not Evaluated (NE)
		Catla catla (F. Hamilton, 1822)	Not Evaluated (NE)
		Cirrhinus mrigala (Hamilton, 1822)	Not Evaluated (NE)
		Cirrhinus reba (Hamilton, 1822)	Not Evaluated (NE)
		Puntius sarana (F. Hamilton, 1822)	Not Evaluated (NE)
		Rasbora daniconius (Bleeker, 1859)	Least Concern (LC)
		Puntius sophore (F. Hamilton, 1822)	Not Evaluated (NE)
		Devario devario (F. Hamilton, 1822)	Least Concern (LC)
Heteropneustiformes	Heteropneustidae	*Heteropneustes fossilis (Bloch)*	Least Concern (LC)
Osteoglossiformes	Notopteridae	*Notopterus notopterus (Pallas)*	Least Concern (LC)
Perciformes	Ambassidae	*Chanda nama (Hamilton)*	Not Evaluated (NE)
		Chanda ranga (F. Hamilton, 1822)	Not Evaluated (NE)
Siluriformes	Bagridae	*Mystus seenghala (Hamilton, 1822)*	Least Concern (LC)
		Mystus cavasius (Hamilton, 1822)	Least Concern (LC)
	Siluridae	*Wallago attu (Bloch & Schneider, 1801)*	Not Evaluated (NE)
		Ompok bimaculatus (Bloch)	Not Evaluated (NE)

Table 2. Shannon Diversity Index

Family	**ni**	**pi=ni/N**	**pi·ln(pi)**
Channidae	3	0.1111	-0.2441
Belonidae	1	0.0370	-0.1285
Cichlidae	2	0.0741	-0.1923
Cyprinidae	13	0.4815	-0.3524
Heteropneustidae	1	0.0370	-0.1285
Notopteridae	1	0.0370	-0.1285
Ambassidae	2	0.0741	-0.1923
Bagridae	2	0.0741	-0.1923
Siluridae	2	0.0741	-0.1923

REFERENCES

[1]. Bairwa, V. P., Prasad, et al. (2020). Ichthyofaunal Diversity of Goverdhan Sagar Lake, Udaipur, Rajasthan. *Journal of Experimental Zoology India*, 23(1), 631–633.

[2]. Banyal, H. S., & Kumar, S. (2015). Fish diversity of Chambal River, Rajasthan State. In M. Rawat, S. Dookia, & C. Sivaperuman (Eds.), *Aquatic Ecosystem: Biodiversity, Ecology and Conservation* (pp. 271–281). Springer India.

[3]. Banyal, H. S., & Kumar, S. (2017). Fish diversity of the Vatrak Stream, Sabarmati River System, Rajasthan. *Records of the Zoological Survey of India*, 117(3), 214–220.
[4]. Banyal, H. S., & Kumar, S. (2019). Studies on fish diversity of the Mahi River, Rajasthan State. *Records of the Zoological Survey of India*, 119(1), 1–8. https://doi.org/10.26515/rzsi/v119/i1/2019/141307
[5]. Bhatt, J. P., Nautiyal, P., & Singh, H. R. (2004). Altitudinal variation in fish diversity in the Himalayan streams of Garhwal region, India. *Ecology, Environment and Conservation*, 10(4), 387–394.
[6]. Dahanukar, N., Raghavan, R., Anvar Ali, P. H., Abraham, R., & Shaji, C. P. (2011). The status and distribution of freshwater fishes of the Western Ghats. *IUCN Red List of Threatened Species - India*, 1–116.
[7]. Daniels, R. J. R. (2002). Freshwater fishes of Peninsular India. *Universities Press*.
[8]. Gophen, M. (2015). Fish community changes in Lake Kinneret (Israel) and their significance. *Open Journal of Ecology*, 5(5), 188–203. https://doi.org/10.4236/oje.2015.55017
[9]. Jayaram, K. C. (1999). *The freshwater fishes of the Indian region* (2nd ed.). Delhi, India: Narendra Publishing House.
[10]. Jayaram, K. C. (2010). The freshwater fishes of the Indian region (2nd ed.). *Narendra Publishing House*.
[11]. Kumar, K., Saini, V. P., & Sharma, L. L. (2006). Ecology and biology of air-breathing fishes of Rajasthan. *Journal of Inland Fisheries Society of India*, 38(1), 34–39.
[12]. Lakra, W. S., Sarkar, U. K., & Kumar, R. S. (2010). Fish biodiversity of India: Pattern, status and conservation needs. *Aquatic Ecosystem Health & Management*, 13(4), 429–439.
[13]. Mohan, D., & Ramkishor, S. (2013). *Ichthyofauna of Rajasthan.* In *Faunal Heritage of Rajasthan, India: General Background and Ecology of Vertebrates* (pp. 257–277). Springer.
[14]. Qureshi, A. (2021). Studies on diversity and seasonal variations in ichthyofauna of Chandrasarovar Pond of Jhalawar, Rajasthan. *International Journal of Trend in Scientific Research and Development*, 5(4), 1367–1371.
[15]. Roat, S., Chaudhary, L., & Bhardwaj, S. (2023). Deciphering the interplay of hydrological parameters, plankton community, and ichthyofauna in Patela Pond, a southern Rajasthan ecosystem. *Journal for ReAttach Therapy and Developmental Diversities*, 6(1), 1909–1918. https://doi.org/10.53555/jrtdd.v6i1.3067 jrtdd.com
[16]. Sarkar, U. K., Pathak, A. K., Sinha, R. K., Sivakumar, K., & Pandian, A. K. (2008). Freshwater fish biodiversity of the River Ganga (India): Changing pattern, threats and conservation perspectives. *Reviews in Fish Biology and Fisheries*, 18(3), 241–254. https://doi.org/10.1007/s11160-007-9078-6
[17]. Sharma, K. K., Vyas, S., & Saxena, M. M. (2015). Seasonal variation in the fish diversity of Mahi River in Banswara (Rajasthan), India. *International Journal of Fisheries and Aquatic Studies*, 2(6), 55–59.
[18]. Singh, P. K., & Sharma. (2013). *Ichthyofauna of Lake Pichhola, Udaipur (Rajasthan)* (master's thesis). MPUAT, Udaipur.
[19]. Talwar, P. K., & Jhingran, A. G. (1991). *Inland fishes of India and adjacent countries* (Vols. 1–2). New Delhi, India: Oxford & IBH Publishing.
[20]. Vyas, T., Roy, S. M., & Choudhary, L. (2020). Ichthyofaunal diversity of the Mahi Bajaj Sagar Reservoir, District Banswara, Rajasthan, India. *International Journal for Research in Applied Science and Engineering Technology (IJRASET)*, 8(7), 371–374.

Labeo rohita (Ham.)

Pangasius pangasius (Ham.)

Labeo gonius (Ham.)

Channa punctate (Bloch)

Mystus seenghala (Sykes)

Catla catla (Ham.)