



ORIGINAL RESEARCH PAPER



ICHTHYOFAUNAL DIVERSITY AND CONSERVATION STATUS OF FINFISH ASSEMBLAGES IN THE CHIKOTRA RESERVOIR, KOLHAPUR DISTRICT, MAHARASHTRA, INDIA

Kishor Adate*¹ and Vinayak Ajgekar²

¹Shivraj College of Arts, Commerce and D.S. Kadam Science College, Gadhinglaj, Dist. Kolhapur, Maharashtra, 416502

²Ajara Mahavidyalaya, Ajara, Dist. Kolhapur, Maharashtra, 416505

*Correspondence author E-mail: kjadata@gmail.com

Received: 22 November 2025

Revised: 15 January 2026

Accepted: 21 January 2026

Published: 30 January 2026

DOI: <https://doi.org/10.5281/zenodo.18482700>

Abstract:

The ichthyofaunal diversity of the Chikotra dam was examined over one year, from January 2023 to December 2023. This study aimed to compile a checklist of the ichthyofauna of Chikotra to enhance fish diversity in Maharashtra's Kolhapur district and to contribute to the documentation of the fish fauna of the Western Ghats. Throughout the study, 36 species were identified, spanning 8 Orders and 12 Families. The Order Cypriniformes was the most prevalent, comprising 49% of the total catch and including 19 species. Following Cypriniformes, Siluriformes was the second most diverse group, with 9 species accounting for 23%. The remaining six orders (Perciformes, Osteoglossiformes, Clupeiformes, and Synbranchiformes) collectively represented 28% of the recorded species. Statistical analyses of the Shannon Diversity Index and Simpson's Dominance Index were also conducted.

Keywords: Chikotra Reservoir, Western Ghats, Ichthyofauna, Shannon Diversity Index, and Simpson's Dominance Index.

Introduction

The biodiversity crisis is among the most critical environmental challenges we face today, with freshwater ecosystems being particularly at risk (1). Although they cover less than 1% of the Earth's surface, freshwater habitats support a considerable portion of the world's species diversity (2,3). Fish populations are essential indicators of the health of aquatic ecosystems, significantly contributing to nutrient cycling, food web dynamics, and the provision of crucial ecosystem services (4,5). Unfortunately, these ecosystems are under global threat from habitat destruction, pollution, invasive species, and climate change, which are causing a rapid decline in fish populations and leading to species extinction (6). The primary focus of freshwater fish in rivers is the catch-based

data of commercially valuable species. However, it is crucial to maintain the ecology of water bodies, and the biodiversity and conservation of fish are not adequately evaluated (7).

India is home to around 2500 fish species, each exhibiting diverse traits. Among these, 930 species from 326 genera are located in inland waters (8), while 1570 species are found in marine habitats (9). The National Bureau of Fish Genetic Resources (NBFGR) in India has developed a thorough and efficient database of the nation's fish genetic resources. The country's aquatic resources, which encompass rivers, wetlands, and an extensive network of man-made reservoirs, are crucial for inland fisheries, supporting the livelihoods and nutritional needs of millions (10). The Western Ghats are notably recognized as one of the world's eight major biodiversity hotspots, renowned for their high levels of species endemism, particularly among freshwater fish (11). With over 300 freshwater fish species, approximately 65% of which are endemic to the area, safeguarding the aquatic ecosystems in the Western Ghats is a national priority (12).

The construction of dams for purposes such as hydropower, irrigation, and flood management has significantly transformed the flow dynamics of most major river systems worldwide (13,14,15). In Maharashtra, a long history of dam building has led to the creation of an extensive network of over 1,800 major and medium-sized reservoirs, which now serve as the region's primary inland fishery resource (16). These reservoirs, including the Chikotra Dam, establish new, static water ecosystems that replace the flowing river habitats.

While reservoirs offer significant societal benefits, such as irrigation, water supply, and enhanced fish production through culture-based fisheries, they also present notable challenges to native fish species (Ichthyofauna) (17). The modification of habitats often favors widespread or commercially introduced species, like the Indian Major Carps (IMCs: *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*) or, controversially, non-native species (*Cyprinus carpio*, *Oreochromis mossambicus*) (18). Although this stocking practice increases commercial catches, it can adversely affect the habitat and survival of Small Indigenous fish and endemic species that have evolved in the original riverine environment (19).

Thus, reservoirs act as complex ecological mosaics where native river remnants coexist with introduced commercial species. Understanding the current species makeup and measuring the relative amounts of native versus exotic fish are vital for assessing the ecological health of the impoundment and guiding sustainable management policies.

Study area

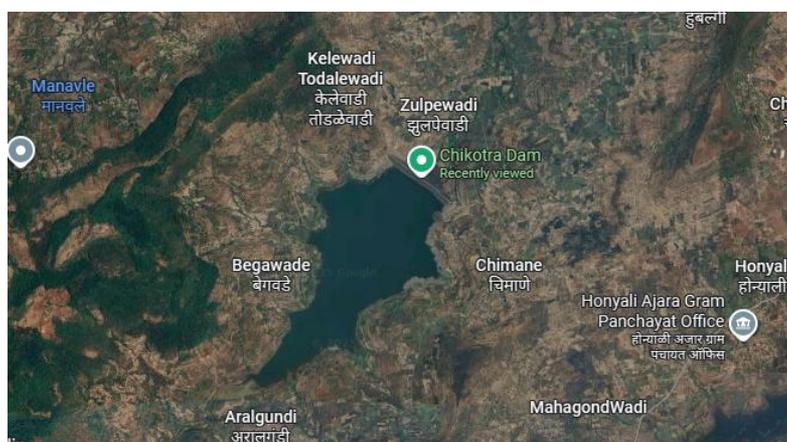


Figure 1: Study area (Chikotra Dam, Zulpewadi Taluka Ajara, District Kolhapur)

The Kolhapur District is located at the junction of the central and southern Western Ghats, an area known for heavy rainfall and dense forests that feed the headwaters of the Krishna River system, especially the Ghataprabha basin and the Chikotra River. This geographical position gives the district's water bodies significant biogeographical value, serving as habitats for many endemic and threatened fish species.

Chikotra Dam specifications

- Maharashtra Krishna Khore Vikas Mahamandal, Pune, and Kolhapur Patbandharae Mandal, Kolhapur, Medium Project Vibhag -2 Kolhapur.
- Name of the project: Chikotra Medium Project
- First permission: January 1994 (39.44 Cr.)
- Second permission: February 2001 (137.94Cr)
- Watershed area: 29.03 Square Kilometers
- Length of the dam: 943.00 Meters
- Depth of the dam: 637.15 Meters
- Dam water height: 612.45 Meters
- Height of the dam: 60.78 meters,
- capacity of the dam: 43.115 dlmd / 1522.39 dlm feet
- Area under water: 231.30 Hectares
- Total benefit area: 7888 Hectares
- Total area under irrigation: 5630 Hectares
- Total Bandhare below the dam: 19 small-scale Bandhare and 9 Kolhapur-type Bandhare.
- Project completion year: 2007
- Electricity generation project capacity: 1 x 0.80 Megawatt.

Material and Methods

Over the course of a year, from January 2023 to December 2023, fish sampling was conducted to assess the diversity of fish populations. Samples were collected from the daily catches of local fishermen working near the dam. This approach enabled the collection of larger, commercially valuable fish and provided qualitative insights into the species present. Fish species were identified using standard taxonomic literature (20,21,22,23,24,25,26,8). For Statistical analysis, two diversity indices were calculated: The Shannon Diversity Index and Simpson's Dominance Index. Shannon Diversity Index (27) is calculated by considering the total number of individuals and the number of taxa, ranging from a 0 community with only one taxon to higher values of communities with many taxa.

$$H = - \sum_i \frac{n_i}{n} \ln \frac{n_i}{n}$$

Where n_i is the number of individuals of the 'i' taxon, n is the total number of individuals.

Simpson dominance index (28) ranges from 0 (where all taxa are equally present) to 1 (one taxon dominates the community entirely).

$$D = \sum_i \left(\frac{n_i}{n} \right)^2$$

Where n is the number of individuals of the 'i' taxon

Results

A total of 39 fish species, belonging to 8 Orders, 12 Families, were recorded from the Chikotra Dam reservoir over the twelve-month sampling period. The overall species richness (S) was therefore 39, which is considerable and satisfactory.

The Order Cypriniformes was the most dominant, contributing 49 % of the total catch and accounting for 19 species. Following Cypriniformes, Siluriformes represented the second most diverse group (9 species, 23 %), while the remaining six orders (Perciformes, Osteoglossiformes, Clupeiformes, and Synbranchiformes) collectively accounted for 28 % of the recorded species.

The Family Cyprinidae was overwhelmingly dominant, comprising 19 species (49 % of total richness). Other well-represented families included Bagridae (4 species). Families like Danionidae (3 species), Mastacembelidae (2 species), Siluridae (3 species), and Cichlidae represented by a single species.

Shannon's Diversity Index 3.489 shows a strong relationship with overall species richness. Simpson dominance index 0.03102. It represents that two individuals chosen at random will belong to different species.

Discussion

This study examines the fish species composition and diversity (ichthyofauna) in the Chikotra Dam. We discovered 39 different fish species, reflecting significant diversity, although these species are under threat. Similar research has been conducted on the ichthyofauna in Kolhapur district (29, 30). Various human activities and fish farming practices endanger these species. Consequently, it is crucial to focus on preserving ichthyofaunal diversity in this region. Conservation efforts should emphasize habitat protection and sustainable fishing practices to reduce threats to these species. Raising public awareness and involving the community are vital elements of successful conservation strategies. Additional research is necessary to track population trends and evaluate the impact of human activities on these fish species. Collaborative efforts among government agencies, non-governmental organizations, and local communities will improve the effectiveness of these measures. Conducting regular environmental assessments can help identify new threats and adjust conservation strategies accordingly. Strengthening legal frameworks and enforcement mechanisms is essential to ensure the long-term preservation of ichthyofaunal diversity.

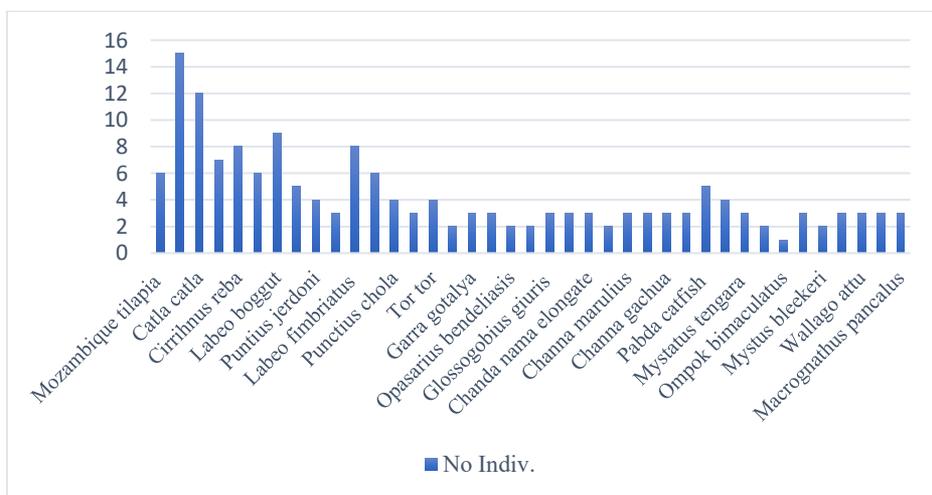


Figure 2: Checklist of ichthyofauna from Chikotra Dam

Table 1: Species Checklist and Conservation Status in Chikotra Dam, January 2023 to December 2023

Sr. No.	Order	Family	Species	IUCN Status
1	Cichliformes	Cichlidae	<i>Mozambique tilapia</i>	LC
2	Cypriniformes	Cyprinidae	<i>Labeo rohita</i>	LC
3	Cypriniformes	Cyprinidae	<i>Catla catla</i>	LC
4	Cypriniformes	Cyprinidae	<i>Cirrihnus mrigala</i>	LC
5	Cypriniformes	Cyprinidae	<i>Cirrihnus reba</i>	LC
6	Cypriniformes	Cyprinidae	<i>Labeo kalbasu</i>	LC
7	Cypriniformes	Cyprinidae	<i>Labeo boggut</i>	LC
8	Cypriniformes	Cyprinidae	<i>Labeo bogga</i>	LC
9	Cypriniformes	Cyprinidae	<i>Puntius jerdoni</i>	LC
10	Cypriniformes	Cyprinidae	<i>Cyprinus carpio</i>	LC
11	Cypriniformes	Cyprinidae	<i>Labeo fimbriatus</i>	LC
12	Cypriniformes	Cyprinidae	<i>Salmophasia boopis</i>	LC
13	Cypriniformes	Cyprinidae	<i>Punctius chola</i>	LC
14	Cypriniformes	Cyprinidae	<i>Puntius sophore</i>	LC
15	Cypriniformes	Cyprinidae	<i>Tor tor</i>	NT
16	Cypriniformes	Danionidae	<i>Silver hatchet chela</i>	LC
17	Cypriniformes	Cyprinidae	<i>Garra gotalya</i>	LC
18	Cypriniformes	Cyprinidae	<i>Garra mullya</i>	LC
19	Cypriniformes	Danionidae	<i>Opasarius bendeliasis</i>	LC
20	Cypriniformes	Danionidae	<i>Salmostoma boopis</i>	LC
21	Gobiiformes	Gobiidae	<i>Glossogobius giuris</i>	LC
22	Mugiliformes	Ambassidae	<i>Chanda Nama Hamilton</i>	LC
23	Mugiliformes	Ambassidae	<i>Chanda nama elongate</i>	LC
24	Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	LC
25	Perciformes	Channidae	<i>Channa marulius</i>	LC
26	Perciformes	Channidae	<i>Channa punctata</i>	LC
27	Perciformes	Channidae	<i>Channa gachua</i>	LC
28	Perciformes	Channidae	<i>Channa striata</i>	NT
29	Siluriformes	Siluridae	<i>Pabda catfish</i>	NT
30	Siluriformes	Clariidae	<i>Clarius batrachus</i>	LC
31	Siluriformes	Bagridae	<i>Mystatus tengara</i>	LC
32	Siluriformes	Bagridae	<i>Sperata seenghala</i>	LC
33	Siluriformes	Siluridae	<i>Ompok bimaculatus</i>	NT
34	Siluriformes	Bagridae	<i>Mystus armatus</i>	LC
35	Siluriformes	Bagridae	<i>Mystus bleekeri</i>	LC
36	Siluriformes	Ritidae	<i>Rita rita</i>	LC
37	Siluriformes	Siluridae	<i>Wallago attu</i>	NT
38	Synbranchiformes	Mastacembelidae	<i>Mastacembelus armatus</i>	LC
39	Synbranchiformes	Mastacembelidae	<i>Macragnathus pancalus</i>	LC

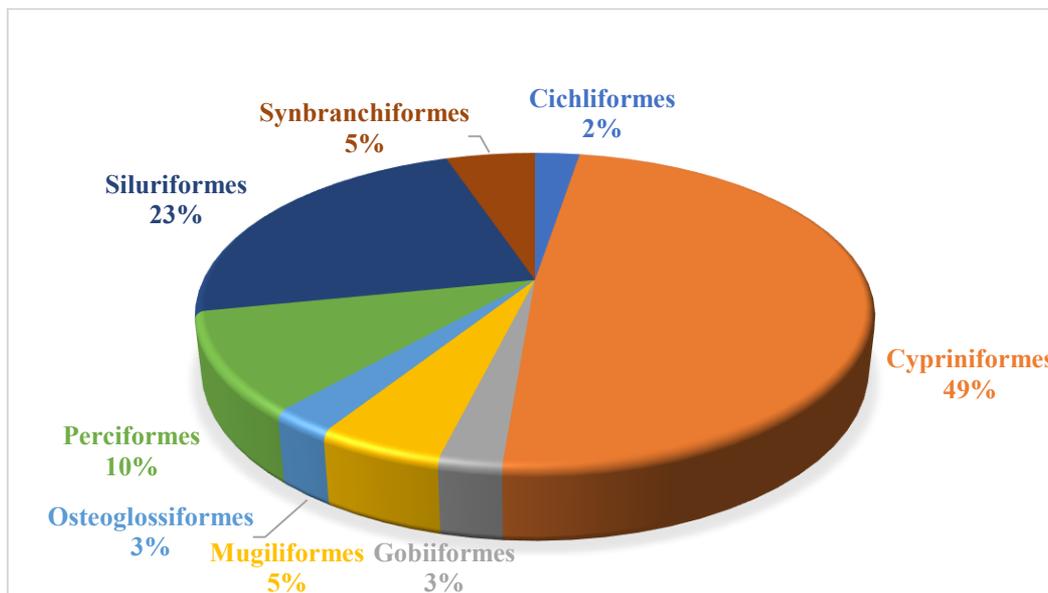


Figure 3: Ichthyofauna of Chikotra Dam (Order dominance)

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