



RESEARCH ARTICLE

Exploring the Biodiversity of Fishes of Gandiali Dam in District Kohat, Khyber Pakhtunkhwa, Pakistan

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ARTICLE INFO

Article History:

Received 13 July, 2026

Received in revised form 21 July, 2026

Accepted 30 August, 2026

Published online 10 September, 2026

Keywords:

Biodiversity

Fish fauna

Gandiali dam

Kohat district

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ABSTRACT

Ichthyological diversity reflects the richness of fish species in aquatic environments. Globally, 8,411 freshwater fish species have been documented. In Pakistan, approximately 193 freshwater fish species have been recorded, belonging to class *Actinopterygii*, subclass *Teleostei*, comprising three cohorts, six *superorders*, thirteen orders, thirty families, and eighty-six genera. The present study was conducted to investigate the status of fish biodiversity in Gandiali Dam, Kohat, during February 2024. A total of 25 specimens representing four species were collected and identified using the keys of Ahmed and Sandhu (2007). The identified species belonged to class *Actinopterygii*, comprising two orders (*Cypriniformes* and *Siluriformes*) and two families (*Cyprinidae* and *Siluridae*). The *Cyprinidae* family included *Labeo rohita*, *Cyprinus carpio*, and *Cirrhinus mrigala*, while *Ompok bimaculatus* represented the *Siluridae* family. The results indicate that *Cyprinidae* is the dominant family in Gandiali Dam. Notably, *Ompok bimaculatus* was recorded for the first time from this site. The study highlights the need for continuous monitoring to conserve and manage the fish biodiversity of Gandiali Dam sustainably.

1. Introduction

Fish are aquatic, cold-blooded vertebrates characterized by scales covering their bodies, fin-like appendages, and gills as their main respiration apparatus [1]. They represent the most diverse group of vertebrates, playing essential ecological roles and providing direct or indirect benefits to human welfare, including proteins, vitamins, minerals, income, and employment opportunities throughout the world [2].

The term “ichthyodiversity” refers to the study of fish biodiversity [3]. Biodiversity assessments are crucial for understanding the abundance, composition, and ecological functions of aquatic life, which directly influence ecosystem services.

Globally, approximately 8,411 freshwater fish species have been reported, including 930 species from Indian freshwater bodies, which constitute 41% of all fish and 20% of vertebrate species. In Pakistan, about 179 fish species

have been documented, categorized into five superorders, ten orders, twenty-six families, and eighty-two genera [4]. Kohat is a district of Khyber Pakhtunkhwa province, Pakistan, with diverse freshwater resources. Gandiali Dam, located north of Kohat city in Gandiali Bala town, is one such important water body supporting local fisheries and aquatic biodiversity [6]. The present study was conducted to determine the current state of fish biodiversity in Gandiali Dam, Kohat District, providing updated baseline data for conservation and sustainable utilization.

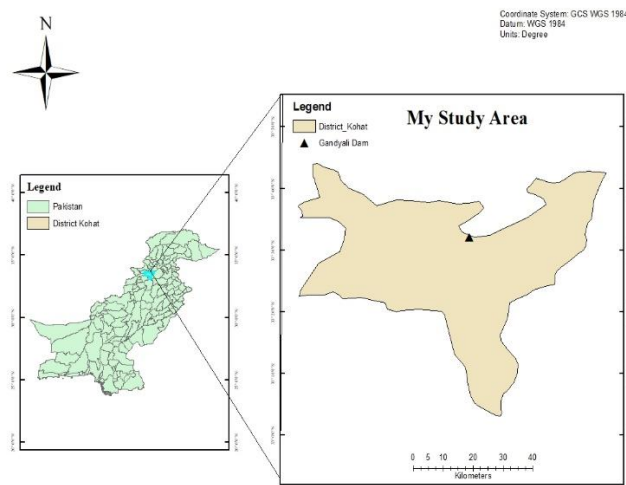
2. Material and Methods

2.1 Study Area

This town, known as Gandiali Bala, is situated in the Kohat District region, which is part of the province of Khyber Pakhtunkhwa in Pakistan. In this region, there is the Gandiali Dam, situated north of the city of Kohat.

Latitude-33.5333, longitude-71.6167. Kohat is a district in the province of Khyber Pakhtunkhwa, Pakistan. It lies in the southern part of Peshawar District and is adjacent to the northern fringes of Bannu and Karak Districts. It is some 72 km to the provincial capital of Peshawar. The Gandiali Dam is a mini dam located on the northeastern side of Kohat District in Khyber-Pakhtunkhwa Province, Pakistan. This dam was built in Kohat to collect rainwater for various purposes, including the production of drinking water, domestic use, and farming.

Figure 1: Map of Gandiali Dam, Kohat (drawn by ArcGIS)



2.2 Sample collection

Fish sampling was carried out in February 2024 using multiple gear types, including cast nets, hand nets, and fishing hooks, with the assistance of local fishermen. Sampling occurred over three consecutive days at three different stations around the dam. Each site was sampled for approximately 3–4 hours per day. The fish were counted, measured, and handled carefully to avoid damage. The total fish catch was 25 (Figure 2).

2.3 Preservation

After sample collection, fish were preserved in formalin solution, such as it consists of 10% pure formalin and 90% water.

2.4 Identification

Fish identification was carried out using the taxonomic key by Mirza and Sandhu (2007) Fishes of Punjab, Pakistan Identification was verified by local guide and previous species record of region.

2.5 Data Analysis

Species Composition, abundance and diversity indices were analyzed to assess the Ichthyofauna of the gandiali dam Kohat. The relative abundance % of each species was calculated by following formula

$$\text{Relative abundance} = (n_i/N) \times 100$$

n_i is number of individual of species, I and N is total number of individual of all species

To assess species diversity, the Shannon-Wiener diversity index was calculated using following formula

$$H' = - \sum_{i=1}^S P_i \cdot \ln(P_i)$$

Where S is total number of species, and P_i is the proportion (relative abundance) of the i -th species. The index account for species richness and evenness of community. (Shannon and Weaver, 1963).

The Simpson's dominance index (D) was calculated as

$$D = \sum_{i=1}^S (n_i/N)^2$$

n_i is the number of individual of species, N is the number of total species

The evenness index (J') was calculated using $J' = H' / \ln(S)$

Which measures how evenly individuals are distributed among the species present. J' values ranges from 0 to 1 with close to 1 mean its even in community.

3. Result

This investigation was conducted to ascertain the current state of fish biodiversity of Gandiali Dam, Kohat. It was conducted in February 2024. A total of 4 fish species were collected and identified, which belong to one class, two orders two family, and four genus. The total catch was 25. All four species belong to class *Actinopterygii*. Among the four species, three species belong to Order *Cypriniformes* and family *Cyprinidae*, one species belongs to Order *Siluriformes* and family *Siluridae*. All four species belong to four different genera, which is *Labeo*, *Cyprinus*, *Cirrhinus*, and *Ompok*. The four different species are *Labeo rohita*, *Cyprinus carpio*, *Cirrhinus mrigala*, and *Ompok bimaculatus* (Table 1). The family *Cyprinidae* is the most dominant one with three species, which are *L. Rohita*, *C. Carpio*, and *C. Mirgala*, followed by *Siluridae* with one species, *O. bimaculatus*. On the species level *L. rohita* is dominant with 10 samples, followed by *C. carpio* with 7 samples. The other two species, *C. mrigala* and *O. bimaculatus*, with 5 and 3 samples, respectively.

3.1 Biodiversity indices

A total of 25 fish samples, which belong to four species, were collected. Biodiversity analysis was performed using standard ecological indices to assess species diversity, dominance, and relative abundance.

Among the four recorded species, *Labeo rohita* was the most abundant (40%), followed by *Cyprinus carpio* (28%), *Cirrhinus mrigala* (20%), and *Ompok bimaculatus* (12%) as shown in Table No 1.

The Shannon–Wiener diversity index (H') was calculated as:

$$H' = - \sum_{i=1}^S P_i \cdot \ln(P_i) = 1.30$$

Where P_i is the proportion of individuals of species i and S is the total number of species. A value of $H' = 1.30$ indicates

The observed lower diversity may be attributed to several factors. Firstly, Gandiali Dam is a rain-fed reservoir, and

Table 1: Fish species composition and relative abundance in Gandiali Dam (Feb 2024).

Class	Order	Family	Genus	Species	Common Name	Sample Size	Relative Abundance
Actinopterygii	Cypriniformes	Cyprinidae	Labeo	<i>Labeo rohita</i>	Rohu	10	40.0
Actinopterygii	Cypriniformes	Cyprinidae	Cyprinus	<i>Cyprinus carpio</i>	Common carp	7	28
Actinopterygii	Cypriniformes	Cyprinidae	Cirrhinus	<i>Cirrhinus mrigala</i>	Mrigal carp	5	20
Actinopterygii	Siluriformes	Siluridae	Ompok	<i>Ompok bimaculatus</i>	Indian butter catfish	3	12
Total						25	100.0

moderate diversity, suggesting a relatively balanced fish community without extreme dominance.

The Simpson's dominance index (D) was calculated as:

$$D = \sum_{i=1}^S (n_i/N)^2 = 0.29$$

$$1 - D = 0.71$$

Where n_i is the number of individuals of species i and N is the total number of individuals. The Simpson's diversity value of 0.71 supports the presence of a moderately diverse fish community.

The species richness (S) indicates the total number of species, which is 4.

The evenness index (J') was calculated as:

$$J' = H' / \ln(S) = 0.94$$

This high evenness value means that individuals were almost equally distributed among the recorded species, with no species being extremely rare or dominant.

These index values suggest that the Ichthyofauna community in Gandiali Dam is relatively balanced and moderately diverse, though further seasonal and spatial surveys may uncover greater richness.

4. Discussion

In the present study, four fish species were recorded from Gandiali Dam, all belonging to the class Actinopterygii. Three species (*Labeo rohita*, *Cyprinus carpio*, and *Cirrhinus mrigala*) were from order Cypriniformes and family Cyprinidae, while *Ompok bimaculatus* belonged to order Siluriformes and family Siluridae. This indicates that *Cyprinidae* remains the dominant family in this freshwater habitat.

Previous studies conducted at Gandiali Dam have reported higher fish diversity. For example, Hameed et al. [5], recorded six cyprinid species, and Ilyas [6] documented ten species from this site. More recently, Ullah et al. [7] reported seven species from two families (*Cyprinidae* and *Channidae*). Compared to these studies, the current findings indicate a reduced species richness.

at the time of sampling, water levels were low due to dry seasonal conditions, which may have restricted habitat availability for certain species. Secondly, sampling was conducted only during one month without seasonal replication, potentially missing migratory or seasonally abundant species. Additionally, Gandiali Dam is used extensively as a fishing spot, and anthropogenic fishing pressure could also contribute to the reduced abundance and diversity of fish species [8,9,10].

Despite these limitations, the dominance of Cyprinidae observed in this study aligns with findings from other freshwater ecosystems in Khyber Pakhtunkhwa, where this family consistently represents a major portion of the fish community [5,8]. Notably, the presence of *Ompok bimaculatus* from family Siluridae, which was not reported in previous assessments, indicates the potential of Gandiali Dam to support species beyond Cyprinidae [11,12]. Generally, continuous monitoring involving larger sample sizes and multi-seasonal surveys is essential to track changes in fish biodiversity. Such data are crucial for effective fisheries management, conservation planning, and the sustainable utilization of Gandiali Dam as an important local fishery resource.

5. Conclusion

The present study documented four fish species in Gandiali Dam, with Cyprinidae as the dominant family. Compared to previous studies, a decline in species richness was observed, possibly due to low water levels at sampling time, single-season sampling limitations, and high fishing pressure. The study highlights the need for systematic biodiversity assessments involving year-round surveys and strict regulation of fishing activities to conserve fish diversity and ensure sustainable utilization of Gandiali Dam's aquatic resources.

Figure 2. Shown different types of Fish species.

Figure A: *Labeo rohita* (Hamilton, 1822). It belongs to family, Cyprinidae. This species was most dominant in sample with 40% relative abundance. There fin formula is D.2-3/12-14;P.1/15-16;V.1/8;A.2-3/5;C.19;L.1.40-43).



Figure B: *Cyprinus carpio* (Linnaeus, 1758). It belongs to the Cyprinidae family. Second most abundant with 28%. There fin formula is (D.3/17; P.15; V.9; A.3/5; C.19; L.1.36-38)



Figure C: *Cirrhinus mrigala* (Hamilton, 1822). This specie belongs to the Cyprinidae family, the relative abundance is 20% of total catch. There fin formula is (D.3-4/12-13;P.18-19;V.9;A.3/5;C.19;L.1.40-45).



Figure D: *Ompok bimaculatus* (Bloch, 1822). This specie belong to the Siluridae, Contributing 12% of total catch. There fin formula is (D.4-5;P.1/12-14;V.7-8;A.2-3/60-75;C.17)



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