



Ichthyofaunal Diversity of Baran Dam District Bannu, Khyber Pakhtunkhwa, Pakistan: One Health Perspective Analysis

Review Article

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Citation

Khan, M.Y., Ullah, S., Ullah, I., Khan, M.Z.U., Ullah, A., & Bashir, F. (2025). Ichthyofaunal diversity of Baran Dan District, Bannu, Khyber Pakhtunkhwa, Pakistan: A one-health perspective analysis. *Open Access Public Health and Health Administration Review*, 4(1), 205-211.

WEBSITE: www.mdpi.com
ISSN: Print: 2959-619X
ISSN: Online: 2959-6203
PUBLISHER: MDPIP

Abstract

Fish are cold-blooded vertebrates adapted to life in water. They breathe through gills and have a pair of fin-like appendages if present. Fish are among the most successful biodiversity of vertebrates in that they can exist in almost every type of aquatic habitat, including glacial water and new springs, as well as it may also endure an extremely wide range of salinity. The objective of the current research was to determine the Ichthyofaunal richness and the place that fishes play in the Baran dam Bannu ecosystem, Khyber Pakhtunkhwa, Pakistan. The research work was conducted from a public health perspective from May 2023 to May 2024. In this study, 10 species were reported, namely *Notopterus notopterus*, *Oreochromis mossabicus*, *Mystus bleekeri*, *Mystus seenghala*, *Ompok pabda*, *Ompok bimaculatus*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Pampus argenteus*, and *Channa punctatus*. Family notopteridae was represented by *Notopterus notopterus*, and family cichlidae was represented by *Oreochromis mossabicus*. *Mystus bleekeri*, *Mystus seenghala*, *Ompok pabda*, and *Ompok bimaculatus* were represented by the family Siluridae, *Cirrhinus mrigala* and *Cyprinus carpio* were represented by the family Cyprinidae. Family Bramidae and family Channidae were represented each by a single species *Pampus argenteus* and *Channa punctatus*, respectively. The present study reveals that the environmental conditions of Baran Dam, Bannu, are favorable for fish survival and growth. Hence, it helps in producing healthy fish, and they are not injurious to human health. The results of this research have important implications for important conservation efforts as all as nutrient-rich food for the people of the area of Baran dam, Bannu, Khyber Pakhtunkhwa, Pakistan.

Keywords: Ecosystem, Ichthyofaunal, One Health Perspective, Descriptive Analysis, Pakistan.



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Introduction

Fish are cold-blooded vertebrates adapted to life in water. They breathe through gills and have a pair of fin-like appendages, if present (Iqbal & Lubna, 2023). Fish represent the finest biodiversity of the vertebrates since they might be present in virtually all types of water bodies, beginning with glacial water to new springs, and even in salinity can even withstand a vast range of salinity. About extra than 25,000 species of fish were diagnosed at some stage in the arena. Of these, approximately 58 percent are marine and brackish water species, at the same time as 41 percent are freshwater species, and 1 percent are migratory species that flow backward and forward between salt and freshwater. From Pakistan's freshwater bodies, more than 186 species of freshwater fish were proposed (Haseeb *et al.*, 2022). Biodiversity encompasses the quantity, variety, and distribution of genetic, phenotypic, and ecological variation among populations, species, groups, and ecosystems (Cahyono, 2018).

Aquatic biodiversity is a highly significant phenomenon as it provides us with the concept of life within water. This is why the initial attempt to comprehend the aquatic ecosystem of an area is the study of the Ichthyodiversity of the area. Fish occupy an extensive array of aquatic environments, ranging from the frigid waters of Antarctica to the warmth of geothermal springs. Fish possess the remarkable ability to endure a wide range of salinity levels. Fish are ectothermic aquatic vertebrates that respire through pharyngeal gills, utilizing fins for propulsion and equilibrium (Abbas¹, Arsalan¹, Panhwar, Khan, & Sadia, 2020). As poikilothermic animals, fish breathe with their gills and swim with their fins. They rely on water for dissolved oxygen, support, food, reproduction, and shelter because they dwell underwater (Ahmad, 2020).

The present study is designed to investigate the diversity of the fish in Baran Dam, Bannu, with a focus on identifying and documenting the various species inhabiting this aquatic ecosystem. In addition, it aims to examine the role of fish within the ecosystem, including their contributions to nutrient cycling, food web dynamics, and the maintenance of ecological balance. By understanding both the diversity and ecological roles of fishes in Baran Dam, the study seeks to provide valuable insights for sustainable management, conservation practices, and the enhancement of biodiversity in the region.

Literature Review

A study documented a total of ten species in their survey conducted at Bargant Dam, located in North Waziristan, Pakistan. The species identified include *Barilius vagra*, *Cyprinus carpio*, *Puntius sarana*, *Cirrhinus mrigala*, *Ctenopharyngodon idella*, *Labeo rohita*, *Hypophthalmichthys molitrix*, *Oreochromis niloticus*, *Oreochromis aureus*, and *Tortor* (Ahamed *et al.*, 2020).

Khan *et al.* (2024) conducted a study assessment on the fish variety in the Karak district of Khyber Pakhtunkhwa, Pakistan, identifying 21 species from a total catch of 1,794, including 4 distinct orders, 4 families, and 14 genera. The richest family was the Cyprinidae, which appeared to have 16 species, namely *Cyprinus carpio*, *Labeo rohita*, *Labeo calbaso*, *Carassius auratus*, *Catla catla*, *Cirrhinus mrigala*, *Ctenopharyngodon idella*, *Puntius ticto*, *P. sophore*, *Hypophthalmichthys molitrix* *Barilius vagra*. *Barilius pakistanicus*, *Crossocheilus latius*. Another prominent family was *Crossocheilus diplocheilus*, where there is a total of 3 species, namely: *Channa punctatus*, *Channa straitus*, and *Channa gachua*. The family Siluridae and Mastacembelidae are represented by single species: *Ompok pabda* and *Mastacembelus armatus*, respectively (Khan *et al.*, 2024).

Ali *et al.* (2020) reported the identification of seven fish species from the Changhoze Dam in the Karak district, classified into two different orders, two families, and five genera based on systematic counting. The family Cyprinidae of the order Cypriniformes was the richest in the present study and is represented by 6 species, namely *Barilius vagra*, *B. pakistanicus*, *Crossocheilus latius*, *Labeo rohita*, *Cyprinus carpio*, and *Hypophthalmichthys molitrix*. Only one species, namely *Mastacembelus armatus*, represented the family Mastacembelidae of the order Mastacembeliformes (Ali, Zaman, Farooq, Ali, & Ullah, 2020).

Rehman *et al.* (2022) reported the fish fauna of Khanozi dam of Pishin district, Balochistan, Pakistan. Fifty fish samples were found, which belonged to a single family, four genera, and four species, such as *Cyprinus carpio*, *Carassius auratus*, *Tor soro*, and *Labeo Boggut*. *Cyprinus carpio* was regarded as the highest fertile among them, with dominant species constituting 40 per cent. of the total catches. This indicates that the dam environment is conducive to the biodiversity of this economically important carp species, although a few species present in this dam are still endangered (Rehman, Ullah, Zuberi, Dawar, & Khattak, 2022).

Methods and Materials

The current study was carried out between May 2023 and May 2024 in the Baran Dam, which is situated in the Bannu District of Khyber Pakhtunkhwa, Pakistan. A medium-sized, low-head, earth-core rock-fill, low-head, and low-head hydroelectric dam with a capacity of 5,800 KW is Baran Dam (Anwar & Saeed, 2023). It traverses the Kurrum River and the Baran Stream and is important in enhancing agricultural productivity in the Khyber Pakhtunkhwa southern districts (Nafees, 2022). Bannu District, situated in the southern region of the province, shares borders with Karak District to the east-north, Lakki Marwat District to the east-south, and North and South Waziristan to the west, with an estimated population of 1,357,890 according to the 2023 census and an annual growth rate of 1.94% (Ali, Abbas, & Haq). Fish samples were collected randomly from various locations within Baran Dam during the study period, utilizing the assistance of local fishermen and employing different fishing methods, such as hand nets, cast nets, and hooks. (Moazzam & Osmany, 2024).

Since formalin causes discoloration during long-term storage, photographs of the fish were taken immediately before preservation in 10% formalin (Andersson & Kettunen, 2021). After the collection and photography process, all samples were preserved and subsequently transferred to the laboratory of the Zoology Department at Government Postgraduate College, District Bannu. In the laboratory, the collected fish were identified using fins, scales, coloration patterns, spots, morphometric measurements, meristic counts, magnifying glasses, microscopy, and standard taxonomic keys (Andersson & Kettunen, 2021).

Figure 1

Map of District Bannu



Results and Findings

The present survey was conducted from May 2023 to May 2024 at the Baran Dam district, Bannu, Khyber Pakhtunkhwa, Pakistan. During this study, 10 species were reported. The Ichthyofaunal diversity of Baran Dam comprises a variety of freshwater fish species belonging to different taxonomic groups. From the order **Osteoglossiformes**, the family **Notopteridae** is represented by *Notopterus notopterus* (commonly known as Pari). The order **Perciformes** includes species from two families: The **Cichlidae**, represented by *Oreochromis mossambicus* (Blue Tilapia), and the **Bramidae**, represented by *Pampus argentus* (Paplet). The order **Siluriformes** is dominated by the family **Siluridae**, which includes *Mystus bleekeri* (Catfish), *Ompok pabda* (Catfish), *Ompok bimaculatus* (Catfish), and *Mystus seenghala* (Singara). The order **Cypriniformes** contributes species from the family **Cyprinidae**, including *Cirrhinus mrigala* (Mori) and *Cyprinus carpio* (Common Carp). Finally, the order **Channiformes** is represented by the family **Channidae**, with *Channa punctatus* (Snakehead). All these species belong to the class **Actinopterygii**, reflecting a rich diversity of ray-finned fishes in the Baran Dam ecosystem. The Taxonomic Table of the reported species is given below:

Table 1

Taxonomic position of fishes in Baran Dam

Order	Family	Species	Class	Common Name
Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Actinopterygii	Pari
Perciformes	Cichlidae	<i>Oreochromis mossabicus</i>	Actinopterygii	Blue Tilapia
Siluriformes	Siluridae	<i>Mystus bleekeri</i>	Actinopterygii	Catfish
Siluriformes	Siluridae	<i>Ompok pabda</i>	Actinopterygii	Catfish
Siluriformes	Siluridae	<i>Ompok bimaculatus</i>	Actinopterygii	Catfish
Siluriformes	Siluridae	<i>Mystus seenghala</i>	Actinopterygii	Singara
Cypriniformes	Cyprinidae	<i>Cirrhinus mrigala</i>	Actinopterygii	Mori
Perciformes	Bramidae	<i>Pampus argentus</i>	Actinopterygii	Paplet
Cypriniformes	Cyprinidae	<i>Cyprinus carpio</i>	Actinopterygii	Comma Carp
Channiformes	Channidae	<i>Channa punctatus</i>	Actinopterygii	Snakehead

Discussion and Conclusion

The current study was conducted from May 2023 to May 2024 to learn about the Ichthyofaunal diversity of Baran Dam, Bannu. A total of 10 species, namely *Notopterus notopterus*, which belongs to the family Notopteridae, *Oreochromis mossabicus* belongs to the family Cichlidae, *Mystus bleekeri* belongs to the family Siluridae, *Ompok pabda* belongs to the family Siluridae, *Ompok bimaculatus* belongs to the family Siluridae, *Mystus seenghala* belongs to the family Siluridae, *Cirrhinus merigala* belongs to the family Cyprini dae, *Cyprinus carpio* belongs to the family Cyprinidae, *Pampus argentus* belongs to the family Bramidae, and *Channa punctatus*, which belongs to the family Channidae. Among the reported species, *Pampus argenteus* is reported for the first time from the Baran dam district of Bannu. [Ilyas et al. \(2015\)](#) reported 5 species from the Damai stream. The 5 species were *Barilius vagra*, *Labeo rohita*, *Puntius sarana*, *Oreochromis aureus*, and *Oreochromis niloticus*. But in the present survey, none of the five species is reported. [Khan & Hasan \(2010\)](#) reported 7 species from Changhoz Dam, Karak. Among the reported species, *Cyprinus carpio* was common in the present survey. While *Barilius vagra*, *B.pakistanicus*, *Crossocheilus latius*, *Labeo rohita*, *Hypophthalmichthys molitrix*, and *Mastacembelus armatus* are not recorded in the present research work. [Khan & Hasan \(2014\)](#) reported a total of 21 species from District Karak, Pakistan: *Cyprinus carpio*, *Labeo rohita*, *Labeo calbaso*, *Carassius auratus*, *Catla Catla*, *Cirrhinus mrigala*, *Ctenopharyngodn idella*, *Puntius ticto*, *P. sophore*, *Hypophthalmichthys molitrix*, *Barilius vagra*, *Barilius pakistanicus*, *Crossocheilus latius*, *Crossocheilus diplocheilus*, *Cyprinion watsoni*, *Aspidoparia morar*, *Channa punctatus*, *Channa straitus*, *Channa gachua*, *Ompok pabda*, and *Mastacembelus armatus*. Our study has some similarity with respect to the 4 species, namely, *Cyprinus carpio*, *Cirrhinus mrigala*, *Channa punctatus*, and *Ompok pabda*, which are common in our studies.

From the current research work, it is concluded that Baran Dam is the most suitable site for fish growth and survival. But due to climate change, anthropogenic activities, and agrochemical contamination, Ichthyofaunal diversity is adversely affected, and the number of fish is decreasing day by day. It is also concluded that the Baran Dam provides a wetland for migratory birds. The present study also recorded *Pampus argentus* for the first time from Baran Dam, Bannu.

Limitations of the Study

1. Seasonal Coverage: Sampling was done during certain seasons, which may not have completely captured year-round fluctuations in fish variety, migratory, or breeding patterns.
2. Sampling Effort and Gear: The variety of nets and fishing gear employed, together with the sample frequency, may have affected the quantity and size of caught species, perhaps leading to an under-representation of cryptic, nocturnal, or deep-water species.
3. Restricted Spatial Coverage: Data were gathered from designated locations within Baran Dam. Untapped or hard-to-reach regions (profound or densely vegetated areas) may include more species not documented in this study.
4. Taxonomic Constraints: Certain species were mostly recognized based on physical characteristics. In the absence of DNA verification, misidentification or the oversight of closely similar species may occur.
5. Environmental Data Gaps: The restricted monitoring of water quality indices (e.g., dissolved oxygen, pH, heavy metals) hindered the capacity to directly connect fish diversity with environmental conditions.

Future Research Directions

1. Comprehensive Seasonal Monitoring: To record fish species' spawning, migration, and population variations throughout the year, future studies need to expand sampling throughout all seasons. This would give a fuller picture of the diversity of the ichthyofauna at the dam.
2. Broader Spatial Coverage: Incorporating deeper water zones, vegetation regions, and inflowing streams into surveys can enhance the detection of species that were previously undocumented or scarce and may have been overlooked in initial research.
3. Integration of Molecular Techniques: Along with physical identification, DNA barcoding and genetic analysis can help uncover hidden species, examine population structure, and improve taxonomy.
4. Long-Term Biodiversity Monitoring: Establishing a program for ongoing monitoring can help track changes in fish diversity brought on by invasive species, climate change, environmental changes, and human activities.

Recommendations

1. We need to stop or process the trash that comes from residences and ends up at the Dam.
2. Illegal fishing must be banned.
3. Arrangement of training and workshop regarding conservation.
4. Encouragement of ecotourism
5. Community awareness regarding pollution.

Declarations

Ethical Approval and Consent to Participate: This study strictly adhered to the Declaration of Helsinki and relevant national and institutional ethical guidelines. Informed consent was not required, as secondary data available on websites was obtained for analysis. All procedures performed in this study were by the ethical standards of the Helsinki Declaration.

Consent for Publication: Here, we, the authors, give our consent for publication.

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Availability of Data and Materials: Data will be provided upon written request from the corresponding author.

Competing Interest: The authors declare that they have no conflict of interest.

Funding: Not applicable.

Authors' Contribution: MYL, SU, IU: conceived the idea and literature review. MZUK, AU, FB: collected the data. MYL, SU, IU: developed methodology, MZUK, AU, FB: did data analysis, editing, proofreading, edited, edited, and submission of the article to the journal for publication.

Acknowledgement: The researchers are thankful to their colleagues and officials, who took their precious time to provide the data.

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