



Study on ichthyofaunal diversity and physiochemical parameters of Baran Dam, district Bannu Khyber Pakhtunkhwa (KP) Pakistan

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Abstract

The current research with title on study on ichthyofaunal diversity and physiochemical assessment of the Baran dam, district Bannu. It was carried out between February to March and May to October 2022. A total of 27 species from 18 genera, 8 families, and 5 orders were gathered. With a percentile range of 81.85%, the cyprinidae family was the most prevalent and abundant, whereas the mastacembelidae family had a lower abundance of 0.92%. After examining their total dissolved solids (TDS), pH, oxygen, hardness, alkalinity, and temperature, the majority of physico-chemical parameters showed substantial regional variation (ANOVA, $p < 0.05$). Temperature and pH readings, however, did not show any differences between the sampling locations ($p > 0.05$).

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Key words: Ichthyofaunal diversity, physiochemical assessment, Baran dam, cyprinidae, parameters

1. Introduction

Due to variations in rainfall in the catchment areas, these ecosystems dynamic characteristics are a result of fluctuations in water levels. Fish migrations, species interactions, food availability and ecological factors in the fluvial environment all contribute to this dynamic's variations in fish community structure (Akhtar et al., 2014). The size of the fish scales grows in direct proportion to the fish's length. In fact, it has often been claimed that the connection between "scale size and body length" in many fishes has a curvilinear nature during the course of their lifetimes. The primary factor influencing fish growth and population is fish size. Scale studies have been shown to be a useful method for examining the relationships between fish species from various genera or families. It will be simple to distinguish between the various fish groups by using the characteristics of fish scales (Saddozai et al., 2015). There are total of 40,000 species of vertebrates and 21723

live fish species have been identified, of which 8,411 are freshwater species and 11,650 are marine species (Mittermeier & Mitemeir, 1997; Jayaram, 2010). In Pakistan fresh fish fauna is characterized by a minimum of 193 fish species belonging to the class Actinopterygii and sub-class Teleostei. Among these 03 cohort, 06 super orders, 13 orders, 30 families and 86 genera are reported (Rafique, 2007). The physical and chemical characteristics of water quality have a significant impact on fish development and variety. The physiochemical and biological characteristics of water are all part of its quality. Numerous physicochemical factors, including as alkalinity, water temperature, free carbon dioxide, pH and total hardness have a substantial impact on fish health (Bibi et al., 2018). These procedures include the examination of many parameters, including pH, turbidity, conductivity, total suspended solids (TSS), total dissolved solids (TDS), total organic carbon (TOC), and heavy metals. If these metrics' values exceed the safe limits established by the World Health Organization (WHO) and other regulatory agencies, they may have an impact on the quality of drinking water. One of the most crucial elements that directly affect aquatic life is temperature. The temperature is recognized as the most crucial biological element and parameter for all metabolic processes of the organism in the water (Boyd, 2019). The diversification of fish species is significantly affected by the pH of the water. The pH range that is ideal for fish production is 6.5 to 9.0. pH 4.0 is the alkaline death point of water, pH 4.6 is the sluggish growth point, pH 6.5 is the reproduction point and pH 11 is the acidic death point. All of the chemical, physical and biological activities of lakes and river may be influenced by changes in PH values (Nazir et al., 2015). The current study aimed to identify the fish species living in Baran dam and their physiochemical parameters.

2. Materials and methods

2.1. Study area

The current study was conducted during February to March and May to October 2022, to investigate the ichthyofaunal diversity of Baran dam in district Bannu. Baran dam was completed in 1962. It is situated in the west of Mamand Khel Wazir (FR) to supply water for irrigation purposes. It is approximately 6 km far from Bannu city. It can be found between latitudes 33°01'N and longitudes 70°-30'E, respectively. The temperature around the dam is 6°C in the winter and 48°C in the summer. The dam measures an average of 3475 feet in length and 120 feet in height. The dam has an accommodation capacity of 98,125 acre feet. In actuality, the dam is filled by the vast River Kurram, which originates in Afghanistan and flows directly into the districts of Bannu Pass and Lakki Marwat in the south (Figure 1).

2.2. Collection, preservation, and identification

The local fishermen used a variety of tools, including nets and fishing gear, to harvest fish out of the dam. Large fish were sliced in half and preserved, whereas little fish were kept immediately in a 10% formalin solution in bottles. The fish were recognized to the species level using the available key and relevant literature (Talwar and Jhingran, 1991).

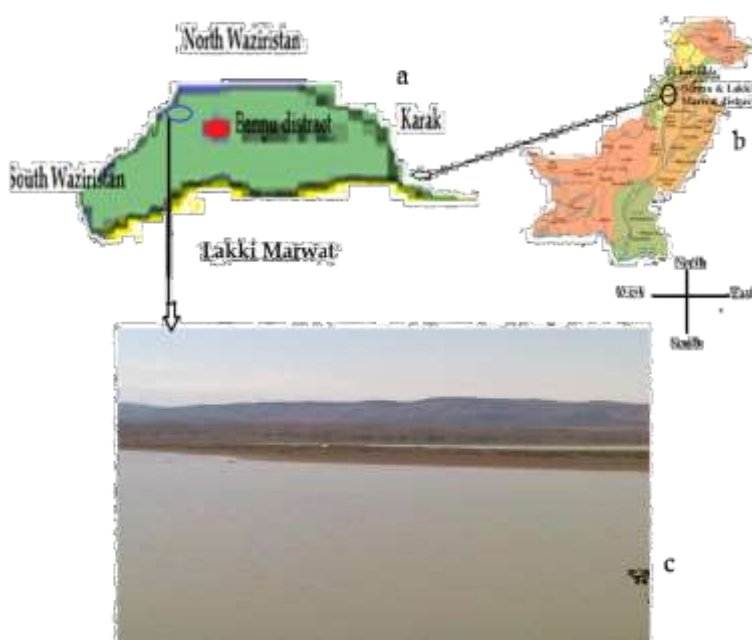


Figure 1: a; Map of District Bannu: b; map of Pakistan: c; Short view of Baran dam

2.3. Assessment of physiochemical parameter

One litter water has taken from Baran dam in a plastic bottles with screw caps once in a month during February to March 2022 and May to October 2022 in between 1.00 to 3.00 p.m and brought to the water monitoring laboratory National Agriculture Research Center (NARC) Islamabad for analyzed their hardness, alkalinity, Power of Hydrogen ion concentrations (pH), and total dissolved solids (TDS). Oxygen concentration and temperature of the water was checked at the site of the dam directly.

2.4. Alkalinity

Water sample containing 100 ml was taken in beaker and added 4-8 drops of methyl orange indicator due to which color of the sample will turned orange color. This solution was titrated against H₂SO₄ (sulphuric acid) drop wise in burnet until orange color disappeared. The initial and final readings were calculated by the following formula.

Initial reading + final reading × 10.

2.5. Hardness

Water sample containing 100 ml was taken in beaker, 2 ml of buffer solution and 4 drops of Eriochrome Black T indicator was added. When purple color appeared, the solution was titrated with EDTA (ethylene diamine tetra acetate) solution, till the solution turned blue. The initial and final readings were calculated by the following formula. Initial reading + final reading × 10

2.6. pH determination pH was calculated by using pH meter. 50 ml water have taken in beaker and kept the tube of PH meter (Model: 320; Merk, Germany) for ten minutes. The reading has started on the screen until graph appears and the reading has stopped by specific figure and reading was noted.

2.7. Total dissolved solids (TDS)

TDS of the sample was measured by TDS meter (Model: 20; Olympics). 50 ml of water have taken in beaker and sink the beak of the meter for 10 min. The reading has started on screen for few min, stopped automatically, and note the reading.

2.8. Dissolved oxygen (DO)

DO meter (Model: Ox 20; Merk, Germany) was directly sink in the dame kept it for few minutes. You did not check the oxygen in the laboratory because the oxygen is changeable.

2.9. Temperature

The temperature of water has measured by the centigrade alcoholic bulb thermometer (Model: Ox 2, Pak). This measurement was taken half foot below in dame, but not in lab because the temperature of the water sample was changed with the changed in the area like oxygen. First of all, put the centigrade alcoholic bulb thermometer in reservoir for seven minutes, the alcohol level of the centigrade alcoholic bulb thermometer has raised or low according to the temperature of the water sample of the reservoir. The correct reading has noted on paper.

2.10. Statistical analysis

Data analysis using SPSS software version 20.0 was used to analyze the collected data. A oneway ANOVA was employed to compare the variations in water quality parameters among the sampling sites.

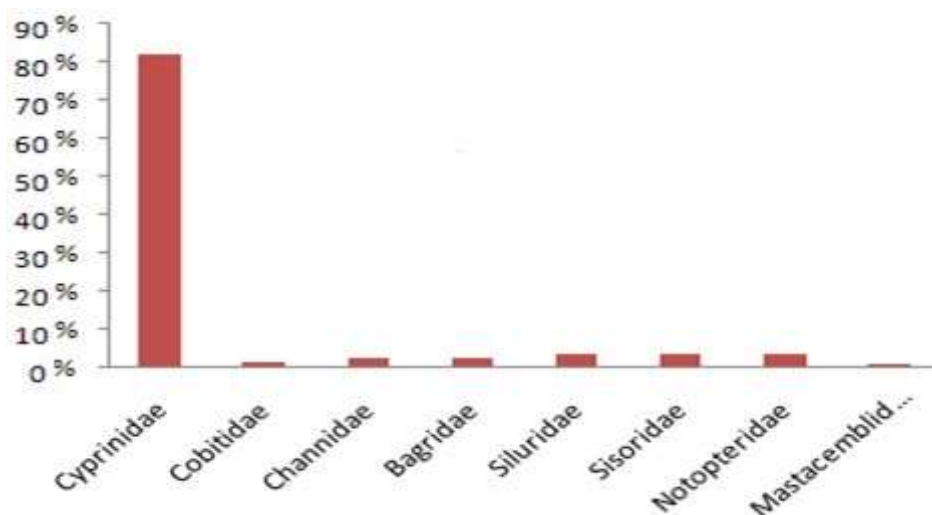
3. Results

In the present study, a total of 27 fish species were recorded and belonging to 18 genera, 8 families and 5 orders. The cyprinidae family was most common and abundant represented by 17 species, channidae, siluridae and sisoridae families were represented by 2 species, cobitidae, bagridae, notopteridae and mastacemblidae families were represented by 1 species, recorded from this area. The catchment frequency of the collected specimen was 431, majority of them were commercially important fishes (Table 1).

In Baran dam the Cyprinidae family was most dominant represented by the percentile range of 81.38%. Similarly, the remaining families were arranged in descending order as follow; Sisoridae: (3.71%) > Siluridae: (3.70%) > Notopteridae: (3.48%) > Bagridae: (2.78%) > Channidae: (2.54%) > Cobitidae: (1.39%) > Mastacemblidae: (0.92%) respectively (Figure 2).

Table 1: Relative abundance of fish species

Order	Family	Scientific Name	Common Name	Catchment Frequency	% Catch
Cypriniformes	Cyprinidae	Cyprinus carpio	Gulfam	22	5.10
		Labeo rohita	Rohu	33	7.65
		Ctenopharygodon Idella	Grass carp	35	8.12
		Catla catla	Thaila	30	6.96
		Cirrhinus mirgala	Mori	37	8.58
		Hypopethelmic molitrix	Silver carp	45	10.44
		Labeo calbasu	Kalbance	05	1.16
		Tor putitora	Mahasher	25	5.80
		Barilius vagra	Lahori chilwa	18	4.17
		Barilius bendelisis	Baril fish	10	2.32
		Labeo boga	Boga labeo	08	1.85
		Cirrhinus reba	Reba carp	14	3.24
		Puntius ticto	Popra	16	3.71
		Puntius sarana	Sarputi	13	3.01
		Puntius sophore	Sophore popra	11	2.55
		Salmostoma bacaila	Small chal	17	3.94
		Salmostoma Punjabensis	Punjabi chal	12	2.78
Perciformes	Cobitidae	Botia rostrata	Dohser	06	1.39
		Channa punctate	Daula	07	1.62
Siluriformes	Channidae	Channa striata	Snake head fish	04	0.92
		Mystus bleekri	Mujahid	12	2.78
Siluriformes	Bagridae	Ompak pabda	Papta	09	2.08
		Ompak bimaculatus	Pallu	07	1.62
	Sisoridae	Gagata cenia	Ceni fish	11	2.55
		Glyptothorax cavia	Kani	05	1.16
		Notopterus notopterus	Pari	15	3.48
Mastacembeliformes	Mastacembli dae	Mastacembelus armatus	Bam	04	0.92

**Figure 2:** Percentage abundance of fish families collected from Baran dam.**Family cyprinidae**Gulfam, *Cyprinus carpio*
(Linnaus, 1758)Rohu, *Labeo rohita*
(Hamilton, 1944)Grass carp, *Ctenopharydon Idella*
(Valencienes, 1944)

Thaila, *Catla catla*
(Hamilton, 1944)



Mori, *Cirrhinus mirgala*
(Hamilton, 1944)



Silver carp, *Hypopethelmic molitrix*
(Valencieenes, 1944)



Kalbance, *Labeo calbasu*
(Hamilton, 1822)



Mahasheer, *Tor potitora*
(Hamilton, 1822)



Lahori chilwa, *Barilius vagra*
(Hamilton, 1842)



Baril, *Barilius bendelisis*
(F. Hamilton, 1833)



Boga labeo, *Labeo boga*
(F. Hamilton, 1822)



Reba carp, *Cirrhinus reba*
(Day, 1878)



Popra (Rittatus), *Puntius ticto*
(Hamilton, 1822)



Sarputi, *Puntius sarana*
(F. Hamilton, 1822)



Sophore popra, *Puntius sophore*
(Day, 1878)



Small chal, *Salmostoma baciaia*
(Hamilton, 1823)



Punj chal, *Salmostoma punjabensis*
(Hackle, 1779)



Family cobitidae
Dohser, *Botia rostrata*
(Bloch, 1793)



Family Channidae

Daula (Guddu), *Channa punctata*
(Scopoli, 1777)



Snak head fish, *Channa striata*
(Gunther, 1868)



Families Bagridae and Siluridae

Mujahid, *Mystus bleekeri*
(Francis Day, 1877)



Papta, *Ompak pabda*
(Hamilton, 1822)



Pallu (Pafto), *Ompak bimaculatus* (Bloch, 1794)

**Family Sisoridae**

Ceni fish, *Gagata cenia*
(Hamilton, 1822)



Kani (Bang), *Glyptothorax cavia* (Hamilton, 1822)

**Families notopteridae and mastacemblidae**

Pari, *Notopterus notopterus*
(Pallas, 1769)



Bam, *Mastacembelus armatus*
(Bernard Germinde Lacepede, 1800)



Figure 3: Biodiversity of fish species collected from the Baran dam

3.1. Ranges of water parameters of Baran dam

The (mean \pm SE) reported values of the physico-chemical characteristics are showed in (Table 2). The water parameters such as of alkalinity, hardness, pH, TDS, oxygen and temperature shown significant variations (ANOVA, $p < 0.05$) among the sampling sites in the reservoir. However, pH and temperature values did not reveal difference among the sampling sites ($p > 0.05$). The concentration of Alkalinity ranged from 168 to 91.3 5 mg/L with a total mean of 189.2 ± 2.5 mg/L in the reservoir. The value of the Hardness was found between 166 and 225 mg/L with a total mean of 233 ± 2.00 mg/L. The pH of the reservoir ranged between 7.31 to 8.2 with a mean of 7.47 ± 0.07 respectively. The total dissolved solids (TDS) were found between 351 to 420 ppm with a total mean of 417.5 ± 2.6 in all sampling sites. The value of the DO was 3.5 to 7.8 mg/L with a total mean of 4.4 ± 0.2 mg/L. The value of the Temperature 13. 2 to 25.3 °C with total mean of 24.4 ± 0.01 °C respectively.

Table 2: One-way ANOVA of the mean water parameter in different habitats from Baran dam.

Parameters	Site I	Site II	Site III	Mean (M \pm SD)	p-Value
Alkalinity (mg/L)	185 \pm 3.00	187.2 \pm 1.2	170 \pm 1.00	189.5 \pm 2.5	0.001*
Hardness (mg/L)	197.5 \pm 2.17	169 \pm 2.00	220.5 \pm 2.27	233 \pm 2.00	0.0020
Ph	7.48 \pm 0.48	7.41 \pm 0.41	8.09 \pm 0.10	7.47 \pm 0.07	0.732
TDS (ppm)	417 \pm 6.00	408 \pm 9.00	354 \pm 2.00	417.5 \pm 2.6	0.000*
DO (mg/L)	7.2 \pm 0.1	5.35 \pm 0.35	7.1 \pm 0.1	4.4 \pm 0.2	0.020*
Tem (°C)	13.4 \pm 0.1	20.2 \pm 0.1	22.25 \pm 0.16	24.4 \pm 0.01	0.863

TDS: total dissolved solids; DO: dissolved oxygen; Tem: temperature; M: mean; SD: standard deviation.

4. Discussion

In the current research, total of 27 fish species were collected, of which 18 genera, 8 families and 5 orders were recorded from Baran dam during February to March 2022 and May to October 2022. The cyprinidae family was most prevalent characterized by 17 species, channidae, siluridae and sisoridae families were represented by 2 species, cobitidae, bagridae, notopteridae and mastacembelidae families were represented by one species. Ali et al., 2020 identified 14 species and cyprinidae family was the most prevalent family among these 11 species, with one species belonging to the channidae, mastacembelidae and nemachelidae families. In 14610 fish were gathered by Kalsoom et al in 2021 and 12 different species were recognized. There were 5 species in the Cyprinidae family, 2 in the Bagridae family and 1 each in the Allidae, Channidae, Cichlide, Siluridae and Mastacembelidae families respectively. Total of 7 species of the family Cyprinidae were reported by Ullah et al in 2022, including Labeo rohita, Catla catla, Carassius auratus, Cirrhinus mrigala, Hypophthalmichthys molitrix, Cyprinus carpio, and Tor khudree. Eight species, representing seven genera, four families, and four orders, were found by Khan et al. (2019) in two locations along the Kurram River (Kurram Gari and Daud Shah). With five species, the cyprinidae family was the most abundant, followed by the notopteridae, mastacembelidae, and channidae families, each with one species. The specimen that was obtained had 49 catchment frequencies, with the percentile values of cyprinidae (63.27%), mastacembelidae (14.28%), notopteridae (12.24%), and Channidae (10.21%), respectively. The majority of the species included in the collection were fish that were important for commercial purposes. Naveed et al., 2017 collected total of 80 specimens of fish and identified up to species level. Among these 7 species were identified and these species were Mastacembelus armatus, Glyptothorax stocki, Gara gotyla, Tor putitora, Schizothorax plagiostomus, Barilius pakistanicus and Channa gachua respectively.

The water parameters of the current research shown significant variations (ANOVA, $p < 0.05$) among the sampling sites in the reservoir. However, pH and temperature values did not reveal difference among the sampling sites ($p > 0.05$). The concentration of Alkalinity ranged from 168 to 91.3 5 mg/L with a total mean of 189.2 ± 2.5 mg/L in the reservoir. The value of the Hardness was found between 166 and 225 mg/L with a total mean of 233 ± 2.00 mg/L. The pH of the reservoir ranged between 7.31 to 8.2 with a mean of 7.47 ± 0.07 respectively. The total dissolved solids (TDS) were found between 351 to 420 ppm with a total mean of 417.5 ± 2.6 in all sampling sites. The value of the DO was 3.5 to 7.8 mg/L with a total mean of 4.4 ± 0.2 mg/L. The value of the Temperature 13. 2 to 25.3 °C with total mean of 24.4 ± 0.01 °C respectively.

According to Kalsoom et al., 2021, total suspended solids (TSS) in water ranged from 112 3 ppm while total hardness ranged from 126 1 to 172 5 ppm. The measured conductivity, PH, temperature, colour, taste, TS, and TDS of the water were all compared to the World Health Organization (WHO) standard levels.

According to Ullah et al., 2022, the results of the current study clearly show that all of the physiochemical parameters were determined to be within acceptable ranges and not detrimental for cultivating and raising fish. The greatest alkalinity and hardness readings in the river Kurram were 186.5–2.69 mg/L and 218.5–4.5 mg/L, respectively, in June and August. The pH was measured at 8.26 0.24 in April and 6.82 0.10 in October. TDS levels reached their highest and lowest points in April and August, with 474.53.5 ppm and 3244.1 ppm, respectively. According to Khan et al. (2019), the months of May and July had the highest oxygen and temperature values (7.15 ± 0.14 mg/L, 27.8 ± 0.06 °C), while the months of June and January had the lowest values (4.3 ± 0.1 mg/L, 13.1 ± 0.05 °C). The remaining months had moderate values.

5. Conclusion

The current study was conducted during February to March 2022 and May to October 2022 and concluded that the cyprinidae family was most common and abundant with percentile range of 81.85%, while mastacembelidae family was less abundant 0.92% respectively. Additionally, Baran dam is situated in a hilly location and serves as a recreational area 6 km from the city, local residents and schoolchildren frequently visit the dam for picnics. These kids hurl plastic bottles and shopping bags into the lake, endangering the fish life and maybe causing catastrophic reactions. On the other hand, there are some people who engage in erratic angling, which appears to increase the likelihood that fish species may disappear entirely from aquatic habitats. As a result, it was concluded that the water parameters are barely different from the usual range and may be dangerous for fish life.

Conflict of Interest: None**References**

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