INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 15, No. 1, p. 295-301, 2019

RESEARCH PAPER OPEN ACCESS

Fish biodiversity and physiochemical assessment of river Kurram at District Bannu KP, Pakistan

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Key words: Fish biodiversity, Physiochemical, Assessment of river.

http://dx.doi.org/10.12692/ijb/15.1.295-301 Article published on July 18, 2019

Abstract

The purpose of current study was to investigate the fish biodiversity and physiochemical assessment of river Kurram district Bannu. Total 8 species belonging 7 genera, 4 families and 4 orders were collected from two sites (KurramGari andDaud Shah) of river Kurram. The cyprinidae family was most abundant represented by 5species, notopteridae, mastacemblida and channidae families were represented by 1 species. The catchment frequencies of the collected specimen were 49 and percentile value of cyprinidae (63.27%), mastacemblidae (14.28%), notopteridae (12.24%) and Channidae (10.21%) respectively, while most of the species were commercially important fishes.Water samples were taken in between 1.00 to 3.00 p.m. from two sites (KurramGari and Daud Shah) within a month of river Kurram and brought to the water monitoring laboratory National Agriculture Research Center (NARC) Islamabad for analyzed their hardness, alkalinity, pH (Power of Hydrogen ion concentrations), TDS (total dissolved solids), temperature and oxygen.After analyzing their physiochemical parameters showed the normal values and not too much different and risky for fish life in the river Kurram.

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Introduction

Fish word derived from that animal which have skull, backbone and without limbs called non tetra pod craniate. Their gills are modified for respiration present throughout a life and limbs are replacing by the fins used for locomotion. Fish are also used by the peoples in different ways like deities, religious symbols and their books and movies are used as entertainment. They are also caught by recreational fisher and are kept in the aquarium for ornamental purposes. Instead of these they are also used as food and best food source (Nelson, 2006). Fish meat is rich source of protein because it contain about 16-20 % as compared to about 12 % in eggs, 3.5 % in milk and 6.6 % in rice and wheat. In Asian areas approximately 13 % of the total animal protein present in the form of fish protein (Kumar, 1992). The fish fauna of fresh water is extremely varies and excellent rather than warm water fish fauna of Pakistan in the Indus plain (Rafique, 2000). Majority of the fresh water fish species have certain endemic distribution (Rosenfold, 2002; Magurran, 2009). Due to this endemism and human activities the fresh water fish fauna around the earth are under serious threats (Magurran, 2009). Fish repeatedly live in the receiving water and included the chemical, physical and biological histories of the water. Most fish species have huge life span of (about 2-10 years) and can both imitated term and present water quality (Adams, 2000).The abiotic components in reservoirs like temperature, oxygen, pH, presence of toxic substances and changes in water level are the most effective causes on either the absence or the presence of certain species (Rodriguez-Ruiz, 1998). Oxygen is one of the most important components of aquatic ecosystems present in water in dissolve form. It is necessary for the metabolism of aerobic organisms, and it effects inorganic chemical reactions. Majority it is used as an indicator of water quality, because high amounts of oxygen usually represent good water quality. It enters in to the water surface by diffusion; by rapid movement such as waterfalls or riffles in streams. The quantity of dissolved oxygen gas depends extremely on temperature and somewhat on atmospheric pressure (Friedl*et al.,* 2004).The current study was aimed to investigate the fish biodiversity and physiochemical assessment of river Kurram at district Bannu KP, Pakistan.

Materials and methods

Study area

The river Kurram is a large river which irrigates the Baran dam and directly comes from Afghanistan entering to the district Bannu at the north-western side, rapid flow to the LakkiMarwat at the south. The height of the water flow is about 10 to 30 feet, totally full of boulders and stones. Mostly used for irrigations, their sides are richly marsh and greenery lands and soil are silt in nature.

Collection, preservation and identification of fishes

Fishes were caught from two main sites namely KurramGari and Daud Shah ofthe river by the local fisherman using different sources like angling and nets. Small fishes were collectedin 10% formalin solution in bottle, while large fishes were cut their abdomen and preserved. The fish were identified up to species level according to related literature and key (Talwar and Jhingran, 1991) available.

Assessment of physiochemical parameter

Water samples were taken in between 1.00 to 3.00 p.m. from two sites (KurramGari and Daud Shah) within a month of river Kurramand brought to the water monitoring laboratory National Agriculture Research Center (NARC) Islamabad for analyzed their hardness, alkalinity, pH (Power of Hydrogen ion concentrations), TDS (total dissolved solids), temperature and oxygen. But their detailed were as follow.

Alkalinity

100 ml of water sample 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 H_2So_4 (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.

Hardness

100 ml of water sample 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

pH determination

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

Total dissolved solids (TDS)

A total dissolved solid was measured by the TDS meter. Water sample of 50 ml have taken in beaker and sink the beak of the TDS meter for 10 min. The reading has started on screen for few min, stopped automatically, and then this was the exact value of TDS of water sample. TDS meter model was (Model: 20; Olympics).

Dissolved oxygen (DO)

Dissolved oxygen was measured by the DO meter. For oxygen measurement 50 ml of water samples was taken in beaker and keep the digital oxygen meter for 5 min. The exact value was fixed on oxygen meter and noted. DO meter model was (Model: Ox 20; Merk, Germany).

Temperature

The temperature of water has measured by the centigrade alcoholic bulb thermometer. This measurement was taken half foot below in both water bodies, but not in lab because the temperature of the water sample was changed with the changed in the area. 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. The centigrade alcoholic bulb thermometer model was (Model: Ox 2, Pak).

Results and discussion

Total 8 species belonging 7 genera, 4 families and 4 orders were collected from two sites (KurramGari andDaud Shah) of river Kurram. The cyprinidae family was most abundant represented by 5 species, notopteridae, mastacemblida and channidae families were represented by 1 species (Table 1).

Table 1. Fish biodiversity collected from river Kurram.

Sl. No.	Orders	Families	Scientific names	Common names
			Commercially desirable fish species	
1	Cypriniformes	Cyprinidae	*Tor putitora*	Mahasher
2			*Cirrhinusmirgala*	Mori
3			*Labeocalbasu*	Kalbance
4			*Bariliusmodistus*	Indus baril
			Commercially less desirable fish species	
5			*Labeodyocheilus*	Torkey
			Carnivores fish species	
6	Osteoglossiformes	Notopteridae	*Notopterusnotopterus*	Pari
7	Mastacembliformes	Mastacemblida	*Mastacembelusarmatus*	Bam
8	Perciformes	Channidae	*Channapunctata*	Daula (Guddu)

The percentage composition of all collected species from two sites of the river Kurram was in descending order as follow; *C.mirgala*: (18.36%)>*T. potitora*: (16.33%)>*M. armatus*: (14.28%)>*N.Notopterus:* (12.24%) and *B. modistus*: (12.24%)>*L. dyocheilus:* (10.21%) and *C. punctata:* (10.21%) >*L. calbasu*: (6.13%)(Table 2). The cyprinidae family was most abundant, while the notopteridae, mastacemblidae

and channidae families were less abundant. These families were arranged in descending order as follow; cyprinidae: (63.27%)>mastacemblidae: (14.28%)>notopteridae: (12.24%)> and channidae: (10.21%) respectively (Fig. 2). The highest values of alkalinity and hardness were in June and August with ranges of 186.5±2.69 mg/L, 218.5±4.5 mg/L respectively.

Table 2. Percentage composition of fish species collected from river Kurram.

Sl. No.	Scientific names	Catchment frequencies	% composition
Commercially desirable fish			
1	*Tor putitora*	08	16.33
2	*Cirrhinusmirgala*	09	18.36
3	*Labeocalbasu*	03	6.13
4	*Bariliusmodistus*	06	12.24
Commercially less desirable			
5	*Labeodyopcheilus*	05	10.21
Carnivores fish species			
6	*Notopterusnotopterus*	06	12.24
7	*Mastacembelusarmatus*	07	14.28
8	*Channapunctata*	05	10.21
Total		49	100

The pH was recorded with values 8.26±0.24, April and 6.82±0.1, October. The maximum and minimum values of TDS were recorded in months of April and August were 474.5±3.5 ppm and 324±4.1 ppm respectively. The oxygen and temperature values (7.15±0.14 mg/L, 27.8±0.06 °C) were considered maximum in months of May and July, while the minimum values (4.3±0.1mg/L, 13.1±0.05 °C) were recorded in months of June and January, the remaining months have moderate values (Table 3).

Table 3. Physiochemicalassessmentof river Kurram.

S No	Months	Alkalinity (mg/L)	Hardness (mg/L)	PH	TDS (ppm)	DO (mg/L)	Tem (°C)
		M±SD	M±SD	M±SD	M±SD	M±SD	M±SD
1	January	177.5±0.5	194±4.00	7.22±0.02	406±6.00	7.1±0.1	13.1±0.05
2	February	181.5±0.6	165±3.00	7.15±0.15	415.5±7.5	5.45±0.14	16.05±0.06
3	March	152.5±2.5	207±2.00	7.95±0.05	346.5±4.5	7.15±0.15	18.1±0.1
4	April	142.5±2.6	186.5±6.5	8.26±0.24	474.5±3.5	5.4±0.3	20.05±0.05
5	May	169±3.00	172.7±1.7	7.86±0.04	330.5±1.5	7.15±0.14	24.15±0.07
6	June	186.5±2.69	113.5±1.5	7.12±0.02	404±4.00	4.3±0.1	26.1±0.1
7	July	173.5±32.5	210.5±5.5	7.4±0.01	419±2.00	6.35±0.16	27.8±0.06
8	August	171±1.00	218.5±4.5	7.5±0.05	324±4.1	7.16±0.14	25.15±0.05
9	September	170.5±1.00	133±3.00	7.05±0.15	462.5±6.5	4.5±0.1	23.25±0.04
10	October	170±1.11	141.5±1.5	6.82±0.1	373±3.0	7.2±0.01	22.05±0.02
11	November	185.6±0.50	177±2.00	7.64±0.31	442.5±2.5	5.2±0.2	19.15±0.05
12	December	184.5±3.5	167.5±0.35	7.99±0.01	374.5±3.5	6.18±0.01	17.05±0.03

TDS: total dissolved solids; DO: dissolved oxygen; Tem: temperature; M: mean; SD: standard deviation. In present study total of 8 species belonging 7 genera, 4 families and 4 orders were collected from two sites (KurramGariandDaud Shah) of river Kurram. The Cyprinidae family was most abundant represented by 5species. In Pakistan total of 6 species were collected from river Swat by the (Hussain and Shah, 1960). Total of 23 species were collected from Tanda dam Kohat by (Nisar, 1998). A study was conducted in the adjacent districtKarak on Changhoz Dam, who reported 7 species belonging 2 orders, 2 families and 5 different genera(Khan and Hasan, 2011). The collected species were *Bariliusvagra, B. pakistanicus, Crossocheiluslatius, Labeorohita, Cyprinuscarpio, Hypopethelmicmolitrix*and*Mastacembelusarmatus*re

spectively. 12 species were collected from Zebi dam namely *Cyprinuscarpio, Bariliusvagra, Labeorohita, Carassiusauratus, Catlacatla, Cirrhinusmirgala, Ctenopharngodonidella, Puntiusticto, P. sophore, Hypopethelmic*and*Channastraitus* (Ilyas, 2004). Similarly 5 species belonging 5 different genera 2 different families and 3 orders were documented from Karaabdal stream by the (Ugurlu and Polat, 2008). 15 species were documented from Harsool-savangireservoirbelonging12 different genera 4 families and 3 ordersby the (Shinde*et al.,*2009). The sample size of the present study was smaller as compared to above mentioned studies because of short study period.

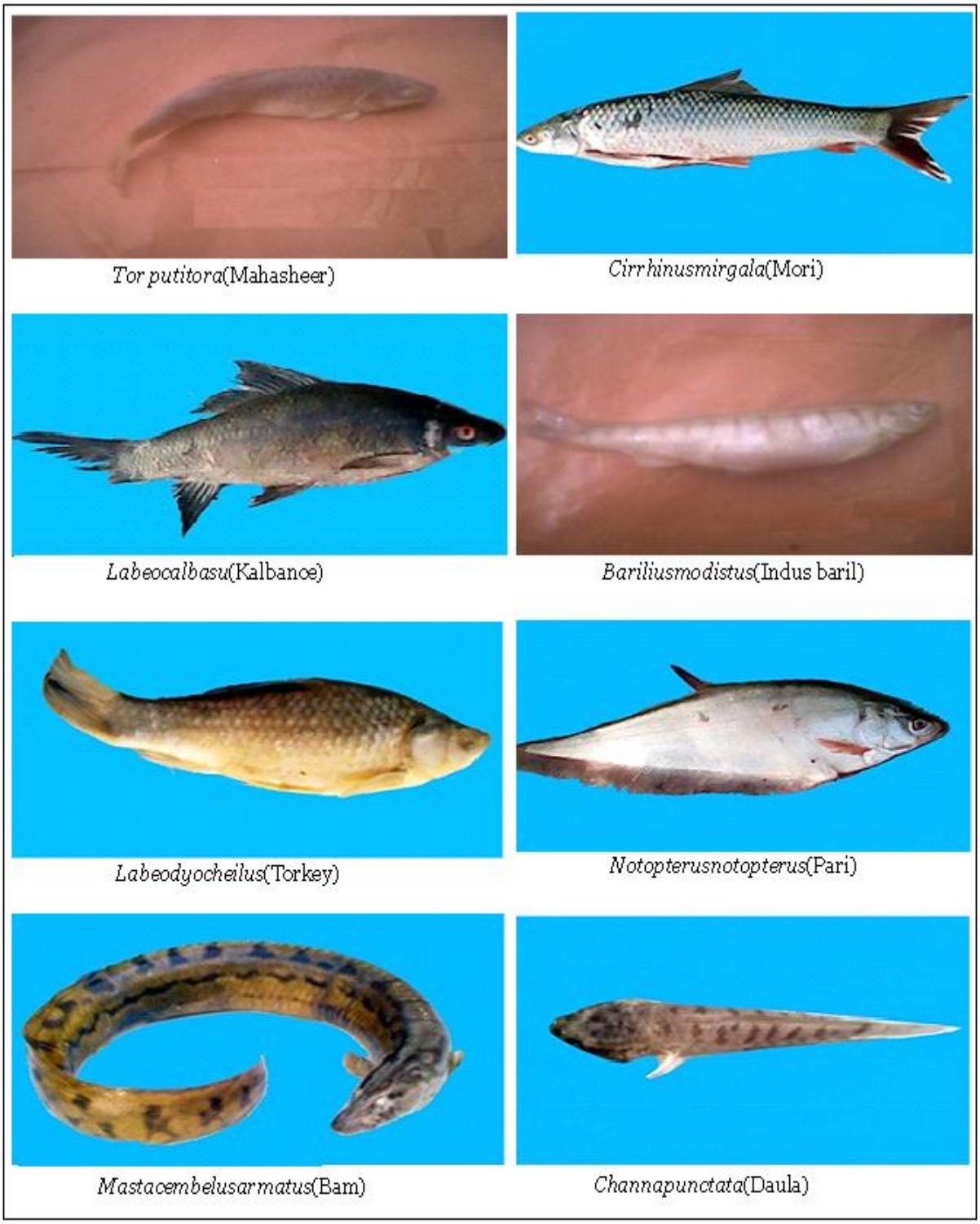

Fig. 1. Images offish species collected from the river Kurram.

In river Kurram the highest values of alkalinity and hardness were in June and August with ranges of 186.5±2.69 mg/L, 218.5±4.5 mg/L respectively. The pH was recorded with values 8.26±0.24, April and 6.82±0.1, October. The maximum and minimum values of TDS were recorded in April and August 474.5±3.5 ppm, and 324±4.1 ppm respectively. The oxygen and temperature values (7.15±0.14 mg/L, 27.8±0.06 °C) were considered maximum in months of May and July, while the minimum values (4.3±0.1mg/L, 13.1±0.05 °C) were recorded in months of June and January, the remaining months have moderate values.

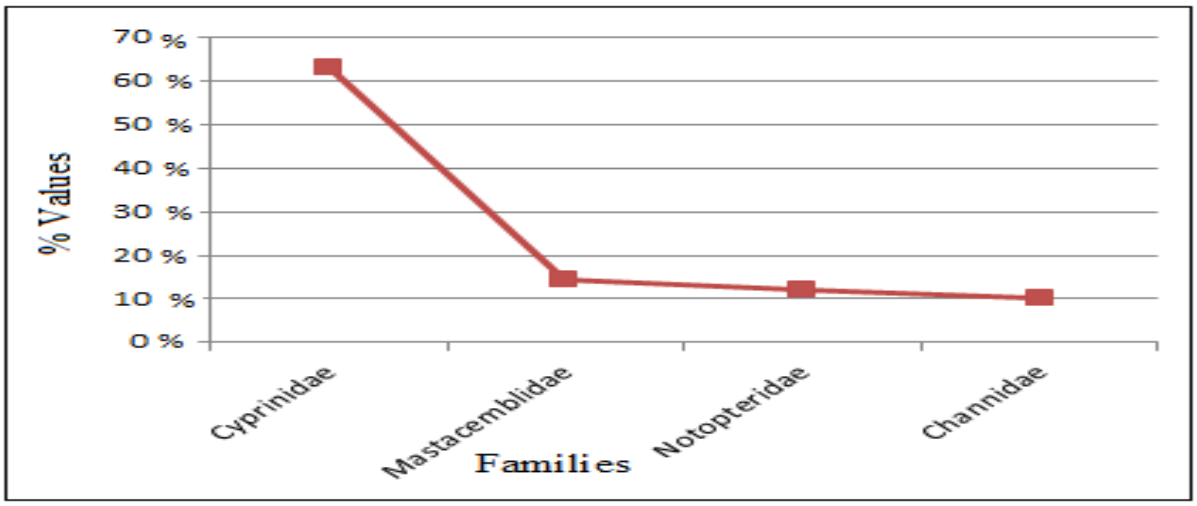

Fig. 2. Families abundance of fish species collected from river Kurram.

The values of the alkalinity were ranged from 208.19-175.77 mg/L. The high alkalinity value was in the month of July (208.19 mg/L), while the minimum value was in the month of February (175.77 mg/L). Similarly the higher value of the hardness was recorded in the month of January ranged 524.61 mg/L, while the lower value was founded in June with the range of 389.76 mg/L, respectively. The maximum value of pH was recorded 8.40 during July, while lowest value was recorded 8.07 in December month. The higher value of the TDS was recorded 446.87 ppm in November month. The minimum value was recorded 320.46 ppm in May month. The higher value of DO was recorded in the month of January with the ranged of 6.5 mg/L, while the lower value was recorded in the month of November with the ranged of 4.0 mg/L, respectively. The maximum value 30.66 °C of temperature was recorded during the month of June. The lower value 18.33 °C was recorded in January month documented by the (Shinde *et al.*, 2011). Similarly higher and lower values of the alkalinity were recorded 308.18 mg/L and 275.77 mg/L in the August and February. The hardness was founded with the ranged of 485.2-190 mg/L, respectively. Similarly the higher value of the pH was founded in December month ranged of 9.15, respectively.

The lower value was ranged of 7.68 in August month. The higher value 346.14 ppm of the TDS was founded in the month of December, while the lower value was documented in October with the ranged of 220.40 ppm, respectively. The higher value of DO was recorded with rang of 5.6mg/L, while the minimum value was founded with the range of 4.10mh/L, respectively. The maximum, minimum values of temperature were recorded with the range of 32 °C and 20 °C, reported by (Sangpal*et al.*, 2011). Physiochemical parameters of the present study was recorded normal because the fishery department has avoid the river Kurram from human activities, actually it irrigates the Baran dam.

Conclusion

From the current study it was concluded to conserve the fish biodiversity in river Kurram. The cyprinidae

family was most abundant represented by 5 species. After analyzing their physiochemical parameters showed the normal values and not too much different and risky for fish life in the river Kurram. The department of the fisheries should brought new species in the water bodies to enhance the fish biodiversity because it is the evidence to provide proteins to the human population.

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