



International Journal of Fauna and Biological Studies

Available online at www.faujournal.com

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International
Journal of
Fauna And
Biological
Studies

ISSN Online: 2347-2677
ISSN Print: 2394-0522
IJFBS 2015; 2 (2): 57-61

Received: 02-11-2014
Accepted: 22-12-2014

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Ichthyofauna of river Kabul at Nowshera, Khyber Pakhtunkhwa, Pakistan

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Abstract

A study on the fishes of River Kabul at District Nowshera, Khyber Pakhtunkhwa was conducted from August 2011 to November 2011. A total of 24 fish species were identified belonging to 4 Orders (Cypriniformes, Siluriformes, Channiformes and Mastacembeliformes) and 8 families (Cyprinidae, Nemacheilidae, Sisoridae, Siluridae, Bagridae, Channidae, Mastacembelidae and Schilbeidae). Family Cyprinidae was the richest family of the present survey represented by 14 species; viz *Carassius auratus*, *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Puntius sophore*, *Puntius ticto*, *Crossocheilus diplocheilus*, *Tor macrolepis*, *Orienus plagiostomus*, *Barilius pakistanicus*, *Barilius vagra*, *Barilius modestus*, *Gara gotyla*, *Labeo rohita* and *Cirrhinus mrigala*. Family Channidae was represented by two species, i.e. *Channa punctata* and *Channa gachua*. Family Siluridae was also denoted by two species i.e. *Ompok pabda* and *Wallago attu*. Two species, namely *Mystus bleekeri* and *Sperata sarwari* characterized Family Bagridae. All other families were represented by a single species i.e. *Acanthocobitis botia* (Nemacheilidae), *Glyptothorax punjabensis* (Sisoridae), *Mastacembelus armatus* (Mastacembelidae) and *Clupisoma naziri* (Schilbeidae). Throughout the study period, *Puntius* was the most dominant and abundant genus of the fish followed by *Barilius*, *Cyprinus* and *Channa*. In the present survey, *Sperata sarwari* (Bagridae) is reported for the first time from Kabul River. However, fish diversity was significantly lower at Azakhel (Nowshera) due to the acidic pH of the water of the study area i.e. 6. Further studies are required to be done to fully comprehend the present pollution status and its effects on biotic fauna.

Keywords: River Kabul; Khyber Pakhtunkhwa; *Puntius ticto*; Nowshera; Bagridae; Water quality.

1. Introduction

Fisheries is a major foreign currency earner and a chief occupation for the coastal inhabitants of Pakistan [1]. In 2006, Imports of fish were negligible while exports were to the amount of 196 million USD in Pakistan [2]. During recent years, similar trends have been witnessed all over the subcontinent. The term Ichthyo diversity refers to a variety of fish species on the basis of context and scale; it could refer to alleles or genotypes within Piscean population, species within a fish community, and to species or life forms across aqua regimes [3]. In Pakistan (then referred as West Pakistan), Dr. Nazir Ahmad, the first Director of fisheries department, was among the pioneers to study fish diversity from various parts of the country. His work was further elaborated by Dr. Ramzan Mirza from Department of Zoology, Government College, Lahore, Pakistan [4]. Their studies have investigated fish species of both freshwater and marine habitats in the country.

Round about 173 fresh water species and 786 marine species have been described from Pakistan [5]. About 35 species of fishes from Peshawar district, and 5 species from Mardan district were reported in a survey in 1963 [6]. Some of the comprehensive ichthyo diversity studies indicating rich faunal structure in River Kabul have been carried out by researchers like [7, 8, 9 & 10]. In the 90s, the maintenance of fisheries and aquatic life were hospitable in River Kabul, but nowadays it is referred as a sewer frequently among concerned scientists, environmentalists, NGOs and government officials of the KP in recent years [11]. Elevated levels of chemical parameters in the river are an evidence of man induced pollution.

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Local fish populations along the industrialized banks are also being affected by the high pollution rates [12]. These recent pollution claims after the cataclysmic 2010 floods, demanded an investigation of the current status of fish fauna in River Kabul. In this research, fish diversity of the River Kabul and standard climatic factors affecting fish diversity were investigated.

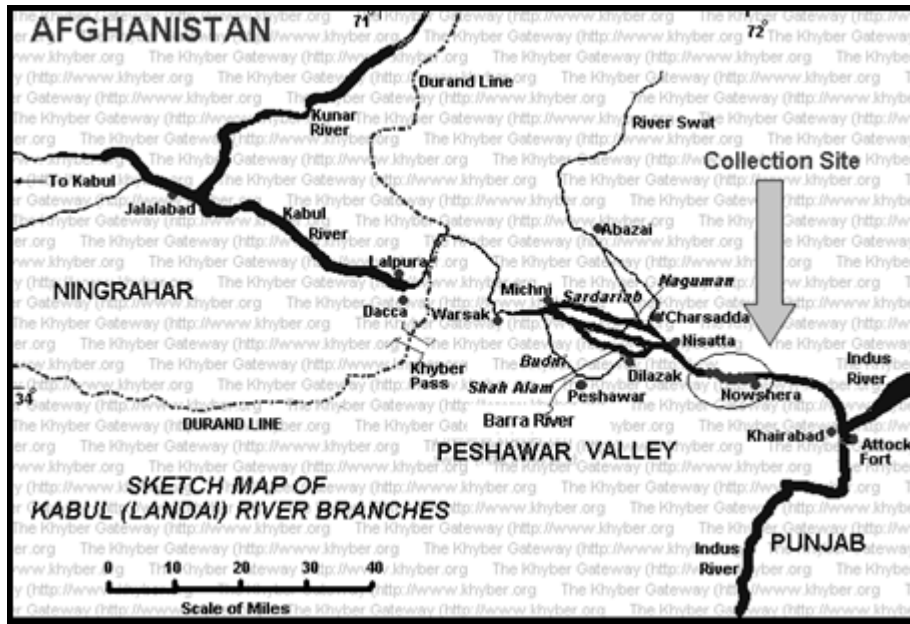
2. Materials and Methods

The present study was carried out in River Kabul at Nowshera (Figure 1). Kabul River originates from the base of the Unai

Pass in the Paghman mountains in Afghanistan [13]. The Kabul River enters Pakistan at Shalman the Khyber Agency. It flows through the Khyber and Mohmand Agencies flanked by Koh-e-Sufaid Mountains until it reaches Warsak Dam [11].

2.1 Collection site

The collection site was from Pabbi to Nowshera Cantt. The River length in between these two points is approximately 14 km. The collection was made from different localities i.e. Pabbi, Azakhel, Mohib banda and Mardan Bridge Nowshera.



*Arrow pointing towards site of collection at Nowshera

Fig 1: Map of River Kabul (From Google maps)

2.2 Study period

The study span was 4-months, i.e. August to November 2011. Three collections were performed each month.

2.3 Collection and preservation

The fishes were mostly caught by cast net, hand net and simple hooks. Ten percent formalin was used for large fish while small fishes were preserved in 5% formalin. Some specimens were also preserved in 70% Alcohols.

2.4 Identification

Keys were used for identification of fishes upto species level i.e. Fishes of the Punjab Pakistan [14], A contribution to fishes of Lahore [15], Pakistan Ki taza pani ke machlian [16], Inland fishes of India and Adjoining countries, (Volume 1 and 2) [17] and The Fresh water Fishes of Indian region [18] were used.

2.5 Physical parameters of water

All physical parameters except temperature were measured once during the present study in the month of august whereas temperature was recorded for each month. The parameters investigated for the study include: water temperature, pH, velocity of water, T.S.S and T.D.S.

2.6 Water Temperature

Water temperature was measured with the help of a simple mercury thermometer in degree centigrade. Water temperature

was measured by dipping the thermometer in water for about 3 minutes. The process was repeated three times and values were averaged.

2.7 pH

The pH of water was measured with the help of the pH meter.

2.8 Velocity of Water

The average rate of flow or velocity of water was determined by throwing a wooden piece in water at point A and time was noted, when the wooden piece reached point B, time was recorded again. It was calculated by using the following formula.

$$V = S/t$$

Where,

V = Velocity of Water
S = Distance covered by wooden piece
t = Time taken

2.9 Total Suspended Solids (TSS)

A dry filter paper (Whatman, Cat No, 1441125) was weighed on digital balance (Snowrex BBA-600, 600*0.01 g) and denoted as W_1 . Then 100 ml of water was taken in beaker from the river which was filtered through filter paper. The filter paper was then dried, and again weighed and was denoted by

W_2 . The amount of total suspended solids in the given water sample was determined by subtracting W_1 from W_2 [19].

2.10 Total Dissolved Solids (TDS)

Well dried empty China dish was weighed and denoted by W_1 . Then 100ml of river water was taken and filtered to remove suspended solids and then was poured in a China dish, and placed on the burner till water got completely evaporated. China dish was again weighed and denoted by W_2 . The amount of total dissolved solids was determined by subtracting W_1 from W_2 [19].

2.11 Bank Conditions and Color of water

Conditions of the bank and color of water were studied through general observation.

3. Results and Discussions

The present survey of River Kabul at Nowshera, Khyber Pakhtunkhwa, resulted in the collection of 24 species i.e. *Cyprinus carpio*, *Tor macrolepis*, *Carassius auratus*, *Cirrhinus mrigala*, *Crossocheilus diplocheilus*, *Acanthocobitis botia*, *Puntius sophore*, *Glyptothorax punjabensis*, *Puntius ticto*, *Sperata sarwari*, *Barilius modestus*, *Ompok pabda*, *Barilius pakistanica*, *Mystus bleekeri*, *Barilius vagra*, *Wallago attu*, *Orienus plagiostomus*, *Clupisoma naziri*, *Hypophthalmichthys molitrix*, *Channa punctata*, *Garra gotyla*, *Channa gachua*, *Labeo rohita* and *Mastacembelus armatus*. Family Cyprinidae (63.79 %) was the most abundant family of the present study followed by Channidae and Sisoridae. Both Cyprinidae and Channidae have remained the dominant

families of the study region over the past many years [20, 9]. Family *Nemacheilidae*, *Siluridae*, *Bagridae* and *Schilbeidae* were least represented in the sample (Figure 2).

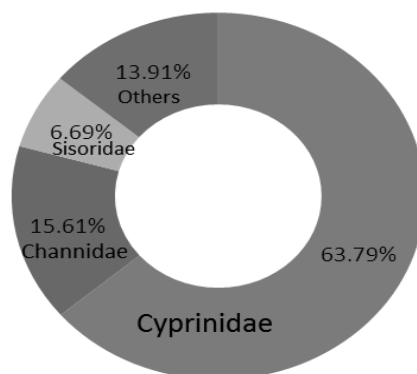


Fig 2: Percentage compositions of fish families collected during the present survey

Puntius followed by *Barilius*, *Cyprinus* and *Channa* are the most abundant genera of the present survey (Figure 3). In Cyprinidae, following were the most abundant species in our collections i.e., *Puntius ticto*, *P. sophore*, *Cyprinus carpio*, *Barilius pakistanicus* and *B. vagra* while the family Channidae was dominated by *Channa punctata* and *Channa gachua*. These species were also recorded in great abundance in the river Swat by [21]. When compared on the basis of species, the most abundant was *Puntius ticto* followed by *Puntius sophore* (Figure 4).

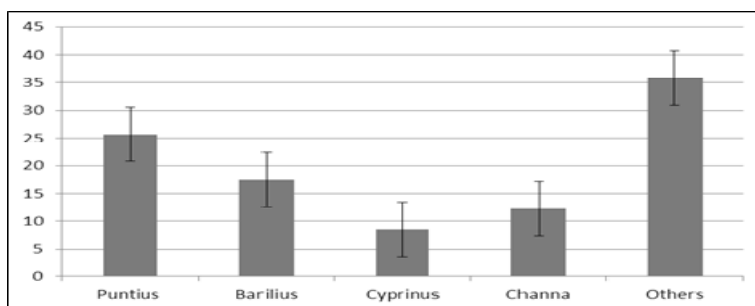


Fig 3: Percentage compositions of various fish genera

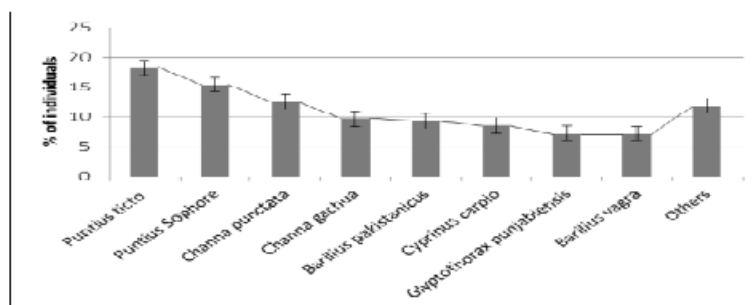


Fig 4: Relative abundance of fish species in the present study

Yet in another contemporary study from river Sardaryab, i.e., a branch of River Kabul, the *Puntius* species dominated fish faunal collections [22]. In Asian tropics among Cyprinids the *Puntius* genus is the most abundant [3]. With respect to species

assemblage, Pabbi was the most diverse site of the present study in comparison to Mohib Banda, Azakhel and Mardan Bridge (Figure 5). Thus, it was noticed that the fish fauna of river Kabul and river Swat are very similar.

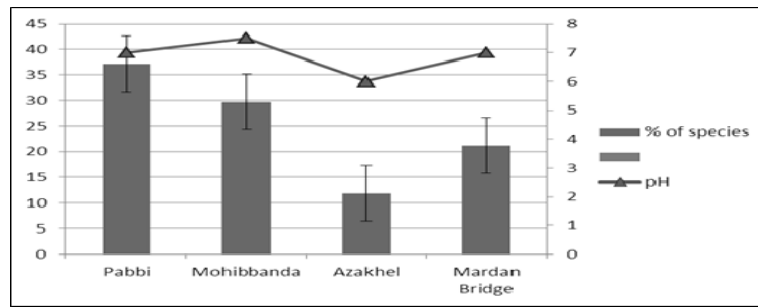


Fig 5: Species abundance at various collection sites

Nine species were recorded from Swat and Buner valleys from which *Tor macrolepis* (identified as *Tor putitora* at that time) and *Orienus plagiostomus* are common with fauna collected [24]. A survey conducted by Sidiqi, identified six species from river Swat at Abazai Charsadda where it merges with River Kabul. Only three species i.e. *Barilius vagra*, *Schizothorax plagiostomus* and *Channa punctata* collected at that time are common with our collection [25]. Reported species like, *Puntius ticto*, *Crossocheilus diplocheilus*, *Channa gachua*, *Tor macrolepis*, and *Mastacembelus armatus* from river Kabul [26] that were also present in our collection. *Tor macrolepis*, *Wallago attu*, *Ompok bimaculatus*, *Ompok pabda*, *Labeo dyocheilus pakistanicus* and Chinese grass carp i.e. *Ctenopharyngodon idella* was declared as major commercial fishes of river Kabul by [27]. Our collection depicts the presence of three species i.e. *Tor macrolepis*, *Wallago attu* and *Ompok pabda*.

Fifty four fish species were reported in a survey with six new records, i.e. *Rashora daniconius*, *Puntius punjabensis*, *Puntius chola*, *Orienus plagiostomus*, *Chanda ranga* and *Glassogobius giuris* from Peshawar, Charsada, Nowshera, Mardan and Nizampur [20]. In the present study, only one species *Orienus plagiostomus* is reported out of six.

An exhaustive study carried out in Afghanistan resulted in 43 fish species from Kabul River [7]. Of these species, the present collection matches 15 species only i.e. *Barilius vagra*, *Carassius auratus*, *Crossocheilus latius*, *Cyprinus carpio*, *Gara gotyla*, *Hypophthalmichthys molitrix*, *Puntius ticto*, *Puntius sophore*, *Ompok pabda*, *Wallago attu*, *Clupisoma naziri*, *Glyptothorax punjabensis*, *Channa gachua*, *Channa punctata* and *Mastacembelus armatus* while the remaining 28 species are missing.

Out of 50 species reported from river Kabul, only 17 species like *Barilius pakistanicus*, *Barilius vagra*, *Cirrhinus mrigala*, *Labeo rohita*, *Puntius sophore*, *Crossocheilus diplocheilus*, *Carassius auratus*, *Cyprinus carpio*, *Acanthocobitis botia*, *Mystus bleekeri*, *Glyptothorax punjabensis*, *Ompok pabda*, *Wallago attu*, *Clupisoma naziri*, *Channa gachua*, *Channa punctata* and *Mastacembelus armatus* were reported in the present collection while the rest are absent [10].

It was observed during the present study that some species of some families were distributed abundantly as compared to others. Moreover, some species were found throughout the study period and these may be called resident species of the area. Whereas those species which were found less in number might not be able to tolerate high or low temperatures and therefore migrate into the surrounding rivers (like Swat, Jindi etc.). This might be the main reason that the fish fauna of these rivers is very similar. *Sperata sarwari* is reported for the first time in River Kabul. Recently the species have also been documented from River Indus at Kalabagh, a few miles ahead

of Nowshera [5].

3.1 Physical Parameters

Temperature plays an important role in the aquatic environment. Certain organisms, including fish, are sensitive to water temperature [28].

The average air and water temperatures of current study in August, September, October and November were (33 °C, 26 °C), (31 °C, 23 °C), (28 °C, 22 °C) and (22 °C, 16 °C) respectively. In the present study a total of 23 specimens of *Cyprinus carpio* was collected out of which only four were collected in November when the average temperatures were very low (16 °C). Similarly for Indian carps like *Labeo rohita*, *Cirrhinus mrigala* and *Catla catla*, the optimal temperature range is between 25-30 °C [29]. Thus, in November, catch of the species like *Labeo rohita* and *Cirrhinus mrigala* was quite low. On the other hand fish catch was quite high during the month of August.

The sequence of abundance for fish species during various months is August: 33.45 %; September: 30.02%; October: 22.58% and November 13.95 %. In the light of the above information it appears that the River Kabul is suitable for any of our cultivated species because the average temperature of the river Kabul (Nowshera) lies within range of thermal tolerance for fish species.

The average velocity of water at Pabbi, Mohib Banda, Azakhel and Mardan Bridge were recorded as 0.39 m/sec, 0.38 m/sec, 0.38 m/sec and 0.38 m/sec respectively.

The pH is one of the most important limiting factors in an aquatic environment; adult fish can tolerate a high water pH, while young ones have low tolerance ranges for pH [30]. PH level of water below 5.0 is lethal to fishes with immediate death at a pH of 4.8 due to respiratory failure. Under acidic conditions, respiratory epithelium is destroyed while the gill lamellae are closely compressed [31]. Thus, this argument justifies less diversity of fish fauna at Azakhel with pH of 6 as compared to other localities observed in the present study. Species abundance was directly proportional to pH. The pH of River Kabul at Pabbi, Mohib Banda, Azakhel and Mardan Bridge was 7, 7.5, 6 and 7 respectively, which is suitable for fishes as well as other aquatic life.

The 2010 flooding in the region of Pakistan severely affected the fish fauna [32]. However, at the time of the present study (just one year after the floods), Kabul River has reverted back to its previous glory in the physical sense (TSS and TDS) and fish diversity. According to Khan and Khan the water of river Kabul shows high amounts of suspended solids during rainy seasons when high flow conditions are prevalent. At such times the suspended solids range between 10-800 mg/Liter [33]. The amount of total suspended solids and total dissolved solids in River Kabul at Pabbi, Mohib Banda, Azakhel and Mardan Bridge were (123 mg/L, 112.2 mg/L), (125 mg/L, 112.5

mg/L), (121.4 mg/L, 116.03 mg/L) and (127.6 mg/L, 115.52 mg/L) respectively.

Fishes collected were measured and average readings for different morphometrics were recorded. For example; total length for *B. pakistanicus* is 12 cm^[8]. Average total length for *B. pakistanicus* collected in the present study is 11.6 cm, which is in agreement with that total length.

4. Conclusions

River Kabul is a healthy aquatic system with respect to fish diversity and is a home to a number of species. The 2010 floods severely affected the region and perhaps the fish faunal structure of Kabul; however the fauna has stabilized itself over the period of just one year. New report such as *Sperata sarwari* from Kabul shows that the river is accommodating new species to its range while retaining its common fauna. Less diversity at sites such as Azakhel show the harmful effects of water pollution on fish fauna due to acidic pH which might be the contribution of the industries present in this region.

To ensure the conservation of the fish fauna of River Kabul at District Nowshera, a research and training center for native fish species is recommended to be established in the area. A strict ban on fish catch should be imposed during breeding seasons. A cooperative relationship should be introduced between Police force and fisheries department for the conservation of fish population. Seminars should also be arranged for awareness and training of students, teachers and general public, fisherman and professional staff etc. Strict laws and rules should be followed for fish conservation and control of water pollution and fisheries staff should be increased to control illegal fishing practices. Dynamiting, poisoning and the use of electric current should be controlled by heavy fines. Although 24 species have been identified from river Kabul, but there is hope to find many more. Therefore more studies should be done on ichthyodiversity and taxonomy of fishes in River Kabul, district Nowshera.

5. Acknowledgment

This paper is based on MSc work of the first author. Authors are grateful to the Department of Zoology, University of Peshawar for providing lab facilities and funding for this research.

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