



RESEARCH PAPER

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A preliminary survey of freshwater ichthyofauna of Qadam Khaila stream and Muhajar Camp stream at Dargai, District Malakand, Khyber Pakhtunkhwa, Pakistan

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Abstract

Biodiversity is of key importance in the sustainability of an ecosystem. It correlates with the physiological changes in animals and environmental factors that fluctuate in a geographic region. Therefore, the current research work was performed to study the biodiversity and distribution of fish of Qadam Khaila Stream and Muhajar Camp Stream at Dargai, District Malakand Pakistan, from May-August 2016. The sample collection was conducted twice a month using different types of fishing net like rods, hooks, scoop net, drag net, hand nets, etc. The fish samples were identified by studying various morphometric measurements and meristic counts. A total of 10 species were identified i.e. *Barilius pakistanicus*, *Crossocheilus diplocheilus*, *Schizothorax labiatus*, *Puntius chola*, *Devario devario*, *Acanthocobitis botia*, *Schistura curtistigma*, *Channa punctata*, *Channa gachua* and *Mastacembelus armatus*. All these species belonging to three orders; Cypriniformes, Channiformes and Mastacembeliformes and four families; Cyprinidae, Nemacheilidae, Channidae and Mastacembelidae. Cyprinidae was the most dominant family represented by five species viz. *Barilius pakistanicus*, *Crossocheilus diplocheilus*, *Puntius chola*, *Schizothorax labiatus* and *Devario devario*. Nemacheilidae and Channidae comprised two species each while Mastacembelidae by only one species only. Hence, it is concluded that these streams harbour rich diversity of fish which elucidate the suitability of these water bodies for the maintenance of biodiversity. Hence, culturing and conservation of fish species in the respective area could improve the economic status of the people.

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Introduction

Biodiversity is of key importance in the sustainability of an ecosystem. It correlates with the physiological changes in animals and environmental factors that fluctuate in a geographic region. In freshwater, biodiversity covers a wide range of ecological services like drinking water, food, fisheries, transport, etc (Balian *et al.*, 2008). For the wellbeing of mankind, it is pre-requisite to protect biodiversity for the preservation of the above mentioned services (Corvalan *et al.*, 2005).

There are so many animal's and plant's species in Pakistan which are very rare and are becoming endangered due to their illegal hunting and habitat loss. The habitats of these species need to be protected as these species play a crucial role in food web, food chain and trophic levels. These habitats protection have been on the rise around the world for decades (Bibi *et al.*, 2013). In Pakistan, protected areas cover only 10.4% land (BAP, 2000). These areas usually play a vital role in maintaining and upgrading biodiversity (Evans *et al.*, 2006). Wetlands assist biodiversity thereby supporting food, fuel, better livelihood, transportation, employment and economy of nations (Shah *et al.*, 2018) as world is constantly using it as food resources (Akhter *et al.*, 2015).

It is highly marked and obvious that betterment of the protected areas is greatly related to an efficient and organised biodiversity (Foundation for ecological Security, 2010). Naturally, human manage and protect only those resources which can directly boost its economy and business. On the other hand, human is also a main source of damaging habitats and protected areas (Salafsky *et al.*, 2001). These damaging habitats and protected area seriously threat the biodiversity and need special attention for survival of animals especially fish fauna. This fauna mainly depends on indigenous resources mostly on wetlands goods (Bibi *et al.*, 2013).

Fish is the one of the key species containing important minerals i.e., zinc, iron, potassium, iodine and phosphorous as well as vitamin A and D and balance level of all the essential amino acids (Brasky *et al.*, 2010). In addition, small amount of

carbohydrates and polyunsaturated fatty acids is also present, having key role against heart diseases (Sanderson *et al.*, 2002) and antiarrhythmic (Givens *et al.*, 2006). Fish are rich share of beneficial oil called Omega-3 fatty acids (Khawaja *et al.*, 2012). Fish oil is very important for both mother and neonates during pregnancy (Dunsten *et al.*, 2004); preventing complications in pregnancy (Olsen *et al.*, 2000). It is also used in heart transplant surgery (Holm *et al.*, 2001), reducing the chances of rejecting new heart thereby controlling blood pressure and kidney damage (Balk *et al.*, 2004).

The pattern of the diversity of fish is reliant on the variations in ecological system of different rivers i.e. water temperature, depth of the river, drainage surface area, water flow velocity, morphology, river discharge, climate, etc (Welcomme, 1985). The abundance of the fish species shows the health of the ecological system and water body (Hamzah, 2007). A lot of researches have been conducted on the biodiversity of fish in Pakistan. These studies resulted in the collection of approximately 193 fish species from freshwater body of Pakistan (Ishaq *et al.*, 2014). A large quantity of commercially valuable species is collected annually. The commercially significant native species of Pakistan include about 30 species. Therefore, the current research work was performed with the aim to study the biodiversity and distribution of fish of Qadam Khaila Stream and Muhajar Camp Stream.

Materials and methods

Sampling Area

District Malakand is positioned at the Longitude and Latitude of 34.5030° North and 71.9046° East respectively. It is geo-strategically more important as it plays a role of connection point for Bajaur, Swat, Lower Dir and Buner. Moreover, the Malakand pass connects Mardan to Swat and Dir. Both Qadam Khaila Streams and Muhajar Camp Stream located at Dargai District Malakand, are the tributaries of River Swat.

Fish Sampling

The sample collection was conducted on the 15th and 30th of each month. Different types of fishing net like rods, hooks, scoop net, drag net, hand nets, etc were

used for the collection of samples from different points of the research site. The samples were then taken in plastic bottles filled with 10% formalin. Large sized fish were injected 5% formalin in abdomen so that to prevent spoiling.

Laboratory work

After collection, the samples were then brought to the Fisheries and Aquaculture Lab, Department of Zoology, University of Peshawar Khyber Pakhtunkhwa, Pakistan. The fish samples were washed properly and then identified by studying various morphometric measurements and meristic counts (Table 3) with the help of different taxonomic keys i.e. Fishes of the Punjab (Mirza and Sandhu, 2007) and Inland fishes of India and adjacent countries (Talwar and Jhingran, 1991). Various types of laboratory instruments were used during identification like Vernier calliper, ruler, magnifying glass, counting needles, surgical gloves, petri dishes, forceps, compound microscope and dissection microscope.

Labelling

After identification, the samples of each species were kept in separate bottles. Each bottle was labelled with name of collector, name of locality, serial number, date of collection and name of the species (both common and scientific names).

Results

During the present study, a total of 663 fish specimens were collected from Qadam Khaila Stream and Muhajar Camp Stream comprising 10 species. The collected species were *Barilius pakistanicus*, *Crossocheilus diplocheilus*, *Schizothorax labiatus*, *Puntius chola*, *Devario devario*, *Acanthocobitis botia*, *Schistura curtistigma*, *Channa punctata*, *Channa gachua* and *Mastacembelus armatus*. All these species belonging to three orders; Cypriniformes, Channiformes and Mastacembeliformes, four families; Cyprinidae, Nemacheilidae, Channidae and Mastacembelidae and nine genera i.e. *Barilius*, *Crossocheilus*, *Puntius*, *Schizothorax*, *Devario*, *Acanthocobitis*, *Schistura*, *Channa* and *Mastacembelus* as shown in Table 1. *Puntius chola* was the most abundant species represented by 109 specimens while *Channa gachua* was the poorest species with 36 specimens only (Table 2).

As *Barilius pakistanicus*, *Crossocheilus diplocheilus*, *Puntius chola*, *Devario devario* and *Acanthocobitis botia* have small sized body that's why these species have no commercial value. However, these species play a vital role in the sustainability of an aquatic ecosystem.

Table 1. Identified species of Qadam Khela Stream and Muhajar camp Stream.

SN	Order	Family	Genus	Species
1	Cypriniformes	Cyprinidae	<i>Barilius</i>	<i>Barilius pakistanicus</i>
2			<i>Crossocheilus</i>	<i>Crossocheilus diplocheilus</i>
3			<i>Puntius</i>	<i>Puntius chola</i>
4			<i>Schizothorax</i>	<i>Schizothorax labiatus</i>
			<i>Devario</i>	<i>Devario devario</i>
5		Nemacheilidae	<i>Schistura</i>	<i>Schistura curtistigma</i>
6			<i>Acanthocobitis</i>	<i>Acanthocobitis botia</i>
8	Channiformes	Channidae	<i>Channa</i>	<i>Channa punctate</i>
9			<i>Channa</i>	<i>Channa gachua</i>
10	Mastacembeliformes	Mastacembelidae	<i>Mastacembelus</i>	<i>Mastacembelus armatus</i>

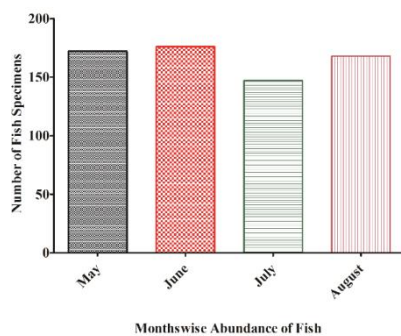
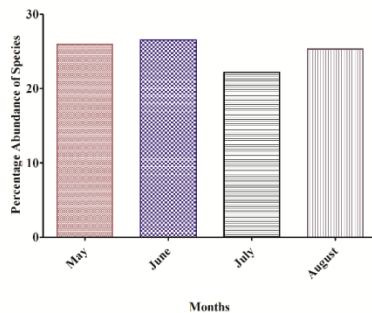
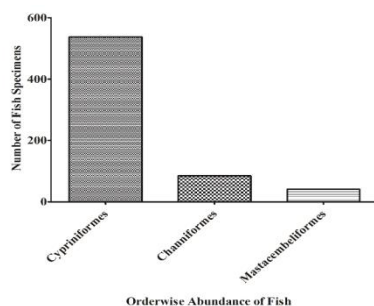
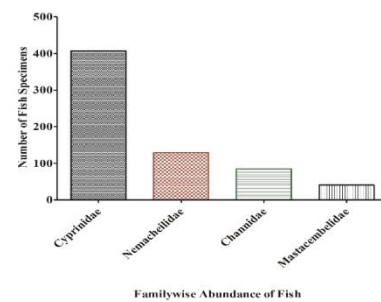
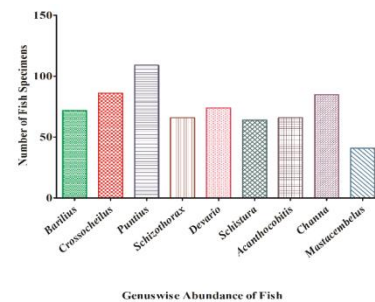
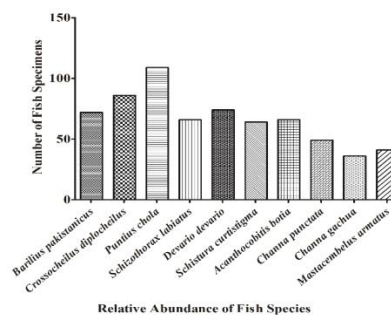
Table 2. Monthwise collection of fish specimen from Qadam Khela Stream and Muhajar camp Stream.

Species	May	June	July	August	Total
<i>Barilius pakistanicus</i>	19	17	21	15	72
<i>Crossocheilus diplocheilus</i>	18	29	21	18	86
<i>Puntius chola</i>	33	27	23	26	109
<i>Schizothorax labiatus</i>	19	17	12	18	66
<i>Devario devario</i>	15	19	16	24	74
<i>Schistura curtistigma</i>	18	15	11	20	64
<i>Acanthocobitis botia</i>	19	21	15	11	66
<i>Channa punctate</i>	13	12	09	15	49
<i>Channa gachua</i>	09	07	11	09	36
<i>Mastacembelus armatus</i>	09	12	08	12	41
Total	172	176	147	168	663

Table 3. Morphometric measurements (cm) of total identified species from Qadam Khela Stream and Muhajar camp Stream.

Species	T. L	S. L	F. L	Sn. L	H. L	E. D	Cp. L
<i>Barilius pakistanicus</i>	9.0	7.5	8.4	0.6	1.5	0.4	1.2
<i>Crossocheilus diplocheilus</i>	9.4	7.5	8.5	0.8	1.7	0.3	0.7
<i>Puntius chola</i>	6.7	5.3	6.3	0.4	1.5	0.4	0.9
<i>Schizothorax labiatus</i>	7.5	6.0	6.8	0.5	1.3	0.3	1.1
<i>Devario devario</i>	9.5	7.5	9.0	0.7	1.8	0.5	0.8
<i>Schistura curtistigma</i>	11.5	9.8	---	1.1	2.4	0.2	2.8
<i>Acanthocobitis botia</i>	7.1	5.9	7.0	0.7	1.5	0.3	0.7
<i>Channa punctate</i>	11.2	9.4	---	0.6	3.3	0.5	0.7
<i>Channa gachua</i>	11.8	9.8	---	0.6	3.2	0.5	1.0
<i>Mastacembelus armatus</i>	21	20	---	1.0	3.3	0.2	---

T.L = Total Length, F.L = Forked Length, S.L = Standard Length, Sn. L = Snout Length, H.L = Head Length, E.D = Eye Diameter, Cp. L = Caudal peduncle length

**Fig. 1.** Monthwise collection of the total fish specimens from May-August 2016.**Fig. 2.** Month wise percentage abundance of total reported fish species from May-August 2016.**Fig. 3.** Orderwise diversity of the total collected fish specimens.**Fig. 4.** Familywise diversity of the total collected fish specimens.**Fig. 5.** Genuswise diversity of the total collected fish specimens.**Fig. 6.** Relative abundance of the total reported fish species from both Qadam Khaila Stream and Muhajar Camp Stream.

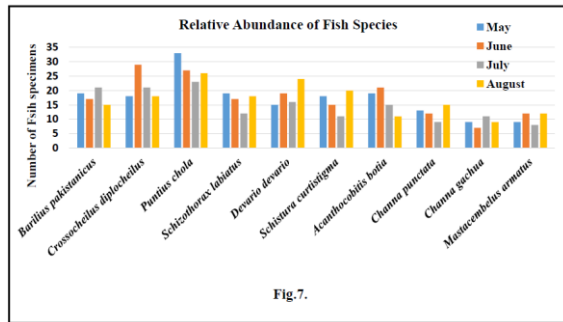


Fig. 7. Monthwise relative abundance of all the fish specimens of total reported species from May-August 2016.

Discussion

Fish are one of the largest groups of vertebrates covering approximately 50% of the phylum vertebrata inhabiting both freshwater and marine water (Shinde *et al.*, 2009). Aquatic biodiversity shows extreme importance as it provides the basic knowledge about aquatic life. That's why the study of fish biodiversity of a locality/region is the primary need to know about the aquatic ecosystem of that region (Khan and Hasan, 2014). Therefore, the current survey was the first effort to get knowledge about the Ichthyodiversity of Qadam Khaila Stream and Muhajar Camp Stream at Dargai District Malakand Khyber Pakhtunkhwa.

Yousafzai *et al.* (2013) reported 38 species from River Swat at Charsadda. Both the Qadam Khaila Stream and Muhajar Camp Stream are the tributaries of River Swat. By comparing, both surveys showed significant similarities i.e. *Barilius pakistanicus*, *Puntius chola*, *Channa punctata*, *Channa gachua*, *Crossocheilus diplocheilus*, *Acanthocobitis botia* and *Mastacembelus armatus* were common. The rest of the species were absent in the current study. However, *Schizothorax labiatus*, *Schistura curtistigma* and *Devario devario* were missing in their study. These variations may be due to the difference in both water bodies as river Swat harbour large food web and food chain. Moreover, District Charsadda is warm area while District Malakand is a semi cold area. Temperature has great influence on fish relative abundance and species richness (Koutrakis *et al.*, 2000). So, temperature may be the key factor resulting in the above stated variations.

Ishaq *et al.* (2014) reported 18 species from River Swat (Madyan to Chakdara). Only five species viz, *Barilius pakistanicus*, *Channa punctata*, *Channa gachua*, *Crossocheilus diplocheilus*, and *Mastacembelus armatus* were mutual in both studies. Moreover, seven genera; *Barilius*, *Crossocheilus*, *Channa*, *Mastacembelus*, *Schizothorax*, *Puntius* and *Schistura* were also common.

Muhammad *et al.* (2014) collected 11 species from River Panjkora which enters the River Swat at Totakan, District Malakand. There was a slight similarity with our study because only three species; *Barilius pakistanicus*, *Crossocheilus diplocheilus* and *Channa punctata* were common. This difference might be due to more vegetation, large variety of food, large amount of water, habitats etc of the River Panjkora as compared to the respective streams. Therefore, their study included wide range of species diversity. Akhtar *et al.* (2014) collected ten species from River Barandu District Buner. By comparing, both studies depict only three common species i.e. *Barilius pakistanicus*, *Channa gachua* and *Mastacembelus armatus*. However, seven genera; *Barilius*, *Crossocheilus*, *Channa*, *Schistura*, *Schizothorax*, *Puntius* and *Mastacembelus* were also conjoint.

During the present study, Qadam Khaila Stream was found more diverse than Muhajar Camp Stream having a diversity of eight species viz; *Barilius pakistanicus*, *Channa gachua*, *Channa punctata*, *Crossocheilus diplocheilus*, *Acanthocobitis botia*, *Devario devario*, *Puntius chola* and *Mastacembelus armatus*. While Muhajar Camp Stream was found to have only four species i.e. *Puntius chola*, *Schizothorax labiatus*, *Crossocheilus diplocheilus* and *Schistura curtistigma*. Only *Puntius chola* and *Crossocheilus diplocheilus* were common to both streams. *Schizothorax labiatus* and *Schistura curtistigma* reported along with *Crossocheilus diplocheilus* from Muhajar Camp Stream in the same habitat but their abundance was less than the later one.

The current study was carried out from May-August 2016 and reported ten species. Among these species, *Puntius chola* was the most dominant species

represented by 109 specimens (16.44%) while *Channa gachua* was the less abundant represented by 36 specimens (5.42%) of the total collected specimens. Amid the Cyprinids, genus *Puntius* exhibits utmost richness in Asian tropics (Khattak *et al.*, 2015). In addition, Cyprinidae was the dominant family comprising of five species while Mastacembelidae was the represented by one species only (Table 2).

Although there was least difference in monthwise collection while using same fishing gears like drag net, mesh cloth, hooks, etc. June was the richest month (176 specimens) while July was the poorest month (147 specimens). In addition, the total catch during the whole period showed significant species evenness and richness (Table 2). All the ten species have been collected in each month and no significant variations were found in monthwise frequency. The reason might be the steady weather of the area during May-August 2016 and no heavy rainfall which could alter the ratio of specimens for each species.

Conclusions and recommendations

During this study, we concluded that both the streams harbour rich diversity of fish especially Qadam Khaila Stream, which elucidate the suitability of the water bodies for the maintenance of biodiversity. Hence, culturing and conservation of fish species in the respective area could improve the economic status of the people.

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