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Similarity in ichthyodiversity of two connected rivers in Pak-Afghan border: River Chitral and River Bashgal and their frequency of distribution

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Abstract

River Chitral and River Bashgal are first two feeding rivers of River Kabul which join each other at Pak-Afghan border in Arandu, Pakistan. These connected water bodies were assessed to explore similarity in ichthyodiversity. A total of 157 specimens were collected which represented 7 species namely *Schizothorax plagiostomus*, *Schizothorax esocinus*, *Racoma labiata*, *Glyptosternum reticulatum*, *Tryplophysa choprai*, distributed in both rivers, and *Tryplophysa kashmirensis* and *Tryplophysa hazarensis* were collected from River Chitral only. The water bodies have five (5) species in common, showing more than 71% similarity regarding fish fauna. It also confirms the presence of *Tryplophysa choprai* in Afghanistan.

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Introduction

River Kabul, a large river flowing through Pakistan and Afghanistan has a very important role in the lives of the people of the region. It is used for irrigation and fishing thus contributing in the economy of the masses. It is also used as waste bin as thousand tons of municipal, anthropogenic and industrial wastes are added into the river annually (Baig *et al.*, 2010; IUCN, 1994). The course of River Kabul mainly originates from two points i.e Paghman Mountains in Afghanistan and Chiantar glacier, Chitral Pakistan. River Chitral accounts for a major part of River Kabul both in terms of distance covered and flow having a drainage area of 11,400 km² inside Chitral (Shakir *et al.*, 2010; Yousafzai *et al.*, 2010). River Chitral is joined by River Bashgal at Arandu Pakistan, both jointly flow downward as River Kunar and flow into River Kabul near Jalalabad. River Chitral and River Bashgal are two initial feeding rivers of River Kabul in the Hindu Kush Mountains. Rive Bashgal is also known as Landai Sin and located within Latitude 35° 19'38" N. 71° 35'05" E. It originates from Luluk area of Bashgal Valley and joined by several small streams. Bashgal Valley is geographical feature of Nuristan, formed by the Bashgal River which flows into River Kabul. River Kabul again enters Pakistan in Shalman Khyber Agency. From Paghman to Attock city where River Kabul join Indus, it covers 480 km distance (Yousafzai *et al.*, 2010).

District Chitral is located in the extreme Northwest corner of Pakistan within co-ordinates 71-11.5' East and 73-54' East longitude, and 35-13' North and 36-55' North latitude. It has a total area of 14850 Kilometers and consists of two subdivisions Chitral and Mastuj having 6459 and 8932 Kilometers respectively. It has common boundaries with Afghanistan in the North and West, Gilgit and Northern Areas in the East, District Swat and Dir in the South and Southeast. It is surrounded by 15000 to 25000 feet high ranges of Hindukush and Karakurum and one of the loftiest tracts of the country (Baig *et al.*, 2010). Altitude of Chitral ranges from 1060 meters in the Arandu to 7700 meter at Terichmir

(Aziz, 1987). The majority people of Chitral are "Kohow" and speak Kohowar. The total population of Chitral is 316888 (DCR, 1998).

Nuristan or Nooristan, is a province of modern Afghanistan embedded in the South of the HinduKush valleys. Its administrative center and capital is Parun. It was formerly known as Kafiristan (land of unbelievers) until the inhabitants were converted to Islam in 1896 and hence the region has become known as Nuristan (land of light) (Leary, 1992). Nuristan is located in high elevations along small river valleys in Northeast Afghanistan. The population is approximately more than 150,000 at present, lives in the five large villages of Kamdesh, Nisheigram, Waigal, Wama and Zhonchigal, each with 300 to 500 houses, and in a multitude of smaller settlements.

Nuristan is geographically located at Latitude 34.94° 34°56'23" North of the equator and longitude 70.38° 70° 22'47" East of the Meridian on the map of the world. The province covers an area of some 12,000 square km, bordering on Pakistan to the East and the Panjshir Valley to the West, Kabul and Jalalabad lie on the North and Wakhan in the south. It is drained by the Alisheng, Alingar, Pech and Bashgal rivers and their tributaries (moving from West to East), the area is furrowed by countless steep valleys surrounded by ever higher mountains when approaching the main Hindu Kush ridge with peaks above 6,000 m.

Climatic conditions of both Chitral and Bashgal is similar that is arid and semi-arid continental with cold winter and dry hot summer. Both valleys are situated in highest mountainous range of the world, ecological zonation is distinct between different lands i.e. uplands and lowlands. The study area comes under the Himalaya Hindu Kush ichthyo-ecological zone (Rafique, 2007).

Fishes, the most diverse group of vertebrates occur in every aquatic habitat from the Antarctic ice zone with temperature -2°C to warm waters where temperature

exceeds 44°C (Helfman *et al.*, 1997; Bone and Moore 2008) while the altitudinal distribution ranges from 5000 meter above sea level to some 11,000 meter beneath it (Ali, 1992). Such varying environmental conditions have produced a higher plasticity in fishes so they vary in color and other morphological characters even within species (Dunham, 2011). Fish diversity and distribution are of high concern particularly for fishery biologists. Fish diversity of any aquatic habitat needs to be assessed after some time in order to plan conservation strategy for the wild stock. Fish fauna of a particular area undergo changes from year to year. Distribution of fishes highly correlates with evolution of the water drainages in the geological past and uplift of mountains (Rafique, 2000).

Pakistan has a very rich ichthyofauna, more than 190 valid species including the exotic and cultured species (Rafique and Khan 2012; Mirza, 2010). Pakistan is divided into six different ichthyo-ecological zones (Rafique, 2007). There are about 28 species of cold water fishes in Pakistan (Yaqoob, 2001; Ali, 2010).

Scientific literature are scarce regarding fish fauna of Afghanistan particularly cold water fisheries (FAO, 2002) about 101 fish species are known from Afghanistan and another 38 are suspect to occur (Shank, 2008). Highest numbers of fish species are known from Kabul River in Afghanistan (Coad, 1981; Shank, 2008).

River Kabul has a complex watershed. Plate tectonic and mountain building process have resulted in complicated metamorphic and igneous rocks in the headwaters of the tributaries while sedimentary limestone and shale in the lower Basin of the river. River Chitral accounts for half of the discharge (Yousafzai *et al.*, 2010; IUCN, 1994). The water of the river is used for irrigation and fishing. More than 45 fish species have been identified from the River inside Pakistan among them 35 are very common (Rafique, 2001). Various workers have worked on fish diversity and ecology of River Kabul in the lower reaches but

the upper reaches are comparatively unexplored due to their far flung locations and other resource related factors. Limited scientific data on fishes, other aquatic fauna and various ecological and environmental indicators demanded assessment of the upper reaches and feeding streams.

The current study was carried out to explore the fish fauna and fish diversity of the two connected rivers of the same ichthyo-ecological zone and to know how many fishes commonly occur in these rivers. It was conducted to document fresh and authentic data on aquatic fauna and water pollution in the area. It is the first assessment of Bashgal River for fish diversity and provides fresh data on fish fauna of River Chitral.

Methods and materials

Fish collection and preservation

Fishes were collected from the study area during August to November 2012. Six different zones were selected for fish collection from the rivers. Selections of the zones were made keeping in view feeding streams of the rivers. Balach, Ayune and Arandu areas of Chitral while Bagalgrom, Baghicha and Luluk areas of River Bashgal. Fishes were collected with the help of cast net, hook and lines and gill net. Collected fishes were preserved in 10% formaldehyde solution on the spot, larger fishes were injected with formaldehyde solution of same concentration in the belly.

Identification: The specimens were identified to the specie level at Zoology Department Islamia College Peshawar with the help of standard keys of Jayram (1999), Mirza and Sandhu (2007), Talwar and Jhingram (1991) and Mirza (1973).

Results and discussion

River Chitral and River Bashgal are part of the River Kabul Basin. The current study was carried out in the lower part of River Chitral from Balach to Arandu and River Bashgal from Luluk to Bagalgrom. A total of 157 specimens were collected out of which 87 from River Chitral and 70 from River Bashgal. The fishes belong

to two orders, two families, two subfamilies, four genera and seven species (Table 1). This is a pioneer scientific record of fish diversity of River Bashgal while Rafique (2000 and 2001) carried out a descriptive study of freshwater fishes of Pakistan including Chitral. Similar work had been done by

Mirza (1973). It is a long time since the last study had been carried out in the area. The upper parts of the River Chitral where exotic trout species are stocked were not included in this study. IUCN (1999) enlisted 9 indigenous species from River Chitral including *Tor putitora*.

Table 1. showing systematic account of the fishes.

Order	family	Subfamily	Genus	Species
Cypriniformes	Cyprinidae	Schizothoradnae	Schizothorax	<i>Schizothorax plagiostomus</i>
				<i>Schizothorax esocinus</i>
				<i>Racoma labiata</i>
		Noemacheilinae		<i>Trypophysa choprai</i>
				<i>Trypophysa kashmirensis</i>
				<i>trypophysa hazarensis</i>
Sisoriformes	Sisoridae			<i>Glyptostemum reticulatum</i>

Schizothorax plagiostomus is present in higher number in both rivers. *Schizothorax plagiostomus* was the dominant specie numbering 49, followed by *Schizothorax esocinus*. *Trypophysa hazarensis* was caught in smallest number which was 06 (Table 2). Our results reveal that *Schizothorax esocinus* and *Racoma labiata* were relatively abundant in River Bashgal. Genus *Trypophysa* was represented by three species from River Chitral; *Trypophysa choprai*, *Trypophysa hazarensis* and *Trypophysa*

kashmerensis whereas the collections made from River Bashgal contain a single specie *Trypophysa choprai* of the genus (Table 3). The two rivers show a good correlation in occurrence of fish species which was more than 71%. Five fishes were common in both rivers which were *Schizothorax plagiostomus*, *Schizothoax esocinus*, *Racoma labiata*, *Glyptosternum reticulatum* and *Trypophysa choprai* (Table 3).

Table 2. Showing Fish collected from different zones of River Chitral and River Bashgal.

River Chitral	Frequency	Percentage	River Bashgal	Frequency	Percentage
Arandu	29	30.02%	Bagolgram	27	38.57%
Gehrait	21	23.95%	Baghicha	31	44.28%
Balach	37	45.83%	Luluk	12	17.14%
Total	87	99.80%	Total	70	99.99%
Average	29		Average	23.33	

Table 3. Showing abundance of fishes in River Chitral and River Bashgal.

Fish/Species	River Chitral	Frequency	River Bashgal	Frequency	Total Number	Frequency
<i>Glyptosternum reticulatum</i>	10	11.49%	9	12.85%	19	12.85%
<i>Schizothorax plagiostomus</i>	27	31.03%	22	31.42%	49	31.42%
<i>Schizothoroxesocinus</i>	14	16.09%	17	24.28%	31	19.74%
<i>Racoma labiata</i>	13	14.94%	16	22.85%	29	18.47%
<i>Tryplophysa choprai</i>	10	11.49%	6	8.57%	16	10.19%
<i>Tryplophysa kashmirensis</i>	7	8.04%	0	0.00%	7	4.45%
<i>Tryplophysa hazarensis</i>	6	6.89%	0	0.00%	6	3.82%
Total	87		70		157	

The results also show that fishes are relatively abundant at Balach station and Baghicha station of River Chitral and River Bashgal respectively. Highest number of fishes were caught from Balach catchment zone which is 37 (45.83%) and Baghicha which is 31 (44.28%) followed by Arandu 29 (30.02%). The average catch from each station was 29 and 23.33 for River Chitral and River Bashgal respectively (Table 2). As each catchment zone was located at least after two feeding stream join the river, fish diversity of river may also reflect abundance of fishes in that particular feeding streams.

Schizothorax plagiostomus are 31.21% of the total collection *Schizothorax esocinus* constitute 19.74% followed by *Racoma labiata* 18.47%, *Glyptosternum reticulatum* 12.10%, *Tryplophysa choprai* 10.19%, *Tryplophysa kashmirensis* 4.45% and *Tryplophysa hazarensis* 3.82% (Table 3). It also shows that genus *Schizothorax* is the dominant genus in both rivers.

In previous studies on fishes of Chitral some workers have mentioned *Schizothoraichthys esocinus* as separate specie from Chitral since Hora (1929). *Schizothorax esocinus* has many synonyms one of them is *Schizothoraichthys esocinus* which were considered as separate specie in older literature such as Mirza (1974), IUCN (1999). *Schizothorax* fishes of same specie exhibit differences in morphological characters and are difficult to distinguish (Mir *et al.*, 2013).

Previous studies of Mirza, (1974) and many others have mentioned *Tor putitora* and *Garra gotyla* from River Chitral. Both of them were not present in our collection. Although *Tor putitora* was already thought to be at the brink of extinction from the area (IUCN, 1999) and the area of collecting *Garra gotyla* in previous studies is not known. It may also be due to difference in collection season.

The status of *Tryplophysa choprai* was uncertain in Afghanistan (Shank, 2006) our study confirms its occurrence. The other two species of genus *Tryplophysa* caught from River Chitral possibly escaped from our collection.

All the fishes collected from the rivers are of high Asian origin, it's a common trend in almost all rivers in the area that they have high Asian elements in their upper reaches (Mirza, 1986). Two important rivers in the adjoining areas: River Swat and River Panjkora have greater number of fishes as compared to River Chitral. River Swat has 26 species in the upper reaches (Akhtar, 2014) while Yousafzai *et al.* (2013) have identified 38 species from the lower reaches of the river. Rafique (2000) reported all the seven species collected in the present study were collected from River Swat and other nearby River also. As compared to other rivers of the area, River Chitral, show poor fish diversity. Evolution of this water body in the geological past may have significant role in its poor fish diversity along with low temperature and high turbidity (Rafique, 2001). According to Baig *et*

al. (2010) about 10 tons of waste is produced along the bank of River Chitral and finally deposited in the river, more than one third $1/3^{\text{rd}}$ of runoff and 66% of solid waste annually are added to River Kabul from River Chitral only. Along these factors many more such as destruction of habitat and spawning grounds of the fishes are resulting from constructions along the river, dumping of solid materials into the river banks, formation of artificial lakes to hunt down the migratory birds may also play role in poor fish diversity of the River. Some chemical pollutants may come from the marble industries along the river and motor garages which through their wastes and washouts into the river. Moreover, the introduction of carnivorous exotic trout in the upper reaches of this river may be partly responsible for poor fish fauna of the river.

River Kabul has a very diverse fish fauna in the lower reaches, these fishes are thought to be drained from River Indus. All Cyprinid fishes in Afghanistan are known from River Kabul except schizothoracid which are found in Helmand River as well (Coad, 1981). In Pakistan 45 species have been recorded from River Kabul in the vale of Peshawar (Rafique, 2001). Among these 35 species are commonly known from River Kabul beyond Shalman area (Yousafzai *et al.*, 2010). There is no such source of pollution in River Bashgal except soil erosion. During summer season melting of snow in the upper reaches contribute to high suspended solids in the river. Bashgal is a backward area as compared to Chitral with no industries and also population living along the river bank is small. We also noticed that fishes collected from River Bashgal were considerably large in size from that collected in River Chitral. This may reflect good food availability and environmental conditions of the River and low fishing activity.

Population dynamics of fishes in both water bodies demand a year round monitoring including all seasons and assessment of all potential feeding streams of the rivers.

Conclusion

A collection of 157 specimens was made that belonged to two orders, two families, two subfamilies, five genera and seven (7) species. Seven species were recorded from River Chitral and 5 from River Bashgal during this study. All the 5 species collected from River Bashgal are also present in River Chitral. Thus the water bodies show a resemblance of more than 71% in term of fish diversity. *Tor putitora* previously collected from the studied part of River Chitral was not found. However, this study confirms the presence of *Tryplophysa choprai* in Afghanistan.

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